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Silencing America's Wireless

All our readers are aware the United States Government, through the Secretary of the Navy, has issued orders to close all radio stations whether large or small, commercial or amateur, sending or receiving. All aerials have been ordered dismantled and apparatus removed from the premises.

This action came as a great surprise to all patriots, for a few years past there has been an encouraging of the Government and those who were certain that in time of war they would be allowed to "do their bit" with their outfits for the country.

That the Government should silence all sending outfits as it has definitely and properly, and which we have yet to hear the first complaint on that score. Why the receiving outfits should be dismantled by the Navy Department is very puzzling indeed.

President Wilson's Executive Order is based upon the Radio Act of 1912, which act however, mentions nothing about closing receiving stations during the time of war. That purely receiving stations were considered harmless by the framers of the law, is best proved by the fact that such stations do not require to be licensed as do all sending stations. Moreover, in President Wilson's Executive Order of April 6, no mention is made of receiving stations. Indeed, the following passage strikes us as very significant:

"... and furthermore that all Radio Stations not necessary to the Government of the United States for Naval Communications may be closed for radio communication."

The statics are ours. Particularly the one word "MAY." In the third paragraph the President uses the command words "SHALL," while the word "MAY" does not imply that every radio station should be taken over by the Navy Department. Indeed, the longer we study the third paragraph of the President's Executive order, the more we become convinced that the closing of every amateur station, or even commercial stations, is remote from President Wilson's mind when he issued his order.

In conformity to the Radio Act of 1912, the President in time of war, may authorize any department of the Government to close all radio stations. But the President's order of April 6, was not to the Department of Commerce which in the past controlled the nation's radio affairs, but to the Navy Department. Why? Because the President, it seems to us, had only the radio communications of the Navy in mind. If, therefore, the Navy Department caused the closing of all radio stations, particularly sending stations along our sea borders, such action would have seemed perfectly logical.

But when the Navy Department should wish to close stations a thousand miles removed from the Pacific coast, it would seem very puzzling. Furthermore, why all college radio stations, and those belonging to radio apparatus manufacturers as well, should be dismantled seems far fetched. Then there are cases like the one of the Lackawanna Railroad, which is one of the pioneer railroads in the United States to use wireless for train dispatching. Is it wise to dismantle such stations, on which the safety of passengers depends?

We certainly have no quarrel with the Navy Department; quite the contrary. We wish to help, but we sincerely do hope that its officials will soon find a way to modify its recent sweeping order.

There are, indeed, encouraging signs already. Certain commercial stations on the Pacific Coast have recently resumed operation, and it is to be hoped that amateurs will be allowed to operate their receiving stations, at a not too distant future.

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Electric Crossing Signal Operated by Train's Whistle
By GEORGE WALL

A NEW YORK genius has developed a clever idea for automatically sounding the alarm at railroad crossings, and whereby the alarm is controlled and actuated by the whistle of the approaching train itself. The accompanying illustration shows how the inventor proposes to mount a number of large size horns along the crossing-approaches, each horn being fitted with a super-sensitive electrical microphone, such as a slow-moving dash-pot attached to the sensitive relay, so that the relay could not open the siren and lamp circuits for a period of a minute or so; thus making certain that the signal will sound until the train has past the crossing. The idea is, all in all, quite novel and possesses many other possibilities. The microphone has proven its worth in many difficult roles in industrial as well as military and naval operations. The solution as used in the well-known Dictaphone. When the train whistle sounds for the crossing these microphones, scattered along a distance of several hundred feet on either side of it, pick up the sounds and are caused to control a sensitive relay devise operating on the tuned-reed principle. The relay will thus respond with maximum efficiency to a certain whistle tone as the vibrating reed armature fitted to it is selected to vibrate sympathetically with the dominant note of the locomotive whistle.

When the approaching train's whistle has thus actuated the microphone and in turn caused the sensitive reed relay, the latter closes the proper circuits to a powerful electric siren installed at the top of the signal tower at the railroad crossing, as shown in the accompanying illustration and diagram of the elemental circuits. For night requirements, the alarm may consist of the electric siren and a powerful beam of light, both of which are projected out of the signal horn. The siren is enabled to project its sound out into the horn past the mean descent lamp, as the latter is mounted on a perforated disc, thus allowing the sound waves to pass by it. The alarm tower may carry two or more of these combined electric siren and lamp circuits, and as becomes evident, the operation of the device is extremely efficient; the alarm ceases as soon as the train has past the crossing. There are, of course, several details which are not shown in the accompanying view, which would be necessary in carrying out and applying the plan here proposed. For one thing there would have to be some form of time-element device, such as the slow-moving dash-pot attached to the sensitive relay, so that the relay could not open the siren and lamp circuits for a period of a minute or so; thus making certain that the signal will sound until the train has past the crossing. The idea is, all in all, quite novel and possesses many other possibilities. The microphone has proven its worth in many difficult roles in industrial as well as military and naval operations. The solution as used in the well-known Dictaphone. When the train whistle sounds for the crossing these microphones, scattered along a distance of several hundred feet on either side of it, pick up the sounds and are caused to control a sensitive relay devise operating on the tuned-reed principle. The relay will thus respond with maximum efficiency to a certain whistle tone as the vibrating reed armature fitted to it is selected to vibrate sympathetically with the dominant note of the locomotive whistle.

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The U. S. Navy now offers excellent chances to ambitious young men who have a desire to learn a trade and earn a living. The naval electrician has unequalled opportunities for attaining an exceedingly broad and substantial electrical knowledge, covering dynamo and motor-generator systems, radio apparatus, and a host of other things with which the average "laid-lubber" may never become thoroughly familiar. U. S. naval electricians never need to fear that they cannot land a job after their service in the navy is finished.

Naval service offers many inducements to ambitious and spirited young men. Not only does it provide opportunities for free travel in nearly and distant waters with changing scenes, but it furnishes excellent training of high value in civil pursuits at the conclusion of enlistment. It also furnishes steady, healthful work, free board of a wholesome nature, free lodging and clothing, and in addition provides pay, even during the period of training, that can be practically all set aside for saving. The United States Navy pays its enlisted men better than any other national navy and in most lines more than the men could save and in some cases even more than they would receive in similar pursuits in civil life. Above all this it enables the men to render the highest patriotic service open to the citizens of any nation, that of defending the security of their country in the first line of defense.

The many uses of electricity aboard ship and in the naval stations have been steadily increasing. It is used not only for lighting and power service, but also for communication and signaling, and even for cooking and baking. There are a multitude of electric motors in use for ventilating blowers, ammunition hoists and conveyors, gun-painting equipments, turret-turning machinery, and various other purposes. These motors are supplied thru special control apparatus from turbogenerators, engine-driven dynamos, motor-generators, etc. The lighting equipment includes incandescent and arc lamps, searchlights of the highest powers, special signal lamps, etc. Communication apparatus consequently the training and experience received in their operation and maintenance are of exceptional value to the electrician or radio operator in after life.

Since the proper operation and care of all the varied electrical apparatus is essential to the efficiency of the Navy, it is the practice to send all new recruits for this branch of the service to either of the two Navy Electrical Schools at the navy yards at Brooklyn, N. Y., and Mare Island (San Francisco). Cal. These schools provide instruction in two classes, general electrical work and radiotelegraphy. The length of the full course for both classes is eight months. Men specially proficient in the work pass thru this period in shorter time, depending on the knowledge and skill they show. All students, either recruits or men from the general service, may enter these schools at any time. In addition to the practical instruction imparted at the electrical and other naval trade schools and training stations, the men receive thorough their service aboard ship and elsewhere both academic and practical training to enable them to demonstrate their ability and to ad-

**Chances for Electricians in the Navy**

The U. S. Navy now offers excellent chances to ambitious young men who have a desire to learn a trade and earn a living. The naval electrician has unequalled opportunities for attaining an exceedingly broad and substantial electrical knowledge, covering dynamos and motors, wiring of all kinds, special and standard signaling systems, telephone systems, radio apparatus, and a host of other things with which the average "laid-lubber" may never become thoroughly familiar. U. S. naval electricians never need to fear that they cannot land a job after their service in the navy is finished.

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**Another View of the Electrical School at Mare Island, Calif. Class Receiving Instruction in Electrical Appliances, Including Electric Searchlights.**

Uncle Sam's Naval Men Receiving Training in the Operation of Electric Generators in the Navy School at Mare Island, Calif.

In order that a recruit may enlist for the electrical branch, he must have a knowledge of either general electricity, or be an operator of the Morse telegraph code or have sufficient foundation in radiotelegraphy; to be competent to keep up with the class at the school. Electricians (general) must know the names and uses of the various parts of the dynamo and dynamo-driving engines and must be familiar with the ordinary types of switchboards and methods of wiring. Applicants for both classes must be able to write legibly, must understand elementary arithmetic and must be between the ages of 18 and 25. All applicants must be citizens of the United States, either native or fully naturalized.

In recruiting men these requirements are immediately transferred to the electrical school, where the course of instruction comprises machine-shop work, (Continued on page 142)
Talking Motion Pictures Via Wireless

Many of us have no doubt witnessed an exhibition of talking motion pictures, and numerous patents have been taken out on some very elaborate schemes intended to improve the efficiency of the apparatus involved in recording and reproducing the voice, as well as the figures of photoplay productions.

One of the most novel ideas devised toward accomplishing this purpose is outlined in a recent patent awarded to William J. Vansire, of Brooklyn, N.Y. The accompanying illustration by our artist shows how the inventor proposes to utilize and apply the art of radio communication to the recording and reproduction of talking motion pictures. In the first place, the studio stage is fitted with a metal floor, such as one covered with tin or sheet iron, diated thru a ground wire leading to metal plates (and points if necessary) on the heels of the actors, as shown, and also thru a miniature antenna comprising a series of tin-foil leaves which are sewn in the clothing in the manner indicated in the accompanying illustration. The radio apparatus is carried in the clothing, and the weight of each part distributed in the best manner possible. As will be noted, the batteries are placed somewhat differently in the case of a lady, as compared to a man.

Thus far we see that whenever the actors speak, there will be radiating wireless telephone currents, and these are intercepted or picked up by a larger radio antenna erected back of or just above the scenic settings of the studio stage in the manner illustrated. The stage antenna is connected thru suitable tuning coils, with an oscillation or vacuum bulb device, which is used in this case as a detector and amplifier of the received radiotelephonic currents.

Now we have the actor's voice radiated by wireless from his own person, thence propagated thru space by etheric waves, and finally, we have them coming in thru the receiving circuit of the stationary radio detector. The secondary or auditory circuit of the detector and amplifier is connected with the recording electro-magnets of a Poulton telegraphone, mounted intact on the motion picture camera which is recording the scene photographically. Thus, as the photographer turns the handle on the motion picture camera, he not only records the physical movements of the actors, but simultaneously he also obtains a corresponding record of their voices on the moving steel wire of the telegraphone, which has been explained in detail in previous issues of this journal.

In effect, the telegraphone operates upon the principle that if a moving steel wire is past the pole of an electromagnet thru which electrical voice currents are circulating, then there will be local magnetizations set up in the steel wire corresponding to the voice fluctuations. If then we afterward pass this steel wire under another electromagnet, the coil of which is connected to a telephone receiver, we can then hear the voice reproduced.

The great problem confronting all inventors who take up talking motion picture work is to accurately and practically synchronize the motion picture voice with the voice of the actor. This is the most important problem, and by means of this wireless telephonic arrangement, as proposed by Mr. Vansire, it seems that it should become a simple matter to readily accomplish the purpose intended, viz., to record and reproduce faithfully a talking motion picture, and one in which the actor's lips will not be moving about ten seconds after the voice is heard or vice versa.

In practice a number of loud-speaking telephones are scattered about the moving picture theatre, and as the operator cranks his machine, the telegraphone wire is unreeled at exactly the same speed. The impulses from the recorded telegraphone wire now are used to operate the loud talkers about the house, with the result that the audience sees and hears the actors in a truly remarkable manner.
Electricity and Water to Run Our Autos

Gasoline forms the nucleus of power in practically all automobile engines of the present day, and many inventors and chemists have expended considerable energy and money in an effort to find a satisfactory substitute for this all-important commodity, which has been rapidly and constantly increasing in cost. One of the latest attempts in this direction is that of Mr. Ernest E. Punches, who hails from Detroit, Michigan.

"Give me a suitable tank containing a set of plates submerged in water and a source of electric current, and I will drive your automobile engine without any gasoline whatsoever at reduced cost," says this su- gine cylinders and ignited by an electric spark, it produces a force many times more powerful than that obtained when gasoline vapor is used. Some of the hydrogen gas produced by the electrolytic cell (decomposition of water) is stored in a suitable tank under pressure, which makes it available for starting the car and emergency. The entire combustion unit fits the carburetor side of the engine and is supported by the former manifold holding means and also by the frame of the auto chassis. It has been found by Mr. Punches from trial and also by calculation, that the hydrogen gas produced here described, and which is proposed to substitute for gasoline, will require up to 5 per cent of the horse-power developed by the engine, this 5 per cent of the total engine horse-power being used to drive the decomposing current dynamo.

There are 1,257.52 cubic feet of hydrogen gas in one cubic foot of water at atmospheric pressure, zero degree Centigrade, and it will require 1,728 watts of electricity to decompose a cubic foot of water in one hour. Compare this with the following data, obtained from a Chalmers Motor Car Company engineer:

The maximum revolutions of the Chalmers motor is 4,000 per minute under full load. The motor develops 45 h.p. on an average at this speed, and under full load, with a well worked in motor. The suction displacement per revolution is 244.2 cubic inches; equals 0.0648 cubic feet. Then at 3,000 revolutions per minute and assuming 100 per cent volumetric efficiency, the number of cubic feet drawn into the motor per minute is 30 times 0.0648, or 194.5, and 60 times 194.5, or 11,670, is the number of cubic feet drawn into the motor, of mixture each hour, running at maximum speed and under full load.

The gasoline entering into that mixture is 7 per cent by weight, and the amount by

June, 1917

THE ELECTRICAL EXPERIMENTER

OPTICAL DEVICE THAT RIVALS TELESCOPE IN STUDYING THE HEAVENS.

An optical device, which is said to rival if not surpass the telescope in revealing the mysteries of the heavenly bodies, was exhibited at a recent meeting of the American Society of Mechanical Engineers in New York. The invention was exhibited by Dr. John A. Brashear, the grand old man of American astronomy, of Pittsburgh.

"This instrument is called a disfiguring grating," said Dr. Brashear, as he showed what looked like a rectangular piece of metal about 2 by 4 inches long that changed colors under the electric lights. "On the plate surface of this polished plate, made accurate to one-tenth of a light wave, or within one-forty-five-thousandth of an inch, are ruled more than 45,000 lines between which there is no greater error than one-two-millionth of an inch."

"With this delicate piece of apparatus, made possible, first by rigorous scientific research; second, by the skill of the artist; third, by a knowledge of a vigorous care to avoid temperature changes; and, fourth, by the accuracy of the mechanism, the astrophysicist has been able to tell the composition, temperature and distance of the stars."

REVIVING THE CHAIN SHOT TO DESTROY RADIO AND OTHER AERIAL WIRES.

An American inventor has recently proposed that the military and naval authorities revive a relic of warfare which was in vogue many years ago—from nothing less than the generally well-known chain shot. In our grandfathers' great-grandfathers' day it was considered quite a nifty idea to tie one or more cannon balls together with an iron chain—thus, the name chain shot. The accompanying illustration shows a clever form of split projectile composed of three or more pieces divided in the manner shown, so that by means of a time fuse or other arrangement, these pieces would fly thru the air as a solid projectile, and at the critical moment would explode and describe a path of considerable width thru the atmosphere, and proving, it would seem, of decided efficiency in destroying radio antennae, and all other elevated wire structures such as telegraph and telephone wires, power transmission circuits, etc.

GOVERNMENT TAKES OVER MARCONI STATIONS.

The U. S. Government has availed itself of the offer of the Marconi Wireless Telegraph Company of America, placing its staff and stations at its service and has taken over for the period of the war not only the Marconi stations but all other radio stations for military purposes. The eligible operators will be enrolled in the government service. Stations not required will be closed. The trans-Pacific stations will continue handling commercial traffic, but under government supervision. No ship traffic will be permitted on the Atlantic and Gulf Coasts and the Great Lakes; excepting for the government, but it will

EUROPEAN SOLDIERS USE GAS MASKS FITTED WITH TELEPHONES.

The accompanying illustration shows in a marked manner one of the peculiar and particularly effective scientific devices brought out by the great European war.

Needless to say this war of all wars has developed hundreds, even thousands, of new inventions of every conceivable character. First the Germans invented the gas apparatus by which they aimed to overcome their enemies in the trenches with clouds of noxious fumes, and here we have the answer to this challenge in the form of a gas mask or helmets, which are worn by the members of the trench rescue brigade, who are called upon to go forth and carry prostrate soldiers from their positions where they may have fallen between the trench, when overcome by the gas cloud. Each gas helmet and mask is fitted with a novel and specially designed telephone outlet, properly connected to a trailing wire leading back to the trench, so that the rescuers are able to telephone for aid without removing their helmets or apparatus.

GOVERNMENT RADIO BILL GOES OVER.

House leaders at Washington have decided definitely not to pass at this session the Administration bill for permanent Government dictatorship over wireless apparatus, unless the President specifically requests it.

It was learned that the House Merchant Marine Committee believes the President already has power enough over radio stations to prevent their use in time of war.

The principal feature of the bill is its provision for eventual Government ownership of radio companies. This feature is not considered by the committee to be strictly war legislation.

A New War Invention Is a Split "Chain Shell" That Automatically Explodes at a Given Range. It Should Prove Particularly Valuable in Destroying Radio Antennae and Other Wire Structures.
YEARS ago, when the New York City elevated lines changed from steam to electricity, one of the elevated trains caught fire. An alarm was promptly turned in and in due time the firemen were on the spot. The stream from the high-pressure hose was played on the car, and to prevent the fire from reaching the wooden structure on which the rails rested, as well as the wooden foot path, one of the firemen directed his stream on the third rail. 

The Germans Invented "Liquid Fire". The Germans invented thought. His idea was as follows: Strap to a soldier's back is a lead-lined metal tank carrying a solution of diluted sulfuric acid of about 1200 specific gravity. (A solution of chlorid of lime or even ordinary salt water could be used.) By turning a knob on the outside of the tank a small quantity of zinc or iron filings is thrown into the acid and immediately hydrogen gas is evolved, causing considerable pressure inside the tank. This causes the acid liquid fire is sprayed upon the enemy, being a parallel to the writer's scheme. While shooting flames over a distance of 50 feet or more has not proven a wonderful success, nevertheless the idea seems to have some merits. And if the Germans can shoot flames at us, why can't we return the compliment by shooting electricity at them? One is as easy as the other, with a few points in favor of the latter, it would seem. Briefly, the idea is as follows: Carried in a soldier's pack is a metal tank charged with highly electrified streams of acidulated water under high pressure. This unusual invention is not intended as a substitute for guns, but to supplement them. It represents one answer to the German's "Flammen Werfer"—Liquid fire.

HAVE you ever stopped to consider that a fireman does not dare to let a stream of water from a nozzle strike an electric wire, carrying any appreciable potential, say a thousand volts or more, as he may be electrocuted. Proverbially speaking, it is a poor rule that will not work both ways. Hence we have the unique proposal by Mr. H. Gernsback, that we charge the enemy with highly electrified streams of acidulated water under high pressure. This unusual invention is not intended as a substitute for guns, but to supplement them. It represents one answer to the German's "Flammen Werfer"—Liquid fire.


The result that he is knocked unconscious.

If the stream had been sea (salt) water, there remains little doubt that the man would have been electrocuted instantly.

Upon this principle the writer has based his idea of "wooden electricity" at an enemy, impracticable as the sequel sounds at first thought. Many murderous ideas, of course, have been advanced for trench warfare, the German Flammen Werfer, whereby to be forced out thru the hose attached to the tank and from the hose the acid passes thru the long nozzle carried by the soldier. The acid leaves in a fine stream, less than a quarter of an inch in diameter, and with a fairly calm atmosphere, it should carry from 75 to 100 feet. For most purposes, 50 feet however, will probably be found sufficient.

Now, back in the trench (or behind the and all the rest of the equipment could be placed in an armored car. In that case, the operators would not be exposed to machine gun fire.

When used by the soldier, however, it is self-evident that his equipment must be such that he himself will not be electrocuted. To that effect he wears a special "high-tension" rubber shoe, capable of withstanding 20,000 volts.* Then too he uses "high-tension" rubber gloves, and in addi-

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* www.americanradiohistory.com
A FIXT military policy which will protect the nation and strengthen its defense is the special need of the hour. Each passing day demonstrates this. This League and its sponsors believe that in universal military training lies the nation's chief hope. They therefore urge two things. First and foremost: Stand behind President Wilson in every way. He is bearing a tremendous burden. Assist him in all emergency measures, whether financial, military or economic. Second: Every influence to impress upon our Senators and Representatives in Congress that emergency war measures now pending will not solve our military needs except temporarily. They may carry the country along for the present, but they will not do for the future. The most democratic program as a first military policy for the United States is universal compulsory military training. It treats all alike, makes use of young men before they reach the age where their earning capacity is high and when they are yet unmarried, and gives them intensive military training. Then it sends them back to work. These trained youths will form the backbone of a great, democratic citizen army. This is the only definite, simple and patriotic plan that will make America safe and ready.

I earnestly hope that every American will stand by President Wilson and the Government officials who, with the President, are bearing a gigantic responsibility. I have just returned from the national capital and there is a great sense of measure the weight that is taxing our silent and conservative Chief Executive. It would be shameful to see his gallantry for meeting this crisis defeated. Therefore, as should all citizens, I bespeak general cooperation with President Wilson in these mighty works.

They are emergency measures, as he has said. This universal military training plan is supplementary to the President's emergency measures. It goes further and will last longer. While he is doing all that he can do safely to pilot the ship of state while the unpatriotic rejoice in secret in the opportunity to remain safe and sound at home, pile up money and have a good time.

Such a false premium upon patriotism is not only disadvantageous in a national military program, but it is definitely unbecoming and wasteful. In nine cases out of ten these slackers are also lusies, and under proper tuition would make good soldiers. Further, the pal boys who rush to the colors are the sort who are needed most to man the commercial and financial craft of the nation. The best brains will go into the ranks as privates and leave the slugs guards at home to conduct the nation's affairs. This is fundamentally bad in a democracy.

Selective conscription no doubt may be necessary at times, but it will never be popular. Perhaps war training, on the other hand, is thru it's very universality, plain, and plain, says that all having the blessings of our institutions should, in time of need, their part by defending those institutions. It says, further, that the unrestrained and the untrained soldier is so much cannon fodder that the chances of the trained lad returning home in good health from war are about three times greater than the untrained.

Therefore, in universal military training, the secret of our general military and naval needs for today, tomorrow and All Time is found.

The Universal Military Training League makes special appeal to the people of the country to write their Congressmen and back President Wilson in all his emergency measures and to eradicate forever the doubt, uncertainty and weaknesses of present mobilized military policy by establishing in law a first plan for universal, compulsory military training and service. Stand by your President and strengthen your nation!

What Military Training Does For a Man. Compare the Two Recruits on the Left With the Two Erect Figures on the Right. They Are the "Same Men," Photographed Before and After Training for Five Months in the U. S. Army.

Auxiliary Signal Corps Up-To-Date.

Perhaps the finest single auxiliary signal corps possess by any army has been given to the United States by the American Telephone and Telegraph Company. About 300 engineers already have been elected and some of them have been sworn into army service. The differences between government pay and their salaries with the telegraph companies will be paid by the latter.

The corps will be made up of general plant and traffic engineers to plan, set up and operate telegraph, telephones and wireless plants. If the regular force of the army proves to be too small, men also will be provided to assist in the wireless work.
Electricity's Aid to Women

Who can remember ironing day without wishing there wasn't any such animal. But all is changed. Behold the electric ironer that really does wonderful work at 4 cents an hour. Even the Chinaman is outdone.

Here we have the combination electric stove, strict for action—said action being that of frying eggs. And they do say electroplated eggs taste the best.

Have you ever been down South? If so, you know 'Waffles.' Well, here's an electric 'Waffle-Iron' that makes two delicious and geometrically correct waffles at one time, cooking top and bottom.

And there's the sewing machine, an electric motor driven at half a cent an hour. Press the treadle and control the power.

Do you have to polish waxed floors? This back-breaking task is now accomplished in a short time and in a highly efficient manner, by the electric motor floor-polisher shown.

Remember the fellow who told the Waldorf the steak was too rare? 'Well, give that steak another shock,' said the Waldorf. 'We Cook by Electricity.'
Electricity's Place In Business

Applying Psychology With the Electric "Psychometer.

The latest device for testing speed and efficiency of human thought is the "Psychometer," which is an electrical apparatus now being used in San Francisco, where it is being applied to accurately measure the degree of alertness in employees in various establishments, as well as general mental alertness in all vocations.

The Psychrometer is operated by either alternating or direct current and may be attached to the haseboard electric light socket. The clockwork attachments and electrical connections are operated by pressing a simple telegraph key which is connected with the haseboard plug. The instrument is built in a grip and may be easily carried around. The readings are made by an electric light, which is mounted on the side of the small suit case. The instrument is an accurate gauge of memory and measures speed and quality of thought to the fifth of a second, besides charting alertness and ability to react quickly in mechanical work and emergency situations.

If the machine stops for any reason, the indication on the paper shows this immediately and gives the owner the visual indication of the fact. In addition to this equipment, an electro-magnetic counter is connected to the same circuit, which indicates the number of operations made by the machine. Thus, if this instrument is attached to a printing press, it will indicate exactly the number of printed sheets that the machine has made during a certain period. Each needle has its corresponding counting instrument and both are connected to a single switch. This particular instrument, which is provided with a dial, is adaptable for ten machines.

The second photograph shows the adoption of this device in a clothing establishment, where it is used for checking up the number of coats made by each operative.

Prominent Electric Engineer Becomes Army Man.

Appreciating the importance of securing the ability and training of the engineers of the country for use in national defense, President Wilson has appointed a number of prominent engineers in the country to positions in the army.

One of the appointments which will meet

The Business End of the Electric "Productograph," the instrument that keeps tally on the daily output of each worker in shops and factories.

Photo from Press Illustration Service.

Prof. Münsterberg Claimed to Be Able to Select the "Best" Ship Captains, Locomotive Engineers, Aviators, Etc.—All by Psychology.

Here We See the "Psychometer" Being Used to Test the Mental Alertness of San Francisco Factory Employees. The World's Do Move.
SOUND RELEASES TOY DOG FROM ITS KENNEL.

A very interesting toy has recently been introduced in the toy market and which is here with illustrated. A similar toy was described in our June, 1916, issue, but the present one is of a simpler construction. The “Wireless Pup,” as it is called, is a block of wood, the dimensions of which are those of the interior of the metal case. The lower part of the lever B, should touch lightly the metal surface of the case at point C. Of course this must be within the case. The complete circuit-breaker is placed behind the electro-magnet frame, as noted in the assembled apparatus. Two lugs of metal are fastened to the base to form a sound collector. The connections of the toy “pup” is very simple, and is made as follows: One terminal from the electro-magnet is linked with the metal case of the circuit-breaker. The lever of the latter is terminated in a small flashlight battery and the opposite side of the battery is connected to the second lead from the “pup.” When the “pup” is pushed into the kennel and against the tension of the spring disc, it is held by the energized electro-magnet. Then by making a sound such as by blowing a whistle, the circuit-breaker will be spurred up, thus opening momentarily the circuit which releases the spring disc, bouncing Mr. “Fido” out of the kennel.

The complete circuit to magnetic pull at each end of the toy is as shown in Fig. 1; this shows the dog standing outside of his kennel. The sensitive circuit-breaker and other apparatus are all placed within the kennel. This interesting and most amusing toy was originated and perfected by Mr. Christian Berger, a prominent physicist who has devoted most of his attention to developing scientific toys. The operation of this toy depends upon the opening of a delicate circuit-breaker by sound. When any sound is heard by the circuit-breaker, it is connected in series with a battery and electro-magnet, which acts upon a flat metallic disc. This disc or plate is so arranged that when it is released by the electro-magnet, it will strike the dog, pushing him out of the kennel. The electrical circuit is only made when the flat disc is prest against the core of the magnet, which holds the same to itself until the circuit-breaker is excited by sound waves.

A detail photograph showing the various parts used in making up this toy is given at Fig. 2. The holding electro-magnet is shown at the left and consists of a steel 5/16-inch in length and 1/4-inch in diameter; two insulated end pieces are placed on each end and the coil is wound with No. 30 B. & S. enamelled wire. The complete magnet is mounted on an iron frame, as shown. The small projection on top of the magnet is used to strengthen the magnetic pull of the electro-magnet. The release or discharge disc is fastened to this frame in such a way as to permit the disc to spring forward when released by the electro-magnet. The complete arrangement is then mounted on a wooden base.

The sounds operated circuit-breaker is seen on the right. This consists of a rectangular metal box A, in which the sensitive parts are placed. The horizontal lever B is made from a No. 18 bare wire, bent as shown; the ends are pivoted on a block of wood, the dimensions of which are those of the interior of the metal case. The lower part of the lever B, should touch lightly the metal surface of the case at point C. Of course this must be within the case. The complete circuit-breaker is placed behind the electro-magnet frame, as noted in the assembled apparatus. Two lugs of metal are fastened to the base to form a sound collector. The connections of the toy “pup” is very simple, and is made as follows: One terminal from the electro-magnet is linked with the metal case of the circuit-breaker. The lever of the latter is terminated in a small flashlight battery and the opposite side of the battery is connected to the second lead from the “pup.” When the “pup” is pushed into the kennel and against the tension of the spring disc, it is held by the energized electro-magnet. Then by making a sound such as by blowing a whistle, the circuit-breaker will be spurred up, thus opening momentarily the circuit which releases the spring disc, bouncing Mr. “Fido” out of the kennel.

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Powerful Hydro-Electric Salvage Apparatus to Raise Sunken Ships
By H. Winfield Secor, Assoc. A. I. E. E.

Possibly more than one enterprising inventor of to-day has conjectured on the problem of raising sunken vessels. It is a notable fact, however, that many sunken ships lying within the coast boundaries of our own country. It is not often that we hear of a sunken ship being floated and brought into drydock for the reason that the cost of performing such an engineering feat is generally prohibitive, and also in many instances, the problem of raising the sunken vessel at all has practically been beyond solution.

Now comes an American inventor, of Swedish birth, one Mr. Carl Lingquist, who has devised a markable new scheme for raising sunken ships of no matter what size, as long as they do not lie in too great a depth of water, and which idea he intends commercializing at an early date.

It goes without saying that if Mr. Lingquist's idea, as outlined herewith, proves feasible and successful, that he will find problems and work for several years to come.

The inventor's idea involves the use of two or more telescopic cylinders or chambers, as shown in the accompanying illustration, which are attached thru massive universal joints at their bases to the large horizontal submarine chambers or "feet" which rest on the bed of the ocean or lake. In the first place, it is of course paramount that the exact location of the sunken vessel be known. Having this information, the salvage operation sets out from the nearest port with the necessary number of these large gas-filled cylinders, with their attached base members (or "Forts" as their inventor calls them). The vertical cylinders shown lie horizontally, and as do also the base members, which are made to float, and the vertical and horizontal sections double up like a jack-knife, permitting the several units of this equipment to be towed by tugboats to the scene of the wreck.

The present plans of the inventor consider that salvage operations may be successfully carried on for any size vessel in depths of water up to three hundred feet, and where necessary four to eight or even more chambers will be required. When cylinders are employed, placing an equal number of them on each side of the sunken ship.

Supposing that several units of the salvage equipment are ready and floated to the position where they are to be used, the engineers then proceed to fill the base member with water causing it to sink. As it does so, the upright cylinder naturally assumes a vertical position, and moreover the base member obtains a very powerful hold on the bed of the ocean or harbor by "sand-suction," besides the heavy water pressure bearing down on its outer surface. A number of strong cables are let down in the water, and with the aid of an operator inside the inner pontoon who directs the work, these cables are swept under the hull of the sunken vessel. When all of the cables have been properly placed, the engineers are ready to begin operations for raising the wreck. Here is where the remarkable genius of Mr. Lingquist comes into play, for he does not attempt to raise the ship by means of steam or any other form of engine. He has called upon Dame Nature herself to furnish the wherewithal to raise any ship, no matter what the size. In brief, what he does is this:

The upper telescopic and movable cylinders rising within the vertical floating chambers and guides, they are allowed to fill with water from the ocean itself, and as will be seen these will then sink to any required depth. When they have submerged until their upper structure is just above the water, the valves are closed, and by means of powerful electric pumps (in case the operations take place a considerable distance from shore, gasoline engine-driven pumps are available), the water within the movable upper cylinders is rapidly pumped out. But a moment's reflection is required at once to see that these upper cylinders will naturally become steadily more and more buoyant, and providing they are built of the proper size for the work in hand, they will exert a tremendous lifting power of thousands of tons. After these cylinders have come up a suitable distance the lines are caught by the engineer and the member and the ship is thus held while the floating cylinders re-fill and take a new base, the same operation is then repeated to the surface.

Mr. Lingquist intends building these cylinders, not of steel but of narrow strips of wood, several inches thick, or steel may be used in certain cases. The wood strips are tongued and grooved and caulked and are held in shape by steel bands. The pressure of the water on the outside of the cylinders will in consequence tend to always tighten them, as becomes evident. The inventor has broached and demonstrated new forms of models, his unique idea to a large number of sea-going men, including commanders of Royal Navies, and to a number of naval architects, and has received unsolicited recommendations from these men, who should be qualified to judge as to the efficiency or inefficiency of such a device if anyone could. Not only is this idea of considerable practical utility in salvaging sunken vessels in times of peace, but it possesses according to Mr. Lingquist, several valuable naval features. For one thing he has suggested that one of these hydrostatic units would prove very efficacious in the role of a "Submarine Base," the object being anchored several hundred miles from shore stations if desirable. Also they would serve as a resting place for the crew.

The inner cylinder would have a large capacity for the storage of oil and gasoline for submarines, and in the event of being sighted by a hostile war vessel the upper cylinder and super-structure could be submerged so as to be invisible, and the inventor claims that no force, even the ocean itself, cannot budge his invention for member an inch once it has got its grip on the bed of the ocean by natural "sand-suction," and besides most of the floating members lie in calm water, the action of the waves not reaching very deep. A means is provided for releasing the floating members upon the ocean-bed when it becomes desirable to move the unit to some other location. U. S. Naval Officers have been favorably impressed with this idea.

Closing, it is interesting to note that another valuable possibility of this device is that of releasing stranded vessels which (Continued on page 144)

Among the hundreds of new devices and appliances published monthly in The Electrical Experimenter, there are several, as a rule, which interest you. Full information on these subjects, as well as the name of the manufacturer, will be gladly furnished to you, free of charge, by addressing our Technical Information Bureau.

www.americanradiohistory.com
ELECTRICITY NOW ROCKS THE CRADLE.

"The hand that rocks the cradle, rules the world"—runs an age old proverb. and, albeit, one that embodies more truth than fiction nowadays, perhaps, when we have

and saved a slot into it for a distance of a foot at the other end, this slot passing thru a hole bored in it, the size of the wood handle on the grinding mechanism, which is inserted thru the hole and then the two parts of the connecting rod brought together by means of a little bolt.

Only a minute is required to trundle the little wooden frame to any place in the house, one end being provided with little casters, also shown in the picture. The motor can be attached to any lamp socket by means of a flexible attachment cord, and in this connection one of the binding posts on the motor.

Mr. Joleen has inserted a small push-button switch for starting and stopping the mechanism. When the carriage is set on its little track, the connecting rod can be instantaneously connected by simply laying it on the bar so the handle socket engages the latter, and the apparatus is ready to work. Who will be so kind as to invent an electric bottle feeder? Next!

SEWING MACHINE PLUS MOTOR, SAVES LABOR.

The sewing machine was one of the first household appliances to be equiped with an

head machine. When desired, however, the motor can be removed readily by loosening one thumb screw, as it is light and portable.

The speed regulator is slpit on the treadle and held by a spring, making the mounting exceedingly simple. The operating chain is attached to the metal framework directly above the controller and pulled taut.

The regulator is light and substantial. The case is made of prest steel and the principle of operation is entirely new. When there is no pressure on the treadle the circuit is open. With a slight pressure on the treadle a contact is made and a current pressure is supplied to the circuit when the case is cut off turn by turn. By varying the pressure, one stitch, or several hundred stitches of a thread may be made. There are approximately 100 steps in the controller, giving a corresponding number of speeds.

When folding up the machine it is only necessary to loosen the belt, disconnect the plug, and swing the motor around under the head. Felt pads underneath the base prevent the motor from scratching the finish of the machine.

The motor itself is out of the way when operating. This leaves both sides of the machine table clear so that the operator can use this space for sewing material.

The outfit, which is compact and light, operates on a small motor which may be driven either alternately or direct current mounted on a nickel-plated base, a speed regulator with operating chain and ten feet of cord and plug, and a round leather belt. The weight, including the speed regulator, is only 7 pounds.

The cost of operating this motor is so small as to be almost negligible. At 10 cents per kilowatt hour, it costs less than one cent an hour or less than it takes to run the ordinary incandescent lamp.

THE ELECTRIC TEA KETTLE IS HERE.

The recognized convenience and growing popularity of heating small quantities of water by electricity has prompted the development of the electric tea kettle illustrated.

The successful operation of an electric tea kettle depends largely upon the type of heating element—method of application of heat, etc. The heating element here used is of the submerged type, located on the bottom of the tea kettle models. When in use it is entirely surrounded by water. Thus all heat generated is efficiently utilized.

The tea kettle has a clapper, with 11-1/2 inch gauge, made of copper and spun into shape: spout of white metal; has bail handle, sides of which are steel, grip made of ebonized

A Chicago Genius Has Evolved a Clever Combination—a Baby Carriage Plus an Electric Motor and Parts of a Small Grinder Reduction Gear. Result—No More Pushing the Baby Carriage Back and Forth. We'll Bet His Wife is a Suffragette!

This Electric Sewing Machine Motor Drops Out of Sight with the Head and Drives Very Efficiently Owing to Its Spring Base Mounting.

Here We Have the Electric Tea Kettle. When You Want It and Where You Want It Is Now an Actual Fact.
THE PROPERTIES AND COMMERCIAL APPLICATIONS OF SELENIUM.

By W. P. Alder.

Selenium was discovered by the Swedish scientist, Berzelius, in 1817 as a by-product of the distillation of sulfuric acid from iron pyrites. It has an atomic weight of 79.3, specific gravity in its electrical conducting form of 4.785, its vapor sp. gr. at 2,588°F., being 5.68.

Selenium, like sulfur, with which it is isomorphous, exists in different allotropic forms, three of which are as follows:

(1) Amorphous Selenium is formed as a finely divided black-red powder, when a solution of selenium acid is precipitated by sulfur dichlorid gas, or when the acid is reduced by suitable agents. Amorphous selenium has a sp. gr. of 4.26 and is soluble in carbon disulfide.

(2) (a) Semi-colloidal red amorphous Selenium is formed when solutions of dextrose and selenium or sulfuric are newly heated together. At 100°C, it is partially transformed into ordinary black Selenium.

(b) Colloidal Selenium can be obtained in a blood-red solution by an aqueous solution of the red precipitate obtained by the reduction of SeO.

Selenium is vitreous when the amorphous variety is heated to 218°C, and then suddenly cooled when it forms a brittle, black, glassy mass, soluble in carbon disulfide having a sp. gr. of 4.28.

All three of the above forms have so high an electrical resistance that they may be used as non-conductors. The Selenium as used in the electrical arts belongs to still another modification, viz., the crystalline or metallic state; metallic selenium is obtained when the melted vitreous variety is cooled to 210°C, and then maintained at that temperature for some time.

The gray crystalline modification which makes possible the selenium cell occurs in two forms, viz:

(1) Round granular crystals, stable at 140°C, an insulator in the dark and not very sensitive to changes in light intensity.

(2) Which is readily formed when the above granular form is heated to 200°C. In this form it is a relatively good conductor. It will, however, instantly respond to succeeding exposure.

The general belief, also erroneous, seems to be that the shorter the wave-length, i.e., the violet, are the ones which have the most pronounced effect upon the conductivity of Selenium, but exhaustive research has proven that the waves having the greatest activity for increasing the conductivity have a length of over 5,000 units.

In splitting the light from a certain source, the problem of dividing the rays in definite portions may strike one at first thought as an exceedingly difficult task. In certain kinds of photographic and optical work, however, it is very essential to divide the rays in such a manner that one portion of the light will go in one direction and the remaining portion in one or more other directions. Partially transparent mirrors are used for the purpose, and in order that the precise division of light may be known beforehand, the thickness of the thin layer of metal which is deposited on a plate of glass to form the mirror must be exactly known.

In Fig. 1 is shown the apparatus developed in the research laboratory of one of the leading camera manufacturers for use in making mirrors of different degrees of transparency employed in certain important photographic experiments. Two inverted glass bell jars are shown, each of which is connected to a vacuum-pump system. By means of this arrangement the air pressure inside the jars is reduced to a scant millimeter. This is done because in a rarefied gas the passage of electricity from the cathode, the terminal at the bottom of each jar, to the anode—the upper terminal, is greatly facilitated. The cathode consists of a very thin sheet of metal which usually is of gold or an alloy of platinum and iridium. A short distance above this sheet of metal in a plane parallel to it, the glass plate to be coated is placed on glass pillars as shown.

The larger jar is 16 inches in diameter and 11 inches high and is used for coating mirrors 11 inches square. With the air exhausted the atmospheric pressure on this jar (about 15 pounds per square inch) mounts up to approximately five tons. The current is measured in thousandths of an ampere (milliamperes). The voltage, however, is very high and is stepped up by a transformer from a value of 150 volts to 5,100 volts.

As soon as the current is turned on a pink glow is noticeable in the jar. Just above the thin metal cathode, however, there is a certain dark region which is called the Crooke’s dark space. The action of the current causes minute particles of metal to leave the cathode and to be deposited on the glass plate which is placed just at the edge of the Crooke’s dark space, where the metal is most cohesively deposits.

Fig. 2. Curves showing Reflecting Power at 45 Degrees Incidence and Percentage of Metal Deposited and Light Transmitted for Platinum-Iridium Mirror With Varying Products of Time and Current.

In Fig. 2 is shown a set of interesting curves obtained in a typical run with a cathode of 20 per cent platinum and 30 per cent iridium, measurings 1,200 millimeters by 120 millimeters by 0.1 millimeter. These curves show the reflecting power at 45 degrees incidence and the percentage of light transmitted and metal deposited on a unit of area for varying products of current and time. It was found that a mirror whose transmission was equal to its reflection required a deposit of 2.4 milligrams per square decimeter.

Photos courtesy of Eastman Kodak Co.
A New Optical Pyrometer

The new pyrometer here shown is a practical instrument, and of the same time, accurate instrument, which can be successfully used by unskilled workmen. Temperatures in the range of 700° C. upwards are read directly upon clear, open scales. Owing to the rapidity with which readings can be taken, and the ease of sighting upon small objects, the instrument is particularly suitable for research purposes and in many processes in steel, pottery, glass and other works. It has been developed by an English firm.

The instrument may be regarded as a photometer, in which, by simply rotating the eyepiece, a beam of selected chromatic light from the hot body is adjusted to equal intensity with a beam of similar light from an incandescent electric lamp. It is not a color-matching instrument, and in consequence of the simple construction, accurate readings can be taken repeatedly by different observers with remarkable consisteney. The formula, which expresses the relationship between the intensity of the radiation of a hot body and its temperature, has been examined both theoretically and practically by many investigators and has been shown to give results of great accuracy up to the highest temperatures. The constants of this formula for every instrument are individually determined at several temperatures before calibration.

The general arrangement of the instrument is shown in the figure and includes:

- The pyrometer, consisting of the optical system, the electric lamp, the shield carrying the temperature scale and pointer, the teak carrying-case with fittings for fixing the pyrometer and standard lamp for checking.
- Volt accumulator, ammeter and regulating resistance, complete in teak case; the standard lamp and an adjustable tripod stand.

The following is a brief explanation of the construction. Behind the enlarged part in the front of the pyrometer in which is fitted the electric lamp, are two holes. Light from the object (such as a furnace) under observation passes thru one, and light from the lamp thru the other. These beams of light then pass thru a system of lenses and prisms, are polarised in different planes and rendered monochromatic. Finally, the two beams of light pass thru a system of filters, and are further polarised, while the other is uniformly illuminated by the electric lamp. The two semi-circles are brought to an equal intensity of illumination by turning the eyepiece to which the scale pointer is directly attached as seen. This facts the readings are compared with those of known intensity from the electric lamp. As the accuracy depends upon the constancy of the light from the lamp and the electrical system, a small ammeter and regulating resistance are fitted in the box containing the accumulator to ensure that a correct voltage of the battery may be the current passing thru the lamp is constant. To ensure that the candle-power of the lamp shall remain constant over long periods as the filament ages, provision is made for calibrating the instrument from time to time against a standard-arc lamp, and thus ascertaininng the correct reading of the ammeter when the electric lamp is giving the correct illumination. This test need only be made at long intervals and the standard lamp need not be carried into the factory or plant.

The pyrometer is supplied fitted with one or more temperature scales of any desired range from 700° C. upwards, but the following standard ranges are suggested as suitable for most practical considerations:

- Single scale instruments, 700-1400° C.;
- Double scale instruments, 700-1400° C. and 1200-2500° C.
- Double scale instruments, 900-2000° C. and 1400-4000° C.

ELECTRIC COUCH INDUCES CURRENTS IN THE BODY.

By H. H. Parker.

The electric couch described in this article makes possible a simple application of the commercial alternating current in the electro-therapeutical treatment of insomnia, hardening of the arteries, nervous disorders and other ailments; a number of sufferers from chronic trouble claims that they have been greatly benefited by its use. While the apparatus has been constructed in various forms, the one described has the advantages of simplicity, lightness, neat appearance and case of operation, provision being made for connection to any lighting circuit carrying alternating current at 110 or 220 volts and any frequency.

The couch itself is an ordinary wicker-work affair, to the bottom of which are fastened a series of coils, wound upon laminated sheet iron cores. In the one shown in the illustration eight coils are used, connected in series for 230 volts and in separate groups of four in series when operating on 110 volts. At a convenient point at the end of the couch is placed a wall key socket for cord and plug.

Owing to the use of alternating current, laminated iron cores must be provided for the coils; these are built up of No. 22 gauge iron straps one and a half inches wide by twenty-six inches long, the completed core being about half an inch thick. The strips are shellacked before being put together, and are held by paper insulated rivets in order to prevent the formation of eddy currents in the iron or rivets. After insulating the cores they are wound with two layers each of No. 25 D.C.C. magnet wire, coated with shellac or insulating varnish, wrap with cotton armature binding tape and then bent to conform somewhat to the curve of the couch surface when sagged by the weight of a patient lying upon it.

As part of the equipment a Test Coil is provided. This comprises a built-up iron core similar to the others, but only about three-quarters of an inch square in section. At its center is wound two layers of No. 25 D.C.C. magnet wire in a coil about six inches long, the terminals of which are carried to a miniature lamp socket at the end of the core containing a two-and-a-half volt battery lamp. This wand-like contrivance is considered by the patient an indispensable part of the outfit, and is used to determine when the couch is "working." When brought into the influence of the rapidly alternating magnetic field surrounding the coils the little lamp is lighted, the dimensions of its coil being such that the core may be laid upon the couch in close proximity to the coils without danger of burning out the bulb. By moving the test coil away from and around the couch a visible demonstration of the strength and extent of the magnetic field is afforded.

To operate the couch the patient merely lies down upon it and switches on the current. No physical effect is noticeable beyond a slight vibration due to the alternating current, the beneficial results obtained being supposedly an effect of the rapidly alternating magnetic field surrounding the body.

There appears to be a difference of opinion among medical men as to the exact action of this magnetic field upon the human system, but in looking at the subject from the engineer's instead of the physician's viewpoint, the following theory suggests itself: Do the blood circulation passages, the veins and arteries, or any of the organs or other parts, form, as it were, the closed secondary circuit of a transformer, in which currents are induced through the action of the magnetic field produced by the alternating current flowing in the primary winding of the coils beneath the couch?
SIR OLIVER JOSEPH LODGE.
June, 1917, Marks His 60th Birth Anniversary.

One of the most profound scientific workers and thinkers we have ever had, is Sir Oliver Joseph Lodge, who is still an active figure in the field of scientific research, and all of us expect in the near future to see something even more wonderful than any of his preceding discoveries and inventions.

Sir Oliver Joseph Lodge was born on June 12, 1851, at Penkull, Staffordshire, England. He received his early education in the Newport Grammar School and later he entered the University of Coll, London, where he specialized in scientific and mathematical research. His scientific trend was noticed by the professors of different universities, and after he had graduated from this institution he was elected as Professor of Physics at the University of Liverpool. Since 1900 he has been principal of the University of Birmingham.

He has had many honors and degrees conferred upon him and is an active member of many of the leading scientific institutions. Sir Oliver Lodge was presented with the honorary degree of Doctor of Science from Oxford, Cambridge, Victoria, Liverpool and others, also that of LL.D. from St. Andrews, Glasgow, and Aberlaid. He was president of the Mathematical and Physical section of the British Association in 1891, and President of the Physical Society of London. His most important work in electro-physical science is that of wireless telegraphy, in which he has introduced some of the most fundamental steps in commercializing this fascinating art, and in fact he is called by many the father of wireless. The Lodge coherer was the first instrument used for successfully receiving radio waves.

He discovered in 1889 that two metallic surfaces in perfect, but not conducting contact, were welded together when an electric discharge passed between them, and later on studied the propagation of electric waves along wires. He thus came into close contact with the researches of Hertz on the creation of electromagnetic waves in free space, and this work he both expanded and extended.

His interest in these matters was, however, scientific rather than technical, and he himself has admitted that before the matter had received attention from others it had not occurred to him to suggest the employment of Hertzian waves for practical telegraphic purposes. In the course of his scientific work he had directed much attention to the phenomena of electrical resonance. Hence, when it had been indicated that the chief practical importance of Hertzian waves might be in their application to space-telegraphy, Lodge was not slow to apply his knowledge to this subject.

On May 19, 1897, Lodge applied for a provision patent protection in Great Britain for improvements in Synchronizing Telegraphy Without Line Wires, and in this document he states that the subject of his invention was to enable an operator to transmit messages across space to any one or more of a number of different individuals in various localities, each of whom is provided with a suitably arranged and "tuned" receiver. The subject-matter of the specification deals exclusively with the utilization of electromagnetic waves. This is the noted Lodge tuning patent which is universally employed in all forms of radio transmitting apparatus today. The patent recently expired and became public property.

Sir Oliver Lodge is a noted author, and some of his most important works are: "Elementary Mechanics," "Modern Views of Electricity," "Pioneers of Science," "SIGNALING THROUGH SPACE WITHOUT WIRES," "Life and Matter," "Lightning Conductors and Lightning Guards," "Modern Views of Matter," "Man and the Universe," and his latest book: "Raymond: A Treatise of Life and Death," which purports to prove that the author actually received communications from his dead son, who was killed while serving with the English army in France. His theory has been received coldly by the scientific world.

Prof. Bell Receives "Civic Forum Medal" For 1917

The accompanying photo shows the presentation of the "Civic Forum Medal" for 1917, to Dr. Alexander Graham Bell, the inventor of the telephone. Those in the picture from left to right are: John J. Carty, Union N. Beach, Dr. John H. Finley, Prof. Bell and Thomas A. Watson, Who Made the First Telephone for Prof. Bell.

The Inspiring Moment When Professor Bell, Inventor of the Telephone, Was Presented With the "Civic Forum Medal" at New York, on March 21st. Reading Left to Right—John J. Carty, Union N. Beach, Dr. John H. Finley, Prof. Bell and Thomas A. Watson, Who Made the First Telephone for Prof. Bell.

HOW ELECTRIC VEHICLES
BOOST EFFICIENCY.

A New York department store speeds up the loading of its delivery wagons by running its "electric" inside of the building and transporting them to various floors on large elevators.

Sir Oliver Joseph Lodge, Famous English Physicist and Savant. He Is Regarded as One of the Most Important Scientists of Today.
AND another thing," Mr. Robertson checked Pete, "don't bring that blind kid around here any more. He's just in the way, and if he gets hurt the company'll have the damages to pay. What business has a blind kid got around an electric plant, anyhow? You keep him out of here, understand?"

Pete Foley whirled and surveyed the nervous, drawn face of his chief for a moment, and then flung back hastily, "Look here, that boy's a friend of mine and a mighty good friend. He's not in your way when he comes around here, and I'm responsible for his safety. As for the mountain-side, Joe Benson paused and listened to the faint purr of unit No. 1, far away down the slope. Ever since the Snake River Power Company had started the first day's work on this water power project, Joe had been an interested listener of everything that went on. Listening had been his chief avenue of impression, for his eyes were useless, and had been so for several years. He had heard the rumble of the blasters, and the grit and grind of drills and steam shovels as they prepared for the big concrete dam which held back the water. He had listened and been interested, but mystified, until Pete Foley, a member of the electrical construc-

"No, you don't. Not me," Pete interrupted, as Mr. Robertson turned to him. "Here's the boy you want to thank. He saved your plant and not me."

what business he's got around an electric plant, let me tell you that he knows more about electricity right now than some men who are paid big money for what they are supposed to know. He'll make his mark some of these days when he gets into the electrical world, you'll see. And furthermore, he's going to come here whenever he wants to, as long as I'm around."

Mr. Robertson's white,正是 face flushed angrily and his lips parted as if to speak. But he was silent as Pete swung out of the power house and up the trail to the company's tool shack. Pete Foley was a good electrician, a very good electrician. And men with this particular kind of goodness were so scarce in these mountains that it behooved Mr. Robertson to stand for much from this member of his construction crew.

Half way up the road to his home on the mountain-side, Joe Benson paused and listened to the faint purr of unit No. 1, far away down the slope. Ever since the Snake River Power Company had started the first day's work on this water power project, Joe had been an interested listener of everything that went on. Listening had been his chief avenue of impression, for his eyes were useless, and had been so for several years. He had heard the rumble of the blasters, and the grit and grind of drills and steam shovels as they prepared for the big concrete dam which held back the water. He had listened and been interested, but mystified, until Pete Foley, a member of the electrical construc-

"I'm 'ere, chief for the first day's work on the Snake River project had dazzled Joe. Then with a realization of the extent of the undertaking had come, at first as a dream, and then a resolve, the idea that he, too, would become an electrical man, an electrical engineer. True, he was blind. But he was attending the high school up the valley and in two years would be ready to enter

IT was Pete who had answered his hour and volley about the plant and its operation, and during the year which had elapsed Joe absorbed electrical information like a dry sponge taking in water.

At first he had listened to the conversation of the men, but had been loath to take part in it because he felt his own ignorance of their work. However, as time passed, and Pete's daily instructions bore fruit, he began to take a more active part in the talk of the men during the evening. At first they had regarded him as an outsider, whose ignorance of their work was to be tolerated for politeness sake only. But gradually, as Joe's comments and questions became more intelligent, they began to look to him as an equal—as one of their own number professionally. "I'll be hanged if that kid don't know

the university. Other blind men had done things equally as wonderful. Why could he not enter this field?

And what a day this had been. What a wealth of impression and sensation. He had stood beside the great towering masses of iron and copper and had felt with his own sensitive hands the giant castings and coils of the great generators, while Pete explained how they were built and worked. So this April afternoon he went home warmly glowing with new impressions and desires.

Pete did not have time to talk after supper. He went upstairs for his clothes and then disappeared down the slope in the company car, on his way to Melwin to complete preparations for the transformers in the sub-station there. And so Joe sat on the porch and listened to the faint hum of the generators below him,
while he dreamed of his future. Two days later when Pete returned from Merwin, he was69 waiting for him after supper as the group of boarders gathered on the porch.

"Pete," Joe began, "I've been wanting to ask you something since day before yesterday, but you weren't here to answer it."

"Go ahead, but don't go too deep. Remember, I'm only an ordinary electrician," Pete warned.

"Well," Joe went on, "on one of those switchboard letters you passed me today, I noticed there was a rheostat, but you didn't say what it was for. What does it do, anyhow?"

"That's the rheostat for the exciter's field," Pete responded. "It's connected in the shunt winding of the exciter field coils. It controls the voltage."

"What do it do that for?" Joe insisted, going to the bottom of the matter.

"Well, here's the idea," Pete explained. "You see the exciter supplies current to the field of the big alternator. Well, the voltage of the alternator will depend on the voltage of the exciter, because if the voltage of the exciter changes the strength of the field will change and affect the alternator's voltage. So if they want to raise or lower the voltage of the big alternator, they just raise or lower the exciter voltage by putting in more or less resistance in the rheostat. Do you understand?"

"Oh, yes," Joe replied. "Then by adjusting this field rheostat on the exciter you can change the voltage of the big alternator."

"Exactly," Pete assented. Joe sat for some moments, thinking of this new addition to his store of electrical information, while the men about him talked lazily. Robertson's getting grouchly about those transformers, I tell you," one of the men said a moment later.

"If they don't come, the company won't be able to put them in operation, and he seems to think it's up to him to get them here."

"I know that all right, but he oughtn't to blame us, as we oughtn't to blame," Pete retorted. "He's been a fright for the last two weeks."

"What transformers are those?" Joe asked.

"The transformers for the Merwin substation, the step-down set," Pete informed him.

"Haven't they come yet?" Joe asked in surprise.

"No, they've been shipped a week but can't be located on the road or anywhere else."

"What will he do if they don't come?" Joe asked in concern.

"I don't know what's what's bothering him, I guess," Pete replied.

The generators at Portage Falls developed current at low voltage which was then stepped up by transformers which stepped it up to sixteen thousand, five hundred volts, at which tension it was transmitted, over sixty miles, to the mountains. There it was stepped down to two thousand, three hundred volts for distribution thru the service lines of the city. Joe had been there the last week. He also knew that if the step-down transformers did not arrive, the Sagamore River Power Company would be in a very awkward position.

Its franchise required it to supply current to Merwin on May first. Today was April twenty-seventh.

Joe knew that the sixteen thousand volt current could not be turned directly into the city. He knew that burned out equipment and electrolyzed people would be the result. The voltage had to be lowered, but how? He knew that if out of it and tried to think what Mr. Robertson would do, as he sat on the porch and listened to the men talking, and far away the faint hum of the alternators in the power house, limbering up their bearings.

AST month we publish a rattling good story—"Eddy Currents"—by Mr. Adams. We confidently believe that the present tale will appeal to all dyed-in-the-wool electrical readers. You don't require an electrical education to become "en rapport" with the author, as he possesses that happy faculty of weaving the technical and personal aspects in such a way that the moral cannot be missed. The facts related in this story are human, pertinent every-day affairs. Similar obstacles to facing invincible Joe Benson, the hero of this narrative, have confronted all of us at one time or another. But true "Philosophy" will unlock all doors and surmount the greatest of barriers.

**In that "July" E. E.**

**Are There Currents About a Magnet?**—with a number of original photos and charts never published before. By F. F. Mace.

"Cold Light" or La Lumière Froide as the French call it. The work of Prof. Dussaud.

"Back to the Days of "Volta"—with some extremely interesting photos of Volta's original apparatus—by Jacques Froide, our French Correspondent.

"Han Jones—Scientist"—a rollicking, good electrical story with a live wire walkup in every line by H. W. Escholz.

The Marvels of Radioactivity by Jerome S. Marcus.

"Lightning—How to Protect Yourself from It"—An article everyone should read by W. G. Whitman, with illustrations.

A Page of Marvelous X-Ray Photographs, including one of a four-legged chicken.

The Calculation and Measurement of Inductance by H. Winfield Secor and Samuel Cohen.

Besides these and a large number of other valuable and interesting articles, there will appear a liberal sprinkling of timely summer-time topics of interest to all readers. Don't miss the "July issue." I'll be right there waiting for you with a walkup on every page.

"So crazy, if those transformers don't come," Pete replied unconcernedly.

The next day Joe found himself thinking of the problem as again he heard the machines purring away on his way home from school. That night as he sat on the porch he was still thinking of it, and yet he found no ready solution for the difficulty.

"I don't see how they're going to fix that up if those transformers don't come," he complained to Pete.

"Great guns, you aren't trying to figure out a way, are you?" Pete exclaimed.

"No, I don't feel that I ought to be able to, or try anyhow," Joe protested.

"Let Robertson do that. He's paid for worrying," Pete retorted cavalierly.

But that did not satisfy Joe. The plant below had been growing in his very doorstep. He had heard every bit of metal and concrete put into place, and he felt as if the thing were his own. Then, too, was he not going to be a consulting engineer some day; would not a problem similar to this be put to him someday? He was, at least, attempting to solve it now. So he puzzled his brain over the problem for all the next day, suggesting, rejecting, and pondering. But by the evening he had not reached any solution.

He was not the only one who was thinking of this problem. The worried, anxious face of Mr. Robertson was frequently tinged, his dark-ruining eyes, glittering with sleeplessness, testified too plainly of his own struggle over the proposition.

He remained at Portage Falls directing hints of finishing work, while he hoped and almost prayed for the momentary arrival of the transformers so much needed. He telephoned to Merwin to see if they had arrived. Hourly he hoped that they might have come, and then grew despairing as he knew that they had not.

On the morning of the thirteenth he went to Merwin with the determination of staying there until they came, and hoping against hope that service could be started on time.

Pete and the others stayed behind at Portage Falls, finishing the work there. The plant was in order, each great machine ready to send its thousands of volts so much needed. Hourly he telephoned to Merwin to see if they had arrived. Hourly he hoped that they might have come, and then grew despairing as he knew that they had not.

The men boxed up the steps of the Benson home at dinner time. Worry over what would happen to the company did not interfere with his appetite, and he was ready for the fare awaiting him.

But five minutes after he had consumed leisurely inside, he dashed out, leaped off his car, and raced across the steep hillside, recklessly speeding toward the company's tool shack at the bottom. A minute later he flung open the doors of the building and was crowding his auto-mobile. Two minutes later and the pebbles were flying in a stream from his tires. Why he hugged away over the rough roads toward Merwin.

An hour and a half later he stood Mr. Robertson's big high-power roadster before the building. He used his whip, while he himself sprang out and dashed down to the power house, with Pete closely pursuing him.

"It was a varied group which clustered about the switchboard, handsomely drest directors, officers and workmen in overalls. (Continued on page 150)"
AN ELECTRIC SEMAPHORE FOR AUTOISTS.

The accompanying photograph shows a cleverly designed automobile electric signal device which has recently been developed by the well-known civil engineer, Mr. H. Hartman, of New York City.

The invention, which is really quite simple in construction and performs its function just as well, or perhaps better, than many existing and more complicated similar devices, is that of a motorist in which the direction in which the car is going is indicated by means of a revolving pointer.

This purpose of the instrument is to warn motorists to keep to their own lane or to move out of the way, or, at any rate, not to impede the progress of passing traffic.

Such a device is therefore a great advantage to the motorist who wishes to move out of the way of the traffic behind him, and also to the driver of a car which is being overtaken.

AN ELECTRIC INSTRUCTOGRAPH FOR TEACHING AVIATORS.

One of the latest Sperry devices for aviators, or rather for would-be aviators, is known as the "Instructograph" and is illustrated herewith.

It is intended to facilitate the instruction of pupils in the modern two-passenger tractors aeroplanes.

Prior to the advent of this clever device the Pilots-Instructor, occupying the rear seat of the machine, depended on twitching the various controls, after attracting the attention of his pupil-passenger by kicking the back of the forward seat, for imparting such instructions as were necessary.

This crude method of communication is dangerous, as at times neither pupil nor instructor know whether the control of the plane is in their hands or not, and becomes readily apparent.

The Instructograph consists of three units: the transmitting unit, the receiving unit, and the relay unit, all of which pieces are of light and compact construction, the complete installation weighing but six pounds, without batteries, it has been designed for the strength and durability necessary for the hard usage they will be subjected to in service.

The Transmitter consists of a case, of light metal construction, about six inches long, three inches thick, and an inch wide.

A series of six double throw keys project from one edge, to the other, of which every two are engraved plates, bearing all the instructions commonly used in teaching the art of flying.

The keys, which are of such size that they can be easily handled with gloved hands, can be thrown to either the right or left, remaining in the position placed until released by a touch. When they are placed they are seen.

The armature and field coils are enclosed in a water-tight metal case which is seen on the left.

One end of the pointer is fitted with a red lamp, so as to serve as a danger signal.

The armature and field coils are connected to a storage battery and a simple switch, so that the autoist can throw the arm equipped with the danger signal to the right, whichever case might be.

The principle upon which this instrument is based is that of the repulsion and attraction of two different magnets, one stationary (the field), while the movable magnet is the armature.

The arm at its normal position points downward, and as soon as the proper current is past through the field and armature, the pivoted arm turns instantaneously to that direction, by virtue of the attraction between a field coil and the armature coil.

The armisths of to-day whose slogan is Safety First will appreciate this very valuable device, as it cannot be mistaken owing to the relatively large moving surface called into play.

NEW METHOD OF MEASURING PRESSURE OF LIGHT.

In a paper to the Physical Society, Mr. Gilbert D. West describes the experimental determination of the pressure of light by a method requiring few of the elaborate precautions generally necessary in such experiments.

The essential feature of the apparatus was a strip of gold leaf suspended in the middle of a test tube containing air or hydrogen at reduced pressure. Radiation from a 32 c.p. carbon filament lamp, impinging directly on one side of the strip, was sufficient to cause a microscopically measurable deflection of the end.

The pressure of normally incident radiation on a perfectly reflecting surface has been shown by Maxwell and others to be numerically equal to the energy content of the radiation per unit volume, and hence, if this quantity be measured in the way described below, a check on the original observations can be made. The mean of the results of several successive experiments with the deflected strips gave a value for the pressure of radiation which only differed from that calculated from the energy density by a small percentage.

The accuracy and constancy of the final results seemed to preclude their being seriously affected by any errors which in the past had been taken into consideration, and the present research was undertaken with a view to its Fuller investigation, if possible, to complete elimination.

In measuring the energy density, the initial rate of rise of temperature of a blackened copper plate, enclosed in the tube, was measured by the deflection of an attached copper- eureka thermo-junction. Due allowance was made for cooling correction, and the lamp black was assumed to absorb 95 per cent of the incident radiation.

The cold junction was immersed in oil contained in a vacuum flask, and during an experiment a delicate indicating thermometer in the oil only showed negligible variations.

The calibration of the thermo-junction was carried out in the usual way, and a number of minor matters received full consideration.

When from the measurements thus taken the energy reaching 1 sq. cm. in one second is known, the energy per 1 c.c. can be calculated from a knowledge of the velocity of light.

(Continued on page 125)
NEW TELEPHONE SIGNAL A PATIENCE SAVER.

Patience vanishes rapidly while holding a telephone line. Save your time and attention to other important matters while waiting for the other party to resume conversation, say the sponsors of the new 10-fold-the-call-signal here illustrated. This clever device will let you know when the speaker is ready. No electrical connection is needed. It simple rests alongside of the instrument and the receiver is placed on it while line is held open.

HOW STUDENTS STUDY WAVE MOTION.

When the college "Prof." tries to drum the principles of wave motion into his pupils’ craniums, he has available today the mechanical wave reproduction machine here illustrated. The small white disc forms various lines representing curves or waves of certain kinds, depending on how the apparatus is operated. This remarkable model was invented by Dr. Charles Forbes of Columbia University. With this apparatus the formation and propagation of the three general classes of wave motions may be demonstrated, namely:

1. Water or Surface Waves, in which the elliptical motion of the particles of water, the advancing of the crest, and form breakers, the recession of the trough tend to form the underow are exhibited.

2. Sound Waves, or waves of condensation and rarefaction, in which the amplitude of vibration may be changed by lowering the disc support. The lowering of the distant end of the support will also represent the decrease in the loudness of sound.

3. Electric Waves, or transverse vibrations, representing the production of light, heat and electric waves. The progressive undulations of a vibrating cord are also represented.

UNIQUE ELECTRIC SOLDERING TOOL.

A Buffalo concern has recently brought out a new form of electric soldering tool. Among these tools is a two-prong iron with prongs of solid bar brass with nickel-plated finish. This type of iron is furnished in capacities of 150 watts, 250 watts and 300 watts. All are designed to work on low pressure, from 6 to 15 volts, either direct or alternating. Pressure can be obtained from an ordinary lighting or power circuit, either 25 or 60 cycles by interposing a low-voltage transformer, or a storage battery operating at a pressure of 12 volts can be used. Under no circumstances may these tools be used on any voltage over 15.

Another type is the two-handle portable soldering outfit. This is composed of a single prong soldering tool attached to one wire of the secondary side of the transformer and a solder-feeding tool attached to the other secondary wire of the transformer. When a storage battery is used the single prong soldering tool is attached to the negative side, and the solder-feeding tool to the positive side of the latter.

When soldering with this outfit the single prong point is brought to bear upon the object to be soldered, and the solder-feeding tool is brought to bear upon the spot where soldering is needed. The instant the circuit is closed the heat point glows with a white heat, and the solder is held until the work is done. The current ceases to flow as soon as the heating point is taken from the work. This outfit is made in 150- and 300-watt capacities and is designed for use on direct or alternating currents up to 12 volts pressure.

A CLEVER INVENTION IN THE FORM OF AN AUTOMATIC EXTENSION REEL FOR PORTABLE ELECTRIC LAMPS.

It is designed especially for garages, blacksmiths, factories, stores, or any business requiring an extension light. This reel is equipped with 30 feet of lamp cord, easily secured by tightening the arms of the swivel joint to ceiling or beam, as shown.

This swivel joint enables one to walk in any direction with the lamp. It has an automatic lock ingeniously arranged to lock and hold the lamp any distance from the reel. A slight pull forward unlocks the ratchet and the reel revolves, winding the cord back as you advance toward the reel with lamp in hand.

A HANDY ELECTRIC DRINK MIXER.

The soda clerk used to cuss (inwardly) merrily whenever a patron called for a drink that required a fancy mixture—a chocolate milk shake for instance. Wherefore and hence we have in our midst the electric drink mixer that never tires—no matter if you had a thirst like an Arabian camel.

The electric drink mixer is mounted on a swinging bracket. When the machine is pushed back and removed from the glass it takes the position indicated by the dotted lines. Throwing back the bracket operates a switch which breaks the circuit. The swinging down of the bracket automatically closes the circuit.
Electricity and Life
The Uses of High-Frequency Currents in Medical and Lecture Work
By FREDERICK FINCH STRONG, M. D.
Lecturer on Electro-therapeutics. Tufts Medical School, Boston

(Third Article)

The phenomena of high-frequency currents offer us a fascinating field from which to select experiments for public lecture demonstration. In his lecture on "The Realms Beyond the Senses," the author has used high-frequency phenomena to demonstrate the existence of force and matter beyond the range of human perception. In "The Science of the New Age," he has employed similar means in calling attention to the fact that the investigators of to-day are leaving the crude matter of earth and are dealing more and more with Etheric Force—and with matter of a super-gaseous nature. The scientist of the future will have to provide himself with instruments far more delicate than anything hitherto dreamed of or else he will develop supernormal powers of perception by the manifestation of faculties already latent in the human organism.

For the traveling lecturer who wishes to employ high-frequency currents in his work, the large resonator described in the last issue of The Electrical Experimenter may prove somewhat cumbersome and difficult of transportation. Those who wish a lighter, more compact apparatus may use the small resonator shown in Fig. 1.

It is quite small, yet it sends out streamers two feet in length, and may be operated by a 1/2 K.W. "wireless" (step-up) transformer. With this little apparatus beautiful luminous effects may be obtained—as, for example, by connecting the terminals with a tin-foil star glued to a sheet of glass: with a suspended umbrella (opened): with a long wire running out over the lecture hall, etc.

For each of these experiments different tuning will be necessary—the series inductance coil being adjusted to balance the different capacities added to the resonator terminal.

This little resonator is made by winding 600 turns of No. 30 triple cotton covered wire upon a shellacked paper cone, 12 inches in diameter at the bottom, 5 inches at the top, and 14 inches high. It is a difficult matter to insulate this small coil as the turns of the winding are very close together; it can be done, however, by the use of from six to eight coats of Armalac. The primary coil is a ring, 18 inches in diameter, formed of five concentric turns of thin copper ribbon 1 inch wide. The exciting apparatus is the same as that described in the last paper in connection with the large resonator, except that a 1/2 K.W. transformer is used instead of the heavy 1 K.W. (See Fig. 2.)

The writer also employs a standard Clapp-Eastham 1/2 K.W. Tesla coil excited by the same apparatus (see Fig. 3). Connected with two parallel upright wires the spark from this coil will run up and repeatedly reform again at the bottom, producing a very spectacular effect (Fig. 4).

Another brilliant experiment can be performed with two large glass flasks (ordinary carafes or water-bottles will do). One is filled with water containing a few drops of fluorescein solution—a coal tar dye)—the other with water to which a small amount of bisulfate of gunnirite has been added; the bottles or flasks are placed about six inches apart and a wire from the Tesla coil terminal inserted into the solution in each. The current passes down thru the water and the arc takes place between the glass walls of the two flasks. The ultra-violet rays from the discharge cause the water in the flasks to become luminous—the gunniurite solution with a pale blue light, the fluorescein with a beautiful apple-green. The discharge apparently passes directly thru the glass walls of the flask; in reality, of course, the current passes by induction rather than conduction, the flasks acting as condensers in series. (See Fig. 5.)
THE ELECTRICAL EXPERIMENTER

June, 1917

The Use of High-Frequency Currents in the Treatment of Disease.

High-frequency currents are employed by physicians in four principal ways, each adapted to the treatment of certain types of diseased conditions. These are:

1. "Tesla" treatment with vacuum electrodes ("Violet-ray treatment").
2. "Effleuve" or high-frequency spray.
3. "D'Arsonval" auto-condensation.
4. "Dialthermie."

1. The method most frequently employed applies the Tesla current thru glass (vacuum) electrodes for the relief of local pain or inflammation. The little muscular pumps around the veins—the "caso-motor system," which keep the blood circulating by withdrawing it from the capillaries and sending it back to the heart—act more vigorously in tissues over which the vacuum electrode is applied. In this manner waste products which cause rheumatism and gout are dissolved and washed away and fresh blood and white corpuscles are brought to infected parts, thus aiding nature in destroying disease-producing germs and their poisonous products.

In most of the smaller high-frequency machines for physicians' use, but one Tesla terminal is provided; a coil of the resonator type being connected to the glass electrode by a flexible wire. The effects are largely local, but the method is of value in relieving pain, swelling and congestion. The writer has always advocated the bipolar method, even for treating purely local conditions. The best results will be obtained from the use of a Tesla outfit of the type described in last month's ELECTRICAL EXPERIMENTER. The patient is to be connected to one terminal of the Tesla coil by means of a metal electrode held in both hands (a piece of thin nickeled pipe will answer. 1 foot long and 1/2 inches in diam.). In this way the current is diffused thru the entire body. The vacuum electrode, connected with the opposite Tesla terminal, is applied to the skin over the affected part for from five to twenty minutes, a very short spark-gap being used.

2. For the "Tesla Effleuve" treatment a brass bell electrode is used. This can be made from a common brass oil can, the flat bottom being removed and the resulting hollow hemisphere being mounted on an insulating handle. The discharge occurring from the sharp edge of the brass. The patient is seated on the Bakelite pad, which is connected to the Tesla coil. The opposite terminal is attached to the brass bell electrode and a sufficient number of turns of the inductance coil are placed in series with the Tesla primary to give a full "effleuve" or purple brush discharge, when the electrode is held from four to eight inches from the patient, with the local effects from the vacuum electrode.

This method—employed by the writer for years—enables us to obtain the wonderful vitalizing effect of the high-frequency currents on the whole body simultaneously.

By careful tuning a beautiful effect may be obtained. Close examination of this discharge will show it to be literally an electric "brush", formed of thousands of distinct, delicate purple threads. Upon each of these hair-like paths of light countless millions of ions (electrically-active atoms), are being shot from the electrode to the patient at a speed of over 60,000 miles per second; the treated surface is therefore being submitted to a literal bombardment by countless microscopic projectiles which are thrown out in periodic showers from the electrode, once for each cycle of the oscillating current. Two effects are produced—one due to the penetration of the tissues by ion-forming ions, the second to the rhythmic or periodic impact of the discharge upon the nerve endings in the skin and superficial tissues. The writer hopes ultimately to produce an apparatus of a frequency exactly synchronous with the rate of vibration of the sensory nerves: an "effleuve" from such a coil would produce a harmless and efficient local anesthesia so that operations could be performed without the use of ether or cocaine. The effects obtained from the "effleuve" as now used are stimulating and vitalizing to a marked degree. The nerve endings of the skin may be regarded as sensitive antennae of a complicated radio-system, and any intense sustained vibration to which the apparatus is attuned will be transmitted by them to the receiving station. The effect therefore, is not merely superficial but systemic as well. Tuber-

(Continued on page 152)
HYDROSTATICS.
LESSON FIVE.

WATER is so plentiful, and we are accustomed to use so much of it, that very few of us ever think what a great part it plays in our daily lives. It is without doubt an absolutely indispensable sub-
stance. We drink it—we clean ourselves and our belongings in it—our crops depend upon it—ourselves and the fruits of our toil are transported from one continent to another by means of it—practically every manufacturing industry makes use of it. Finally and most important, we swim in it. What would be the use of living if we had no Water? Burst Barch or "the old swimming hole in the creek"? We naturally ask what is water anytime? One could never guess the answer. Water is going more than the result of the combining of two gases—Oxygen and Hydrogen. Oxygen, we remember, is the constituent of the atmosphere necessary to life. Hydrogen is the gas which burned with a pale blue flame in the lesson on "Gases." (See March and April issues of this journal.) The following experiment can be easily performed successfully.

EXPERIMENT 23—(See Fig. 20)—C is a jar nearly full of water to which a few drops of sulfuric acid have been added. (The sulfuric acid is added to make the water a better conductor of electricity. Water alone is not a good conductor of electricity. i.e., is more or less of an insulator, just as glass is. D represents lead wires from a battery of at
least six dry cells in series, or from a storage cell or from the house current if it is direct current. If possible the electrodes should be of platinum. A and B are test tubes filled in the hand after having inverted full of water and are placed over the electrodes. Immediately, and with a rapidity dependent upon the strength of the battery used, bubbles form at the ele-

tron and rise to the top of the test tubes. These bubbles are the result of the decom-
position of the water into its constituents. We notice that in one tube the bubbles form more rapidly and that there is always about twice as much gas in that test tube as in the other. Call this test tube "B." After the test tubes have been filled with the gases, raise them carefully without tipping. Insert a glowing match-stick in "A." It is found to burn brightly. This we remember was the test for Oxygen. If a flame is applied to "B," a slight explosion results, with the test for Hydrogen. Thus we see that water is composed of two parts Hydrogen to one part Oxygen.

EXPERIMENT 26—(Fig. 21)—Illustrating the principle of the siphon. A and B are vessels at different levels, A being higher than B. The vessels are con-

nected by a piece of tubing; b' indicates the level of the top of the tubing and a'a' the level of the water in vessel A. A'b'b indicates the level of the end of the tubing. If the tube is placed in position as indi-
cated in the figure, and A contains water (or any liquid) at a level a'a', nothing happens. However, if the tube is filled with water before it is placed in position, the water begins to flow from A down to B. The siphon will also act if the tube is placed in position, and if one sucks at the lower end; for this is equivalent to filling the tube with water. The explanation of the action is as follows: The up-

ward pressure in the short arm of the tube, is due to the atmospheric pressure (discuss in the last two lessons). In the tube ab, this pressure is equal to the atmo-

spheric pressure minus the downward pressure due to the weight of the column of a'b'. The upward pressure of the tube at b' is the atmospheric pressure minus the downward pressure due to the weight of the column of water b'd'. The force tending to drive the liquid from A to B is greater than that tending to drive it from B to A. It is greater by the amount equal to the difference in the weight of the columns ab and b'd' and hence corre-

sponds to the weight of the column a'd'. Evidently if d', were at the level a'a', the siphon would not operate; and if above a'a', it would operate in the other direction. If the column ab (for water) were greater than 32 feet the atmospheric pressure could not raise the water this distance, and the siphon would not operate.

EXPERIMENT 27—Recently an automatic siphon has been put on the market, and it can be very easily constructed. Fig. 22 shows the automatic siphon in the act of starting. It should be noticed that the tube is filled alternately with bubbles of air and water. This condition prevails only upon starting and shortly after, the water comes out solidly. Fig. 23 shows a home made automatic siphon and all those inter-

ested should make one. It is a piece of lamp chimney about 3 inches long, 5, is a piece of glass tubing about 1/4 inch in diameter stuck thru a rubber stopper. 2, 4, is some more of the same kind of tubing past thru the stopper 3. The height h', should be about a foot and a half. 1, is a small hole drilled thru the lamp chim-

ney 6. 5 and 4, should be about 1/4 of an inch apart. As soon as our auto-siphon is placed in a liquid it begins to operate WITHOUT OUR FILLING IT FIRST. Thus we see that one made entirely of glass, as are the commercial ones, is very convenient in transferring poisonous liquids and acids, as we need not touch the liquid at all. There is nothing mysterious about this siphon and it is easily explained. When the bulb is immersed in the liquid, the liquid rushes in at 1 and at the lower end of tube 5. The liquid rushing in at 1 tends to compress the air in chamber 6. The liquid rushing in at 5 streams up past the gap and thru 4. Hence the outgoing air takes with it some liquid, and, as we stated before, we see alternately passing thru the tube bubbles of air and water. As there is less and less air left in 6, larger and larger quantities of the liquid pass with small bubbles of air intervening, until finally the air being all gone, the liquid (Continued on page 152)
Denver Wireless Station Wins Prize Loving Cup

By W. H. KIRWAN (9XE),
Master Radio Relay, Radio League of America.

To a Denver boy goes the honor of winning the trophy cup for the best Amateur Wireless Station in the United States. This cup was donated by 9XE to the most efficient and best equip amateur wireless station in the United States. We intended to call in a committee to decide upon the merits of the best amateur stations in the country, but station 9ZF in Denver was so far ahead of all other amateurs in sending, receiving, and efficiency, that it would have been a waste of time and energy to have consulted anyone at all.

This station, 9ZF, is known to every progressive amateur in the United States, and is one of the stars of the Colorado Wireless Association, and of which you have all read in a previous issue of this magazine. The winner is Mr. E. F. Doig, of No. 428 South Emerson Street, Denver, Colo. He made nearly all his apparatus himself, and has been assisted by Mr. W. H. Smith of the Y. M. C. A. Radio Club and the Colorado Wireless Association. Mr. Doig was for four years Master Signal Electrician in the Signal Corps of the Colorado National Guard. He now holds a special receiving and sending license from the United States Government. His equipment, although not as large as the Government station, is very complete, as you can clearly see from the photograph.

Mr. W. H. Smith, also well known for his skill as an operator, is associated with Mr. Doig and has worked on his night shifts at this station. Mr. Doig is also secretary of the Colorado Wireless Association and Mr. Smith is the chief operator. This station will hold this cup for one year, and if they win it again in 1918 it will belong to this station absolutely.

The cup has been properly engraved and you will see a picture in this magazine shortly of the cup holding a prominent place in the Laboratory of Mr. Doig. The Government Call Book gives Station 9ZF as belonging to Captain Smith of the Colorado National Guard, but the license was issued some years ago to Captain Smith; however, the station really belongs to, and was made by, Mr. Doig, as explained above.

A record of messages handled at 9ZF from January 13th to March 16th, 1917, shows that 251 messages were received and sent. A number of them were transcontinental messages from coast to coast. Station 9ZF held a very strategic position in the Washington’s Birthday Relay of February 24th, 1917, and without the assistance of this station it would not have been possible to have sent the message thru from coast to coast, nor for the return message to have been brought back.

We believe that nearly all of the stations thruout the United States can well pattern their installations, as far as general arrangement and efficiency is concerned, after Station 9ZF. Another point in favor of Station 9ZF was the fact that, while this station was affiliated with nearly every Radio Club and organization extant, the owners never refused a message, nor did they feel that Station 9ZF was too proud to work with anyone.

In the receiving cabinet is a large loose couple for reception of long wave stations like WG, GV, SL, OUI and POZ, as well as the Government arc stations. A smaller receiving cabinet is used for the shorter wave stations, including the commercial coast and sub-stations on the spark system. There is also a short wave regeneration receiver, which is used in working with the amateur stations. This cabinet also contains an amplifier which can be used in connection with each of the other sets. There is not much to tell about the Rotary Quenched Gap, as the cut shows just what it is, and there are not very many amateurs that have had the chance to read about this outfit.

The 1 kw. outfit which is used mostly, radiates from 12 to 14 amperes on a wave length of 190 meters, and the oscillator transformer is made with edewisound wound copper strip, a type with which you are all familiar, and which is clearly shown in the photograph of the equipment.

There are three towers to Station 9ZF, one of them being 90 high and the other two 75 high. One aerial has six No. 12 aluminum wires, 150 long, and the other aerial has four stranded aluminum cables with 7 strands of No. 14 in each cable, and is 200 long. Both of these aerials are connected L type.

This station has been working regularly with amateur stations on both the Atlantic and Pacific coasts. Working with WEA in the Angeles, Cal, has been a continuous past performance, and recently this station has worked directly with 2FM in New York City. We claim that this is truly wonderful work for an amateur station, and we do not think that there will be any question whatever but that Station 9ZF is well entitled to the prize.

Since holding the Washington’s Birthday Relay, which you will all remember was held in the interest of preparedness, with instructions to all sending stations to interest all wireless amateurs in the United States Radio Coast Reserve, Station 9ZF worked the hardest for recruits of any station in the United States.

We have radio clubs in the United States of minor importance, which seem to think that they were the only ones that had a divine right to exist, who have not, with all their membership, done as much good work in enlisting the amateurs under the Navy Department for coast reserve work as Station 9ZF.

All of the stations have been closed by the Navy Department, on account of the war, for the period of war, and we believe it will be some little time before all of us are working again. In order that your interest will not lag in wireless work, and for the benefit of the many amateurs who have enlisted throughout the country and are now assigned to the various warships, we will continue these write-ups each month, with something of interest to them, and something to remind them of home and (continued on page 143)
Notice to All Radio Readers

As most of our radio readers are undoubtedly aware, the U. S. Government has decided that all Amateur Wireless Stations, whether licensed or unlicensed, or quiet for receiving or transmitting, shall be closed.

This is a very important consideration, especially to those who are readers of THE ELECTRICAL EXPERIMENTER, for the reason that we desire to continue to publish valuable articles in the wireless art from time to time, and which may treat on both transmitting and receiving apparatus. In the first place, there are a great many students among our readers who will demand and expect a continuation of the usual class of Radio subjects, which we have published in the past four years, and secondly, there will be hundreds and even thousands of new radio pupils in the various naval and civilian schools throughout the country, who will be benefited by up-to-date wireless articles treating on both the transmitting as well as receiving equipment.

Therefore, and in view of the foregoing explanation, we feel sure that every reader will thoroughly understand that other articles on transmitting, as well as receiving, apparatus may appear from time to time in these columns, he is not permitted to connect up any radio apparatus whatsoever to any form of aerial.—The Editors.

The Naval Radio Operator

SCHOOLS are established at the Navy Yards at New York and San Francisco for the purpose of furnishing Radio Electricians for the fleet from the enlisted personnel of the Navy. After the required sea service has been performed such electricians are transferred to shore duty at Naval Radio stations and other places.

The electrical branch of the schools is divided into two parts. One branch for general electricians and the other for radio (wireless). Applicants capable of passing the examination are enlisted as landsmen for Radio Electrician. The applicant must be able to take dictation at the speed of twenty-five words per minute and pass centage and square root. Testimonials as to the good character and skill of the applicant as an operator must be presented either from a former employer or from the principal of a school where the applicant has been a student of radio or telegraphy.

In addition to the above, men holding commercial radio licenses and who pass an additional examination at the Electrical School, Navy Yard, New York, or Mare Island, Cal., may be enlisted as electricians third class (radio). In both cases, whether enlisted as landsmen for electrician third class (radio), the regular course at the school follows. The opportunity for advancement in the Naval Radio Service is at present exceptionally good and is worthy of consideration by every commercial telegraph and radio operator.

The pay of electricians both general and Radio is as follows: Electricians third class, $33 per month; Electricians second class, $44 per month; Electricians first class, $55 per month; Chief Electricians (acting appointment), $66 per month, and Chief Electricians (permanent appointment), $77 per month. This pay is increased with each enlistment.

The present policy in the fleet is to advance electricians third class (radio) to electricians second class at the end of a year if their proficiency mark is at least 3.2. Electricians third class (radio) serve (Continued on opposite page)
NEW RADIO TRANSMITTER FOR U.S. "MOSQUITO" FLEET.

The accompanying photograph shows a complete radio transmitter operated from high tension glass condenser and aerial inductance. A transfer switch is also provided for permitting the receiving and transmitting instruments to be connected at any time desired. This is shown in the upper right hand corner. A hot wire ammeter is also furnished, and this is seen in the upper center of the panel.

The three plugs at the bottom are used for several purposes: the left hand one is employed for connecting instruments with the aerial; the center one connects the key with the primary of the coil and battery, and the right-hand plug links the storage battery with the supply source. The plug at the upper left hand corner is used for connecting the power source with the test lazzer of the receiving set. A set of banding posts are furnished for connecting the aerial and ground with the set, and these are seen in the upper part of the panel, each being fitted with the proper name-plate.

During some recent tests, the outfit has proven to be very efficient.

THE JAPANESE T. Y. K. RADIOPHONE SYSTEM.

Among the early distinguished workers in radiophony we find that Messrs. Wichi

a current derived from a storage battery. It was designed for supplying the mosquito fleet with an efficient low power transmitting outfit.

This outfit was developed by A. B. Cole, a New York radio engineer. It consists of a quenched spark gap of the open air type which is mounted on the panel. The sparking surface consists of two large special alloyed discs. The gap is excited by a spark-coil of unique design; this is placed behind the panel, its interrupter, which is of the independent type, being stationed on the front of the panel and visible on the center right. The oscillating circuit consists of the usual arrangements; namely, a

on the large vessels and Electricians second class are sent in charge of the installation on destroyers and gunboats. Men who have served two years at sea, in radio, and who have advanced to second class are eligible for shore duty. The pay and allowances and retired pay of the Navy, and the fact that all men get shore duty makes the Naval Radio Service more attractive than that of the commercial services. A comparison of the two pays and allowances in the Naval Radio and Commercial Radio favors the former.

The physical and moral qualifications required for entrance to the Naval Service apply in all respects to these branches. If the recruit is unable to complete the course of instruction at the Electrical School because of incompetency or insufficiency he will be discharged from the Navy for insufficiency.

(Continued on page 153)
Remarkable Radio Outfit Built By German Spy

A little black box of mystery, seized recently by the police in the belief that it was nothing more than a modern adaptation of a time worn contrivance for swindling unsophisticated persons out of their savings, was revealed as a clever wireless telegraph outfit, capable of receiving messages from as far away as Berlin.

Police and government experts who examined the mechanism in the box declared it to be as perfect in construction as any they ever had seen. It is (or was) the property of Max Hans Ludwig Wax, a German citizen, and graduate of the University of Berlin. Wax, as soon as he had found the police had learned the real nature of the wiretaps contained in the box, assumed an air of stolid indifference, denied he knew the box could be of service either in sending or receiving telegraph messages or that he knew anything of telegraphy, and asserted that apparently useless bits of paraphernalia contained in the box had been placed there by him merely to make the contrivance "look pretty."

Then, the police say, Wax informed prospective dupes that the little black box contained machinery devised by German scientists for reproducing American banknotes and currency bills. If he would place a thousand-and-dollar bill in the "phats" inside the box the contrivance would print ten duplicates of that bill. It then was the duty of the "loyal" German, the police say they were informed, to pass the spurious notes off for American gold, so that eventually this country would be flooded with counterfeit notes and persons loyal to Germany would be in possession of most of this country's gold.

Just as Wax was arrested the police learned that he had left the box in a machine shop in New York City. The police finally located the box in a trunk which they said was equipped with a false bottom. It was not until Sergeant Pierce, in charge of the police wireless station, rigged up as part of the scheme for military defense, by Arthur Woods, Police Commissioner, looked at the contrivance that it was recognized as a genuine and extremely effective portable wireless outfit.

The box is about two and a half feet square. It is covered with black enamel and has silver handles and brass hinges and clasps. It must have cost at least $800, according to the estimate of experts.

As soon as Sergeant Pierce recognized the use to which the queer arrangement might be put, the outfit was rigged up. Its batteries were set in motion, and in a moment the hissing sounds and spattering and flashing sparks that attend the operation of a wireless outfit were in evidence.

Wax persisted, despite the effectiveness of the demonstration, in his assertion that the batteries, tiny dynamo and inductive coils were placed in the box by him to make the apparatus "look pretty." Eventually he said he intended to use them to color to a motion picture scenario he intended to write.

Persistent questioning, however, drew from Wax, according to the police statement, the admission that he, having bought the materials, the box and its outfit were put together for him by a seaman on board one of the interned German ships lying at Hoboken. He refused to reveal the identity of the man, asserting he knew him only as "Franke." and had met him only a few times.

When the examination of Wax had proceeded that far, Fire Chief Woods, Police Commissioner for the New York district, arrived at Police Headquarters. He examined the machinery contained in the box carefully and then verified Sergeant Pierce's statement that it was a wireless outfit of great strength. He agreed with Sergeant Pierce that the apparatus was easily capable of receiving messages from as far away as Berlin. Both experts, however, declared the apparatus probably could not be used to send a message much farther than one hundred miles.

Despite the readiness with which Mr. Krumb and the police operators were able to set the wireless outfit in motion, many contrivances in the box were a mystery to them. It appeared as if there were three sets of batteries, where only one was necessary. The operators express the belief, however, that any one of the three battery sets might have been connected with the rest of the apparatus, so that, even if two batteries failed, there still would be power to keep the contrivance in operation.

The only incomplete thing about the outfit was that the police were unable to find a sending key and a transformer, both of which would be necessary in order that the machine could be used for sending wireless messages. Wax, however, is described by persons who stayed in the house where he lived as having been in the habit of carrying a small hand grip. The grip has not yet been found.

After the police were satisfied of the nature of the equipment in the box they asked Wax to operate it. He fudged several parts of the mechanism for a moment or two and finally succeeded in causing a short circuit which effectively put the whole thing out of commission. The damage, however, can be repaired easily.

In the examination of Wax the police drew from him the statement that he came to this country from Germany in June, 1914.

He denied he had served in the German army, asserting he was rejected for military service because he had a weak heart. Dr. Baker and Dr. Henningsen, German-born, were called in to examine the prisoner. They pronounced him an almost perfect physical specimen and said there was no indication that he ever had suffered from heart disease.

Considerable interest was manifested by the police and federal investigators in papers and letters found in Wax's possession. They declared some were written in code. All of them were in duplicate. One of the papers, according to the police, was a draft for $12,000 and another was for 2,300 marks. The latter was drawn on the Deutsche Bank, of Berlin. It was signed by the police that Wax received some of these papers thru the office of the German Consul in this city several weeks ago. The money, the police said they learned, was sent to Wax by relatives in Germany, who the prisoner declared were both wealthy and influential there.

Electricity Reduces Fire Hazard.

Hereewith we present the vacuum ampere gage, a new Marconi device.

The demand for a small, sensitive, robust instrument suitable for use equally on alternating and continuous current circuits is not new, and inventors have made many attempts to satisfy it.

The instrument is designed primarily as a voltmeter, but the indicate the condition of synton in wireless circuits, and may be employed as a substitute for a thermo-junction and galvanometer combination in the measurement of lengths and decrement. The principle in

By Placing the Delicate Moving Parts of This High Frequency Current Gage in an Evacuated Bulb the Gage is Made Completely Stable and Reliable. It Can Be Used with a Wave Meter to Measure the "Decrement."
rotation of which is controlled by a spring acting against the tension of the filament. When a current passes thru the filaments, heating them and causing them to elongate, the arm takes up a new position and the angular displacement as indicated on the scale is a measurement of the current.

The movement is enclosed in a glass bulb exhausted of air. The sensitivity is thus greatly increased, and the movement protected against damage and preserved from dust or corrosion.

The drawing shows quite clearly the construction of the little instrument, which is made up in such a way as to resemble an electric lamp. In one form the bulb is attached to a brass cap with projecting pins identical with those used on standard English lamp bulbs, and the size of the instrument can be gauged by noticing this feature in the drawing.

The variation in zero which is characteristic of hot wire instruments in general is negligible in this type of instrument, and the natural damping renders the movement especially dead-beat.

The instrument, suitably calibrated, may also be used as a low reading volt-meter or ammeter, or as a shunted ammeter. The normal resistance of the commercial type of vacuum instrument is approximately 12 ohms.

Enclosing the working parts in a vacuum has enabled the makers to place on the market an instrument which should prove of great general utility on account of the fact that, at a reasonable cost, it is possible to provide the means of measuring direct and alternating currents of the order of .01 amp, without sacrificing any robustness of construction. The small size makes it a matter of no particular difficulty to insert the instrument in a circuit where no previous provision has been made for inserting a meter.

With a wave meter using the new vacuum gage the wave-length of the primary circuit of a 1½-kw. set can quite easily be read when the wave meter is held with the plane of its inductance coils parallel to that of the primary of the oscillation transformer at a distance of two to three feet. The noise of the spark, which often hinders the reading of a wave meter by means of a crystal and telephones, in the case of the vacuum gage gives no trouble, as the variable condenser has simply to be rotated until the pointer of the gage gives the most uniform reading. In this way one can be tuned rapidly as well as accurately.

MISS WINIFRED DOW A RADIO ENTHUSIAST.

Hereewith find picture of my radio experimental outfit. My receiving set con-

MRS. CANDLER AN ABLE RADIO OPERATOR.

Mrs. CANDLER of St. Marys, Ohio, says, "I surely am very much interested in wireless and not only interested but have been operating our set ever since it has been in existence. I now hold a first grade commercial license. The first photo of our set was taken last year by NKE and appeared in the ELECTRICAL EXPERIMENTER in connection with the report of the Wallingford's Birthdays.

PHILADELPHIA'S NEW RADIO STATION WILL SEND THREE-FOURTHS WAY AROUND THE WORLD.

Preliminary work of construction of one of the most powerful wireless stations in the world has begun at the Philadelphia Navy Yard, according to a special announcement made recently. The construction of a hangar which will house eight battleship aircoplanes is under way.

The new wireless station will have a sending radius of approximately three-fourths of the distance around the globe, making possible direct communication with the Philippines and other insular possessions of the United States. The aerial structure will be more than 200 feet high.

father's new sixty foot yacht, the Wawana. She is a flush deck cruiser with all modern improvements and powered with a large four-cylinder gasoline engine. She also has two masts about thirty-five feet apart, which I used to support my aerial. There is a large cabin, ten by twelve feet in size, in which I installed my transmitting and receiving apparatus, which consists of a two inch spark coil, two Leyden jars, helix, spark gap and key. Also, two variable condensers, loose coupler, tuning coil, loading inductance, Ferro, galena and silicon detectors mounted upon a movable cabinet.

One of the interesting cruises made last summer was with a company of Marine Boy Scouts of which my father is the commander. We sailed along the coast of Massachusetts Bay, visiting various harbors and spending several days in Marblehead harbor during the festivities of "Marblehead Week," as the great racing events of that notable yachting center are held.

The harbor was filled with yachts of all types and ages from the majestic steam yacht of the millionaire to the small sailing dory of some aspiring youth. I was surprised to find how few of these boats were equipped with wireless apparatus, also how few of them so equiped appeared to be using their apparatus or even listening in. I held conversation with some interested amateurs on shore.

We did not send or receive any "S.O.S." calls, but did have occasion to render timely assistance to a motor boat whose engine had broken down out at sea and towed her to a place of safety before a severe thunder storm broke upon us.

I might say that I detected little difference in the workings of my apparatus aboard the boat as compared with the same on land.

And my set to be of the greatest service in the evening when the crew gathered about to get the time signals and the news of the day.

WIRELESS TELEGRAPHY ON BRITISH SHIPS.

By an Order in Council, issued on July 28 last, every British ship of 3,000 tons gross or upwards is required to have a wireless installation.
The Marconi Type "106" Tuner

By WORTH MacKNIGHT

The receiver consists of a type "106" tuner and a crystal detector. This tuner consists of a variable inductance primary circuit. One end of this inductance is connected to the antenna thru the antenna switch. The other end of the inductance is connected to the ground thru a variable condenser, which can be short-circuited or thrown into circuit at will. The secondary circuit is so constructed that its inductance may be varied and also its inductive relation with the primary circuit can be changed. A variable condenser is provided, which permits a variation of wave length and also the variation of the ratio capacity to the inductance, while maintaining the same wave length. A battery and potentiometer is provided which permits controlling the current thru the detector. A pair of head telephones is used for receiving the signals. A buzzer is supplied which permits the local excitation of this receiver, so as to determine its condition of sensitiveness. A battery furnishes current for the detector and buzzer.

Fig. 1 is a front view of the type "106" tuner and shows the exact position of the different switches and parts for its operation.

The switches marked Transformer Primary are for the purpose of varying the amount of inductance in the aerial circuit. The switch marked Limits varies the inductance in one-turn steps. The switch marked aerial is connected to one terminal of the inductance, so that by varying the transformer primary, a greater or less amount of inductance can be inserted between the aerial and ground. This either increases or decreases the natural period of the primary or aerial circuit. It is necessary, therefore, to make these adjustments to bring the circuit in tune with the received signals. If the wave length of the received signal is shorter than that of the aerial circuit, it is necessary to insert the primary condenser in the circuit. This has the effect of shortening the time period of this circuit. The secondary circuit consists of a variable condenser marked Secondary Condenser, and a variable inductance marked Transformer Secondary.

By varying either the transformer secondary switch or the secondary condenser, this circuit can be tuned to the wave length of the incoming signals. It is also possible to vary the ratio of capacity to inductance, while maintaining the same wave length adjustment. It is often found to advantage to vary this ratio. The handle marked Coupling is for the purpose of varying the inductive relation of the primary circuit and the secondary circuit. After these circuits have been tuned to the incoming signals, the coupling should be varied until a maximum response is found. The handle...
The How and Why of Radio Apparatus

NO. 4—SPARK GAPS.

From time to time we will describe one particular instrument used in either the radio transmitting or receiving art, explaining it in such a way as to make those responsible parts of any oscillatory circuit, and this proves particularly so in radio transmitting circuits, where everything must be designed to realize the utmost efficiency. This means careful and scientific design at every turn, and it takes into consideration such important topics as the proper dissipation of the heat produced in the gap; the proper arrangement of the gap to give the desired time and a number of other vital points.

The discharge through the spark gap in an oscillatory circuit is to alter the condenser in this circuit to charge to the required voltage, and then to break down and permit the charge stored in the condenser to surge back and forth across the gap in the form of sparks, until all of its energy is dissipated. For several reasons the ideal spark gap would be one which would insulate perfectly, or be non-conducting during the time when the condenser was being charged, and conducting perfectly while the condenser was discharging.

The nearer these requirements are fulfilled in any spark gap, the more efficient will be this piece of apparatus perform its function. Where the discharge is passing, the resistance of the gap depends upon two factors: the resistance increasing with the length of the spark, and decreasing rapidly with the oscillatory current, amounting with a half-inch gap to several hundred ohms when a fraction of an ampere passes, and but a small fraction of an ohm when fifty amperes flow across the gap. If the spark length is about half an inch, the resistance with the same oscillatory current flowing, can be taken as approximately proportional to the spark length. However, in a condenser operation, the quantity of electricity is stored up in the condenser, and in consequence the amount of oscillatory current increases with the spark length. Hence, we find two conditions working against each other, as regards the influence of the spark length on the spark resistance.

However, we can increase the amount of current passing thru the gap without increasing the length of the spark, by simply increasing the size of the condenser, and the most efficient circuit for a given amount of power, is that in which there is a moderate spark length with a large condenser.

When the condenser has been fully charged, the spark gap breaks down, and the gap becomes filled with metallic vapor, and for the time being forms a high frequency alternating-current arc. The conductivity of the spark is due to the presence of metallic vapor in the gap. After the discharge ceases, and if this metallic vapor is not quickly removed from the gap, the insulation will in consequence lie very low at the time that the condenser is passing thru its next charging period, which of course occurs in a small fraction of a second, usually.

It is therefore paramount that we recognize the nature of the gap as well as the time in which it is passing. For any indefinite time, it is best with such non-synchronous rotary gaps, to provide a stationary electrode "A," in the form of a segment, having a pitch equal to the distance between two of the rotary electrode points.

For synchronous rotary gaps, driven by a synchronous A.C. motor or by mounting the disc on the same shaft with the motor-generator, as is done in the best types of commercial radio transmitting sets, the first electrodes need not be adapted to a single electrode point on the rotary disc.

One of the most efficient spark gaps used very successfully by constructors, and also by numerous amateurs, is the quenched gap illustrated at Fig. 3. This gap, which is very well known to-day, is designed on several important in semicircles. The foremost of these considerations is that each gap shall be preferably not over 1/100 of an inch in length, and moreover, that the gap shall be absolutely airtight. Further, not over 1,000 to 1,500 volts should be applied to each individual gap, and for higher potentials a considerable number of these short gaps are placed in series, as shown in the illustration herewith; two gaps being adapted to 2,000 volts — three gaps to 3,000 volts, etc.

The action of this gap has been described at some length in a technical manner by Mr. Charles R. Ballantine in the June, 1917, issue of THE ELECTRICAL EXPERIMENTER. Briefly, the action of the gap is based upon the fact that a small quantity of air is trapped between the spark surfaces separated by a mica ring of proper thickness. After the first few sparks have past the oxygen in the trap air is burned up, resulting in a partial vacuum in the gap. This conduces to the rapid quenching therefrom of the spark discharges, due to the condenser, and gives rise to a very ideal set of conditions for the entire radio transmitting circuit. This is because the oscillations in the spark gap—condenser circuit are cut off after the first few heats or sparks, but the oscillations induced in the aerial-ground circuit are left free to oscillate for a longer period. This prevents the reaction of free oscillations in the spark gap circuit which is the secondary circuit—a condition which is invariably found in ordinary radio transmitters fitted with a plain fixed spark gap, and a condition which means less against the best efficiency of such an equipment. The quenched spark gap usually consists of a number of the above described, which are placed in a suitable frame so that considerable...
The Clock Craze
By Thomas Reed

Being cooped up in a flat, late years, I've had to give up experimenting. Mine's a fine flat, as flats go—all modern conveniences, two kinds of cold water as the fellow says, and a fire-escape with a sparrow's nest on it: even a little safe let into the wall, big enough to hold most of the Wife's diamond tiaras if you pack 'em tight. Yes, it has all the conveniences but one, and that's the only one worth having—a workshop.

The nearest I can get to it now is reading the good old Electrical Constructor. When she blows in, I sop her up from front cover to back—every word. Advertisements and all. Well, I'll say so, and I'm not the only one that does it, eh? Bugs?

One place I always stop and smile, and that's the heading "How-to-Make-It Department." I guess my department is the "How-Not-to-Make-It." Usually every time I started went wrong the first time: but the finding out why it wouldn't work, and making it over till it would, wasn't the worst fun in the world. In fact, I think it was the best. No fun simply copying.

When it comes to the electric clock, though, that nearly beat me. There's a thing that looks easy, and snip: yet it's simple enough once you're wised up. I was sort of forced into the clock craze. You see, our kitchen clock was on the blink. Father didn't blame it—good old clock, he said, it had served him faithfully twenty-five years, and was worn out. Worn out nothing! I'll bet old Jerome stood over in his grave at that libel, for one of his excellent brass clocks ought to go for 100 years, and only be talking baby-talk then. I knew what ailed it right: it was so full of my contact-springs, wires, magnets and other junk, that its regular works had become discouraged. But that was a secret between me and the clock, and there were good reasons why the secret was safe with me.

Anyhow, when the clock took to stopping, something had to be done, and done quick, because mother would figure wrong with her Saturday baking, and Mrs. Skillings would get her hot pies out on the window-sill first, which was an awful catastrophe to mother, and made her feel as peevish as the Standard Oil does when a competitor sells a quart or so of gasoline right under its nose.

I had pondered a little on electric clocks, and as I say they looked easy, so I made the family a proposition: for half the price of a new clock I would turn the old one into an electric clock that would go all the time without winding. Father liked the idea because his back got twisted climbing up on a chair to wind the thing, and any clock at all looked good to mother; provided it was a going institution. I said this one you couldn't stop if you wanted to; and it would be so exciting that Mrs. Skillings would be running over to ask humbly what the really correct time was. This is known as promoters' language, and is powerful. It clinched the deal. Father handed over the kale with a feeling which if magnified a few diameters would have been enthusiasm.

Everybody (including myself) expected it would be not over two weeks at the outside before I had the clock rigged up and

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Finally the Electric Clock Problem Settled Down to a Resurrection of Mrs.'s Famous Pendulum. But Oh! that "Agate" Post! X? Likewise Zowie.

was after Mrs. Skillings' goat with it. I took the old clock to pieces for the last time, pulled out a few superfluous wheels and springs, and inserted a pivit and ratchet-wheel where they would do the most good. Then I started daily on the electric pendulum that was to drive it. I wished afterward I'd made the pendulum first.

It was a grand pendulum I made—a seconds-pendulum of the due length of 39.1 inches, with wooden rod and a fine heavy bob. I was so cocksure that I polished it all parts as I went along. But when it was done, it wouldn't work.

There were two or three main reasons why. To begin with, it was hung on pivots, like a telegraph key: and the heavy bob set up so much friction there that it would have taken about a kilowatt to drive it. Of course it should have hung on a suspension spring, which lets the pendulum oscillate while supporting its weight without friction. Bonehead play number one.

Well, I discarded my pivots—lo! I hated it, they looked so pretty—and with my pendulum swinging easily from a spring, I looked to see her go. But nix. Good strong magnet, clean contacts, and...
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all that, but nothing doing. Could anything turn up as a gift to myagara's Answer? oh, out.

You see I had rigged as in Fig. 1, following the illustration in the electric bell. When the pendulum swung over far enough to make contact, the magnet gave a vigorous pull; but unfortunately it checked the

pendulum just as much as it pulled it, and the result was nil. The slow, free-swinging pendulum has been returned to the rapid, springy bell-hammer.

The two weeks were already up, and now it was necessary to perform, meanwhile Mrs. Skillings had put it over again on the pies; so I hid my chagrin under what I hoped looked like a confident sound and attacked the problem again.

The next attempt is shown in Fig. 2. I made a flapping contact, metal on one side and insulated mica on the other. This arrangement worked well, if you get me. The magnet gave a nice pull, and on the back-stroke it let go, all as per intention. But now the pulls accumulated till the pendulum ended by banging against the brushes as the pendulum swung back.

Anyhow, to have it go at all was some consolation. All that was needed now was some sort of metal to catch out the impulsion as soon as the pendulum had all the impulse it needed, and switch it on again when more was required. Now I began to appreciate Hipp's pendulum, described in the text-books. In Hipp's device (Fig. 3) the electric contact is made by means of a notch on the pendulum, which normally pushes past a little swinging trigger attached to the contact-spring.

As the pendulum loses its amplitude, there comes a moment when the notch in the pendulum just catches the trigger, and then when it starts the other way the trigger is raised and the contact made, the magnets are energised, and gives the pendulum a push. The notch now brushes by the trigger again, until the narrowing swings allow it to catch once more, and the process repeats. As the battery runs down, the push is weaker and the contact has to be made more often, but the mechanism does this automatically until the battery is exhausted.

Hipp's rinktum looked effective, if one could only make it; but I was a clockmaker, without the remotest suspicion of the material for his notch post. Agate, he says, just like that: "Take a piece of agate, you know, and put a notch in it." Oh, yes, I had ever heard of was an agate marble; and it didn't look exactly like easy stuff to make anything of.

Four weeks had now gone by, and the family had lost all their peevishness; that is, they had exchanged it for black looks and language not calculated to please. I was raping the usual reward of the san-

(having got an inkling of what ailed its predecessor) that if I monkeyed with its insides, the monkey, I would monkey with my outside; and, in the vigorous language of the day, I was not to forget it.

I knew why a prophet is without honor in his own country. Believe me, my home reputation as a budding scientific and lusty maker of machines is more exact, it looked like the place where a 42 cm. shell has recently landed. But the clock craze had struck in; and oblivious of everything, in his enthusiasm he put the hammer on, and I pondered upon Hipp and his exasperating agate.

I pondered long before, in a burst of enlightenment, the great truth of Budgdom burst upon me—use some other material, even if it isn't as good, anything at all for a start. Couldn't I use steel, brass even! it would last long enough to try it anyhow. It makes me laugh now, my great discovery; but at some time the getting rid of a fixed idea is the hardest part of an undertaking? Why, I could have used pewter, paper, I guess even glass, if you could have found the end.

Don't let anyone discourage you. Bugs, by specifying costly and unusual materials. The inventor's describing his rinktum in the way it looks after he's got it all bashed up in its final Easter dress; but just for a trial you don't need the platinum. Bake-lite, Empire cloth, and "S.C." wire—no, sir, you'll find all you really require in the old junk-box as usual. Me, I grew independent as a matter of materials that I hardly recognized more than two kinds—conductors and insulators!

So, having got the agate out of my head—see page 4 and then I used wood. I used steel for the post and brass for the trigger; and as to durability, let me tell you that after nearly twenty years I can't with the naked eye detect any wear.

Oh, yes, I made the clock, but I had a long hunt for something on Hipp's plan. I sent a model there and the work shop might turn out. After many trials I evolved the form shown in Fig. 4; and I made you free of my invention, Bugs, hop- pliments. I've got enough to make himself an electric clock. There's lots of enjoyment in listening to its sedate ticks, like the slow and steady time of the textile, to be sure, the small units we need to make out good or bad use of. Maybe, now that the war will delay us from wireless work for a while, you'll feel inclined to take up this

fascinating subject of clocks; and if so, I have many valuable "wrenches" which should be delighted to share with you. Only, avoid my experience, and don't make a business, proposition of it at first. C.-U. L. O.-A.

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NEW RESISTANCE MATERIALS.

A New York concern is now marketing tungsten and molybdenum in sheet, ribbon and plate form. This development makes these metals suitable for use in high-voltage apparatus and opens to them a much wider field of usefulness than has heretofore existed. The tungsten and molybdenum ribbon is 0.009 in. wide and 0.00095 in. thick (0.63 by 0.00037 in.), and is made in widths up to 6 in. and in lengths of several yards. In this shape the ribbons ought to be ideal material for the manufacture of some of the heating filaments of various descriptions and suitable for high temperatures, the manufacturer points out. The United States Government has already placed an order for plates of these metals for spark gaps on its Mosquito Fleet.

KINKS FOR THE DRAFTSMAN.

The first "kink" shown is a new section-line. There are a great number of appliances on the market for this purpose, but the one described will do the same work more efficiently, yet be the most expensive device, its advantage being simplicity. It consists of a sheet of celluloid cut as shown. The parts in black are cut away with a sharp knife, leaving a kind of grid. To use this section-line place its base close to the Tee-square and place the pen or pencil into the opening and draw a section-line, following the outline of the grid. Without moving either Tee-square or section-line, place pen into the next slot and so on.

The two corners "X" and "Y" are cut away to the angle of threads used and these may come in handy when drawing bolts, etc.

The second "kink" will save those draftsmen that are on repetition work much time and trouble. It consists of the following: Draw all those bolts, nuts, washers, fit-tings, etc., that are used over and over again in numerous sizes on a sheet of tracing cloth and make a little mark, in the case of nuts and bolt-heads, from where you strike the radius; see point "C". "X" and "Y" shows the height of the bolt head arc.

As most offices use transparent drawing cloth, the standard sheet can easily be slipped under the paper and the outlines traced thru. In the case of many hundreds of bolts, being the same size, it is obvious that the time spent in making the small units will be worth the result.

Contributed by C. A. OLDROYD.
The Influence of Light upon the Contact Potential of Selenium and of Cuprous Oxid

By E. H. KENNARD and E. O. DIETERICH

Department of Physics (University of Minnesota)

T
he change in resistance of crystalline selenium and other light-sensitive substances, such as stibnite, cuprous oxid, etc., under the action of light and other agencies, has been explained on the assumption that it is due to a liberation of conducting electrons from the atoms of the material in question. In other words, the change may be considered as due to a change in the atom itself. If this explanation is correct, then other properties of these substances, which also depend upon inter-atomic forces, should show a variation from light to dark. The authors investigated the influence of illumination upon the contact potential of selenium and of cuprous oxid, since this property is one of those mentioned above.

Using, as a check upon each other, two different methods, Figs. 1 and 2 of determining contact potentials, it was found that a change did take place in both substances upon illumination. In the case of selenium, this difference amounted to something over 0.1 volt, several specimens being examined. The value, in the dark, of the contact potential, relative to clean copper, was about 0.4 volt, and when about 0.5 volt, i.e., the surface becomes more negative on being illuminated. With cuprous oxid, of which but one specimen has been examined thus far, the effect is not so great, being about 0.025 volt.

In the case of selenium the effect is very marked, even when light of very low intensity was used, as can be seen from the curve in Fig. 3, which shows the relation between the change in contact potential of lamplight of 2.8 volts, with a lamp voltage of 25 volts (normal 110) the change amounts to about 0.005 volts, yet at 110 volts a change of about 0.1 volt in the intensity of illumination has increased by a factor of about 2,000 over that at 25 volts, the effect is only 35 times as great.

Until recently the most widely accepted theory of the change in resistance of selenium with a variation of the intensity of illumination has been that proposed by Professor A. H. Plund, of Johns Hopkins University. According to this theory, the effect of light is in the nature of a thermal photo-electric effect. In other words, atoms of selenium expel electrons, the velocity of which is too low to allow their escape from the interior, hence they produce increased conductivity. The true explanation, however, does not seem to be as simple as this, for on the above theory, in the regions illuminated, the concentration of free electrons would be increased, and one should expect diffusion of these electrons into the darker portions, leaving the part illuminated more positively charged. The negative sign of the change in contact potential, however, at once rules out the diffusion hypothesis and makes the simple theory mentioned above inadequate.

An hypothesis which better fits the facts is that contained in a theory recently presented by Professor F. C. Brown of the Iowa State University, which assumes that the action of light consists in changing the rate of recombination of conducting electrons with the selenium atoms, and, in other words, it decreases the potential energy of the electrons in the inter-molecular spaces.

Popular Discussion on the Production of Helium

By Mark Fushman

In a spectroscopic investigation, Janssen and Norman Lockyer observed in the atmospheres of the sun and many fixed stars, a bright yellow line which could not be associated with that of any known substance. They named this line "Helium." Helium was discovered on the earth in 1895 by Ramsay and Travers, who obtained it by heating the rare mineral Cleveite. It was known that this element is a companion of argon. Lastly, it was also discovered in the atmosphere.

Helium has an atomic weight of 4.00 and is monatomic, i.e., that the helium molecule consists of only one atom. At ordinary temperatures, helium is a colorless gas; it boils at about 260°C, and by evaporation at a pressure of 0.15 mm., a temperature 1.5 above absolute zero was obtained.

The fact that this new gaseous element occurred in certain minerals was considered very suggestive. A new light was thrown on this subject by the discovery of radioactivity. Radioactive substances are known to emit spontaneously electrons or particles, as they are now termed. As these particles are emitted the substance changes into a new and different element: this is known as the disintegration theory of radioactivity. In looking for a disintegration product, the presence of helium is noteworthy; for helium is found in minerals and thorium.

Rutherford and Soddy suggested that helium might be a product of disintegration. Ramsay and Soddy obtained thirty grains of radium C and dissolved it in water. Radium bromid produces hydrogen and oxygen, so these gases were drawn off and there remained a small bubble of residue gas, which was introduced into a vacuum tube and showed the characteristic lines of helium. When a very old sample of radium bromid was used, the residue bubble gave the complete spectra of helium. This experiment showed that helium was produced by radium. Helium is also produced from active forms of actinium.

An important role in the formation of the radioactive elements. It may be that helium, like hydrogen, plays a part as one of the elementary elements of which the heavier atoms are built.

It is supposed that at the center or rather in the depths of the earth, where the temperature is high, radioactive elements are being formed and the deposits of radio-elements now on the earth's surface were thrown up from heat ages ago.

The Electrical Experimenter, June, 1917

Curve showing Relation Between Light on Selenium and the Contact Potential.

Condenser Method for Measuring Quick Changes in the Contact Potential. The Electrometer, E, Can Be Connected by Means of Suitable Clips, Either to the Gauze, G, the Selenium Plate, S, or the Copper Plate, C. As Shown in the Diagram the Connections Are Made That, by means of the Potentiometer, P, the Deflection of the Electrometer, M, Which Occurs When Light Falls on the Selenium Plate Thru the Gauze, Can Be Made Zero, and the Change in Contact Potential Determined. Proper Precautions Are Taken, of Course, to Secure Proper Electrostatic Screening.

Card Indexing the "EE."

I have a little stunt which I thought might be of interest to other readers, as follows:

I took a small card index that is sold for a dime file and sold for $1.00 anywhere, and if I read my ELECTRICAL EXPERIMENTERS each month, I note on the cards all those things that may be of future use to me. In this way:

Antenna Switch-Exp. Jan., 1917, page 658: At that time that I want to make articles in my stack of magazines are listed there, which saves hunting thru a stack of several dozen magazines for something I have seen, but cannot find.

Contributed by F. C. BROWN.
High Frequency Apparatus and Experiments

By HUBERT A. McILVAIN

ANY experimenters either do not realize the vastness of the high frequency field, or think that they have not money enough to buy the necessary apparatus. It is the purpose of this article to explain the manner of constructing a few simple instruments, and the method of carrying out some simple experiments.

In the first place, a high frequency transformer must be constructed. An Oudin coil will be the best for all-around work, and it may be made in the following simple manner. Procure an ordinary pasting and mailing tube, about 3/4 inches in diameter and 10 inches long, and cover it with a thin coat of white shellac. While this is still wet, wind the tube with fine copper wire, spacing the turns far enough apart to ensure proper insulation. Enough wire may be found in an old telephone ringing magnet.) Glue this tube upright to a base and fasten three posts on the base. The primary may be made of 6 turns of No. 14 copper wire, connected as in the diagram, Fig. 1.

A condenser may be made by coating both sides of old photographic plates with tinfoil, and placing them in a cigar box, to hold them in an upright position. A spark gap of most any type will answer. A 1/4 inch spark coil should be used.

When the above instruments are constructed, they should be connected up as shown in diagram, and the apparatus is ready. When the spark coil is operated, a brush discharge of purple light should appear around the free end of the secondary, inner end of coil, with sparks about 2 or 3 inches in length. If a piece of metal is held in the hand, a very long spark can be drawn from the secondary wire, without the slightest shock. If, however, the spark is drawn directly into the hand, a severe sting may result. On the other hand, if a pane of glass is held between the secondary wire and the hand, a spark may be received directly into the hand without pain; thus the spark, being dispersed or spread out while passing over the glass.

If a person insulated from the ground grasps the free terminal of the secondary, a match may be lighted from any part of the body. A Geissler tube will light up brightly, when brought near the body. This is also a good way in which to treat heart and nervous diseases. If there is any local trouble, a grounded metallic object should be brought near the point to be treated, thus taking out the induced current at this point.

An interesting experiment is to produce an artificial Aurora Borealis. This may be accomplished with a large electric bulb (a 100 watt turned out one will do), covering the tip with tin-foil. Instead the bulb from the ground and fasten the screw end to the secondary wire. Place a strong permanent magnet on each side and start the coil. A beautiful auroral effect will form inside the bulb. Also, if there are any loose pieces of filament, these will begin to revolve rapidly about the inside of the bulb and will continue to do so for some time after the current is shut off, and each time they touch the glass a shower of sparks will fly in all directions.

A by-product of this tension electrical stress in the air is ozone. Ozone is merely electrified oxygen. When a high voltage discharge takes place in air or pure oxygen gas, the atoms of oxygen are torn apart, and exist in what is known as a nascent state. In this state each atom combines with one other atom, and the chemical affinity of these two atoms is such that, as there is nothing with which they can combine, these atoms pull to themselves and combine with a third atom of oxygen. Thus it is that a new gas is formed. This gas is much denser than oxygen and is many times as active. The smell of ozone is very strong and there seems to be a slight difference in the smell of ozone produced with a static machine and the ozone produced with high frequency current. Ozone is an excellent “germ killer,” as it kills all kinds of disease germs on contact. If it is administered properly, and in time, it will cure consumption.

The electric stress about the coil is so great, that immense quantities of ozone are constantly being generated. In order to treat diseases obtain a box which is large enough to contain the coil and still leave enough space (about 4 inches) on each side to prevent the coil from “grounding.” Run the coil wires through the box and leave the free end of the secondary about six inches long, so as to obtain good radiation surface. Place a hose in the top of the box and another in the lower part of one side. Paraffin the box to prevent leakage, and put a small window in one side so that the coil action may be viewed. Either air or pure oxygen is taken in thru the lower hose and the ozone is inhaled, or otherwise applied from the upper hose. In fumigation, treatment of coughs, pneumonia, colds, and for many other medical uses, besides oxidation of certain materials, bleaching flour and cloth, experimenting with its use in welding and many other commercial uses, ozone is a most valuable agent.

Taking the high frequency field as a whole, it is well worth while for more experimenters to work with it. High frequency current has the properties of both static and galvanic electricity, besides many properties which neither of the above possesses. It will pass over ordinary insulators, such as glass, almost as easily as low frequency current will pass thru copper. It travels over the surface of a conductor and seldom thru it. Its oscillations are

(Continued on page 154)
The Problem of Using The Energy in Sunlight

By Prof. I. Thornton Osmond

Suppose all the electrical energy used in the world for power, heat, traction, light and all the other things obtained for nothing, how the world would be changed.

Energy in electrical form, of limitless abundance, is really falling upon the world provided with apparatus and appliances for the use of electrical energy. But the world does not use this constant, inexhaustible store of power energy, it does coal out of the earth and depends on that for its power, heat and light.

If everyone any experimenter can seek is the direct utilization of solar radiation as the source of power for the world's work.

The following outline of experimental research may enable some circumstance that they can make the investigations to make this discovery. In this work I seek to obtain energy from solar radiation by causing it to produce ordered acceleration of electrons about, and in a conductor — electric current.

Problem: To Obtain Electrical Energy "Directly" from Solar Radiation.

1. The solution here proposed is based on the following principles: 1. The solar radiation is electro-magnetic. 2. The flow of energy is in the direction of propagation, such as in light. 3. The periodic action, vibration, is at right angles to the polarization, and is cyclic variation of two vector magnitudes, electric force and magnetic force. 4. Solar radiation produces acceleration in electrons in such a way that the component of acceleration is in a certain relation to it. 5. Acceleration of an electron produces an (opposite) acceleration of surrounding electrons.

2. The experimental solution is rendered difficult by the great complexity of the solar radiation. Take a small area in a plane at right angles to the solar beam. At every instant there are passing thru this wave of millions of different lengths and periods, and at every point they are in millions of different phases, and the electric and magnetic vectors in these waves at any instant are millions of different directions and continuous changing at every point.

3. A beam of one wave length or period approximately may be obtained by the use of a prism or a grating, preferably a grating.

4. A beam with the electric vector confined to one direction may be obtained by the use of a necessary mirror or a pile of plates; or to two directions, giving elliptic resultant by an additional mirror or a prism.

5. A complex beam, a beam of one wave length, or a beam of one wave length and one direction of electric vector, may be concentrated to a small area, circular or linear, in which, at any given instant, there is but one phase in the focus of a lens, spherical or cylindrical, all waves (of a given length) are in the same phase at any instant.

6. Two parts of a complex beam, of a one wave length beam, or of a one wave length and one electric vector beam may be made to traverse the same space by the use of a biprism or a mirror in such a way that the intensity at various places at any instant has values that vary from zero to four times that of the single beam.

7. Take a vessel with walls readily traversed by the solar radiation and that may be exhausted to high vacuum if desired, and produce an electrically desired effect (as by a filament or wire heated by a current) and bring into this vessel electrodes to receive the radiant energy.

Fresnel Mirrors, one 40x40 cm., the other 40x60 cm.; the latter serving for a Lloyd single mirror, if wanted; apparatus, 25 cm. wide, 40 cm. long; small angles 7°, large angle 16°. 3. Polarizers, reflecting metal plate, plane of iron, glass or sulfur; fine grating; Fresnel, 400 lines per cm.; 5. The transferring, or receiving, apparatus described in 7 above (which may not be necessary). 6. Accessory apparatus, capacity, resistance, inductance, and indicating instruments.

"Wherever wave length enters into the design of these pieces of apparatus it is taken as from 0 cm. to 1.2 cm., as being near the lower limit of waves well above the longest heat waves, i.e., waves producing molecular motion. Greater wave lengths, with corresponding changes in design, may be found to give better results.


For this work it would be desirable, perhaps necessary, to have a complete metal iron) in enclosed container of the infinite kind. If a room of this kind is not available, an iron case 2.4 meter (m.) long 0.2m. wide, 0.2m. high will contain a combination of apparatus given above and the transferring, or receiving, apparatus. The mounting of the combinations of apparatus should permit following the sun or directing to any point within 90° of it.

An electrolytic process of deoxidation has been patented in the United States by Pascal Marino of London. The object to be treated is made the cathode in an electrolyte containing phosphoric acid. In addition to its normal function of carrying the current, this acid acts as a solvent upon rust without attacking the steel or iron body beneath. It is in this last detail that its chief availability lies, since nitric, sulfuric or hydrochloric acids would not display such moderation. Finally, the phosphoric acid is beneficial in preventing subsequent further rusting.

The electrolyte is made by adding ten parts of phosphoric acid to ninety parts of water, or by adding phosphoric acid to a 10% solution of sodium phosphate.

Due to the advent of the war, we are particularly desirous of obtaining manuscripts describing original and practical experiments. All will be considered, but what we need is snappy "Electrical" articles. Be on guard for the enemy—Repetition.
A NOVEL ELECTRIC CHIME.
The accompanying illustration shows an electric chime which I have used in place of an ordinary vibrating bell.

When the First Gong Strikes, Its Dependent Armature Flings Touches Through the Second Magnet "E," etc.

The bell armature should be lengthened and two contact points soldered to the end. When a button is pushed the armature of bell C is drawn over, striking the bell once. The lower contact then strikes N and throws bell E in circuit. The armatures stay over against the magnet as each successive bell is put in circuit, thus keeping the circuit thru lower contacts complete. When bell F is rung, the battery circuit is broken, and all the armatures fly back. Thus the operation is repeated. The gongs should have different tones to give a pleasing chime effect, and as many bells can be used as desired.

Contributed by A. G. CORKRAN.

"HARD RUBBER" BASES FROM "VICTROLA RECORDS."

Wishing to make a detector and not having a suitable base I procured a piece of oak (any wood will do) and an old phonograph record. I cut the wood and record to the desired size. I then put a thin layer of shellac on the wood and press the piece of record on it, and left it for a few hours. When it was dry I sandpapered the edges and polished the composition rubber.

Do You Want a Hard-Rubber Instrument Base? Glue a Piece of a "Victrola" Record and Glue It to a Wooden Sub-Base.

If the above directions are followed very neat bases can be made by the amateur. If the hole in the record does not allow a large base to be made, cut a circular piece of the composition rubber and plug it up.

Use records that have one side blank.

Contributed by LVIMAN R. WALLIN.

FIRST PRIZE, $3.00

SIMPLE AUTOMATIC CIRCUIT BREAKER.
The circuit breaker described below is giving efficient service on the switchboard in my laboratory. The pieces A, B, C and D are brass strips; E is a soft iron screw with two nuts to fasten it to the trigger F. F is an electro-magnet wound with No. 12 silk insulated magnet wire. The armature C is formed from an electric bell. The spring G, and the adjusting screw are used to regulate the instrument. The connections are as shown. The breaker is used on 110 volt A.C. or D.C. lighting circuit. When the contact A touches the contact B, it is held there by the trigger E. The magnet F is always magnetized to a certain extent but an overload or short-circuit causes the magnet to attract the armature C, releasing the contact A, which breaks the circuit. It is to be manually reset.

Contributed by ALGIE RIGGS.

THE SIMPLEST FLASHLIGHT.

Here's the simplest flashlight one can make: A flashlight bulb, A, and battery, and in some cases a strip of brass, B, soldered to the small battery terminal if it is not long enough. The lamp bulb is carefully soldered to the longer terminal strip. The lamp is lighted by holding battery in hand and pressing with thumb on strip B. A reflector (a nickel-plated thimble will do) may be fast to the bulb if desired.

Contributed by ERWIN PETERSON.

SECOND PRIZE, $2.00

ELECTRIC FURNACE MADE FROM PLUMBAGO CRUCIBLE.

An interesting and practical electrical furnace can be made of a plumbago crucible (used by jewellers) and two gas carbons. One of the carbons can be inserted in a hole drilled about 1½" from the bottom of the crucible, and the other held in a clamp. hottest metal must be devised to start the arc—that is, to bring the carbons together and draw them apart. A simple way is to place the crucible on a long board, to be used as a lever, fastened to the base by a hinge of leather. An interesting experiment can be performed by filling the crucible with ground glass up to the lower carbon rod. An arc may be started between the two gas carbons, and this will heat the glass to redness. An arc will then be formed with the carbon rod and the hot glass as electrodes.

TOM RIEBE.

A Simple "Arc" Furnace Made From Two Carbon Rods and a Plumbago Crucible.

The eyes should always be shielded from the intense light of the arc by dark glasses.

Contributed by TOM RIEBE.
AMATEURS!
ATTENTION!!

Now that we are for the time being, deprived of using our Radio outfits, it behooves us to become proficient in learning the Wireless Codes. Operators who know the Code are, and will be, in ever rising demand. The army and navy need thousands of operators right now.

AND THAT IS NOT ALL:

Connect two of these outfits together for intercommunication work and you and your friend five or fifteen blocks distant can converse over a NO. 36 WIRE, so fine that no one will see it. Or you can use instead of the wire, a metallic fence and the ground. Or you can communicate over your 110 lighting line, using no extra wire, only the ground. Full directions how to do this are furnished with the instrument. DEALERS: This is the 20th Century instrument that will sell like WILDFIRE. 500 sold in New York in 10 days. Get our proposition today!

Radiotone Codegraph complete as described, each, $1.75

IMMEDIATE SHIPMENTS

THE ELECTRO IMPORTING CO.

Selenium Cells

Everybody has read about the experiments of telephography (sending photographs over a wire hundreds of miles) made by Professor Korn and others. It is also known that if the problem of tele-vision is ever solved, the selenium cell will play an important role. At present we are the only concern in the United States selling these cells. They are the most sensitive ones made.

Better send for a cell to-d raw and try making an electric dog that will follow a lamp, or an electric burglar alarm. It's very instructive and great fun. (See November, 1916, issue "Electrical Experimenter.")

No. FX517 Selenium Cell, each .... $6.00

IMMEDIATE SHIPMENTS

BOYS!

Here Are the Stars and Stripes in All Their Glory

Be the first one in your town to wear this patriotic emblem. Think of it: An electrically illuminated buttonhole worn in the lapel hole of your coat.

It illuminates our National Flag in the original colors with a brilliant electric light. Just insert Flag in button-hole of your coat, put flashlight case in vest or coat pocket and every time you press the button, the flag in your button-hole flashes up with a beautiful color effect.

Illuminated flag, cord and plug (to 2 cell flashlight) $6.00 (postage 10 cents)

Illuminated flag, flashlight case and battery, cord and plug, complete as per illustration, $1.10 (postage 15c).

DEALERS: Write for our proposition today.

IMMEDIATE SHIPMENTS

"ELECTRO" TESLA COILS

This photograph shows a seven (7) inch spark.

Tesla Coil, made by us in our shops for a well-known institution. We build hundreds of special Tesla Coils for schools, universities, for stage purposes, etc. Spark lengths from two inches to fifteen inches and over.

We are known for careful workmanship and correct designing. The Tesla Coil, shown above (7" spark), without condensers or spark gap, sells for $40.00. Send for our quotations for special coils.
The "Electro" Rheostat-Regulator

This Illustration represents our little current regulator which is used everywhere to regulate battery current. It will regulate the speed of your battery-powered motors of all kinds. It makes an excellent automobile lamp dimmer, where it can be used to dim the light of the bulb. The Electro Rheostat is 10 times, more efficient, giving 10 times the efficiency of other leads. It is constructed ENTIRELY OF PORCELAIN, metal and hard rubber.

The resistance of our Rheostat is 10 times the resistance of carbon or tin leads. It is used in any number of telephone receivers.

No. FK 5000. Rheostat Regulator. Price $6.00

IMMEDIATE SHIPMENTS

"Electro" Pony Receiver

Our Pony receiver is without doubt the best article for the money this day.

Points of superiority:
1. Hard rubber construction which will be beautifully polished. Powerful per- manent magnet for ear magnetism, soft iron core, fibre bobbin, very thin dia-
2. A nose is not a nose to people who phone in noisy places or to people hard of
3. It can also be used for wireless though its low resistance won't permit of such good results as at a higher resistance.

No. EK 1024. Pony Receiver. 15 hours. $0.50

IMMEDIATE SHIPMENTS

BINDING POSTS

No. B-11. Each $0.10
No. B-27. Each $0.07
No. B-25. Each $0.09
No. B-8. Each $0.09
No. B-7. Each $.10

IMMEDIATE SHIPMENTS

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 18 is waiting for you. Positively the most complete Wireless and elec-

The Electro IMPORTING CO.
231 Fulton Street, New York City,
A NOISELESS "ALARM" CLOCK.

By K. M. Coggleshall.

Have you ever been faced with the necessity of opening the door of the alarm clock to wind it at night? Perhaps you may arise at five-thirty in the morning while the rest of the household do not find the necessity of opening the alarm clock to wind it until six-thirty. Perhaps some one may be ill and you wish to awake during the night to give him medicine, and yet do not like to disturb anyone else who may be asleep. Again you may be looking forward to a boisterous dawn starting a fishing expedition but at the same time respect to others you dislike to resort to the alarm clock to awaken you.

To overcome these objections to the ordinary alarm clock, the following apparatus was designed to awaken one sleeper without disturbing the rest of the household.

A box-like, wooden sub-base was built as shown in the illustration. On the top of this base a hole was cut and into this was fitted an ordinary bicycle spot light. A single pole, single throw knife switch was screwed to the upper inside surface of the sub-base. The lamp was then connected, thru the switch, to a battery of sufficient capacity to utilize its full candle-power. If the sub-base is made large enough the battery may be enclosed and the entire outfit made compact and portable.

The bell, as well as the striker, was removed from an alarm clock. A thread spool was attached to the alarm winding key to serve as a drum on which the cord to operate the switch was to wind. This switching device was very simple. A strong cord was attached to the handle of the knife switch, brought up thru a hole in the base and attached to the spool on the winding key.

The mechanical operation of this device can well be imagined. The apparatus is set on the mantel or dresser in the bedroom.

Did You Ever Hear of a "Silent" Alarm Clock—Well, Here's One. It Awakens You by Flashing a Beam of Light on Your Face. Try It.

The spot light is then so adjusted that the full power of the light ray will be concentrated on the face of the sleeper. The alarm should be wound and adjusted as usual. When the predetermined hour has arrived, the alarm mechanism operates, turning the drum, thus winding in the cord, which in turn closes the switch and lights the lamp. All this will be accomplished noiselessly. No one can sleep with a bright beam of light suddenly directed onto the face. Furthermore, it is impossible to miss such a light before getting up with this light in the eyes. It is therefore imperative that the awakened person arise and open the controlling switch and door. Furthermore there is little danger of dropping off to sleep again.

ELECTRIC LIGHT FOR GUN SIGHTS AT NIGHT.

To every hunter knows, it is extremely difficult to aim correctly at night, even tho the game can be seen, for the simple reason that the gun sights on the barrel cannot be accurately viewed.

The accompanying illustration shows how a small, frosted, flash light bulb may be placed just behind the forward sight, with a metallic shield over it, so as not to throw a glare in the gunner's eyes. It is a simple matter to bore a hole in the wooden stock of the gun with an ordinary carpenter's brace and auger, and in the hole place a cell of two from a flashlight battery, the size of these individual cells being about 1½ x 7/16 in diameter. Also the cells may be placed in a brass or fibre tube secured under the fore-arm section of the gun frame. A switch, of unobtrusive proportions, will serve to light the lamp bulb when wanted.

A Tiny Electric Light Fits Just Back of the Forward Sight Proves a Boon to the Hunter at Night.

GOOD INK FORMULAE.

These two formulæ obtained thru original experiments, have been found to produce excellent inks. The ingredients are easily obtained and at little expense. Rain water may be used in place of distilled water thus removing the need of having any chemical apparatus. The resulting inks are each of a beautiful color, make a permanent record, flow easily, and do not corrode the pens. The blue ink can be used successfully and safely in the most delicate of fountain pens.

Blue Ink: Dissolve one ounce of soluble prussian blue in one quart of cold distilled (rain) water. Add to this solution, ½ gram of oxalic acid. Then filter the solution thru filter or blotting paper.

Black Ink: Dissolve one ounce of extract of logwood in one quart of boiling water. When cold, add one-fourth ounce of potassium bichromate and one gram of sodium carbonate. Then filter the solution of one-fourth ounce of prussian blue improves the solution. This ink will cost about 5 cents.

Contributed by CLARENCE S. LEVINE.

STATIC EXPERIMENTS WITH LAMP BULB.

Materials needed—1 or more burned-out electric light bulbs.

Experiment—Take the bulb and hold it near a rapidly moving belt, connected with machinery which is not grounded. Hold the brass end of the bulb close to the belt and sparks will usually jump from the belt to the brass cap.

Charge in this manner for about five minutes, then take it away. Offer it to someone, holding the bulb by the glass end always. When the person goes to touch the brass end a nice hot spark will jump to him, giving a considerable shock.

Contributed by R. G. DEVANEY.

KNICK-KNACKS FOR "RADIO-BUGS."

By placing one of the E. I. Co.'s loading coils against the end of a small loose copper tube, I have been able to catch stations, using up to 6,000,000, this being done without additional inductance in the secondary, built for only 800 meters.

Most loose couplers have the primary tube placed in grooves cut in the heads and by turning it, a new surface is obtained for the slider. Clean the path of the slider occasionally with a rubber pencil or ink eraser.

Use soldierrall on the next loose copper you build and you will use no other.

Contributed by ASA S. KELLER.

AUTOMATIC LIGHT SWITCH FOR CLOSETS.

Herewith is a drawing of a little device I made from scrap materials and which has proved very efficient. It is intended to automatically close an electrical circuit on opening the door of a dark closet or unlighted room, and by means of a small battery and lamp illuminate the interior.

As the illustration shows, the materials and construction are exceedingly simple. Contributed by H. W. WALTER.
Experimental Chemistry

By ALBERT W. WILSON

ACIDS, BASES AND SALTS. (Continued)

As stated in the previous installment, the basicity of acids are determined by the number of hydrogen atoms [replaceable by a metal] in its molecule. Thus: Mono-basic acids contain one hydrogen atom, as Hydro-

chloric acid [HCl], from which only one replacement is possible. Di-basic acids contain two hydrogen atoms, as, Sulfuric acid [H₂SO₄], from which two replacements are possible. Tri-basic acids contain three hydrogen atoms, as, Phosphoric acid [H₃PO₄], from which three replacements are possible. Tetra-basic acids contain four hydrogen atoms, as, Normal Siliceic acid [H₂SiO₄], from which four replacements are possible. Penta-basic acids contain five hydrogen atoms, as, Periodic acid [H₅O₇], from which five replacements are possible.

The higher the basicity of the acid the greater the variety of salts it can yield.

If we take the base Potassium Hydroxid to illustrate the replacement of the hydrogen of the acids, we find that Nitric acid or Hydrochloric acid can form but one salt with Potassium Hydroxid, the reaction being:

\[ \text{KOH} + \text{HNO}_3 = \text{KNO}_3 + \text{H}_2\text{O} \]

and

\[ \text{KOH} + \text{HCl} = \text{KCl} + \text{H}_2\text{O} \]

Other acids have the power to form two or more salts with the same base.

If only half the quantity of base that is required to neutralize the acid is added, half the acid remains unchanged, and on evaporating the solution, the excess acid will pass off. If only half the quantity of acid that is required to neutralize the base is added, half the base will remain unchanged. Sulfuric acid [H₂SO₄] has been found to have the power to form two salts with Potassium Hydroxid [KOH], in one of which there is twice the amount of the metal as in the other. The reactions being:

\[ \text{KOH} + \text{H}_2\text{SO}_4 = \text{K}_2\text{SO}_4 + \text{H}_2\text{O} \]

and again:

\[ 2\text{KOH} + \text{H}_2\text{SO}_4 = \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O} \]

If to a certain quantity of Sulfuric acid only half the quantity of Potassium Hydroxid that is required to neutralize it is added, the first reaction takes place; but if twice as much Potassium Hydroxid is added, the second takes place. An acid of this kind can, further, form one salt with two bases, in which one metal is substituted for one of the hydrogen atoms of the acid and a second metal for the other. As aforementioned, in the molecule of Hydrochloric acid [HCl] as in Nitric acid [HNO₃], there is but one atom of hydrogen. If, therefore, the act of neutralization takes place in each molecule it is complete, and the salt is known as a neutral or normal salt. In Sulfuric acid [H₂SO₄] there are two atoms of hydrogen in each molecule, and either one or both of these atoms may be replaced. If only one is replaced, a salt having the general formula, M₂H₂SO₄, is obtained. This is still an acid, while it is also partly a salt. This is known as an Acid Salt.

It may be difficult for some readers to associate the names Monobasic, Di-, Tri-, Tetra-, Penta-, etc., with the basicity of the acids, but as these names represent the number of hydrogen atoms in the molecule, it may be well to memorize the following:

\[ \text{NaOH} + \text{HCl} = \text{NaCl} + \text{H}_2\text{O} \]

Sodium Hydroxide + Hydrochloric Acid = Sodium Chloride + Water

We perceive from this equation, that the hydrochloric acid no longer is contained in the solution, and that the Sodium [Na] of the base exchanged, or replaced the hydrogen of the acid, forming a salt and water.

EXPERIMENT NO. 54

In the same manner as described in the preceding experiment, prepare a solution of both Potassium Hydroxid and Hydrochloric Acid [HCl]. Pour 5 cc. of the Sodium Hydroxid solution in an evaporating dish, and immerse in a piece of blue litmus paper, allowing it to remain in the solution. Pour small quantities of Hydrochloric acid from the beaker onto a glass rod, allowing it to drip into the evaporating dish, in the manner shown by Fig. 66, stirring the mixture.

It will be noticed that the litmus paper will probably turn red, owing to the fact that the solution has too much acid contained in it. If such is the ease, add a little more Sodium Hydroxid, by allowing to drip from a stirring rod in the same manner as described for the acid. If too much of the Hydroxid is added the litmus paper might again turn to a blue color, and if this happens, add a little more of the acid, drop by drop, till the liquid becomes neutral to the litmus paper. It may be necessary to keep adding either the Acid or the Hydroxid. Introduce another piece of red litmus when you think the solution is neutral, and if it is unaffected, immerse another piece of blue litmus paper in it, and then if the solution does not affect either the red or blue paper it is neutral. If the solution is not clear after it has been neutralized, filter it, and throw away all but about 1 cc. of it.

Place the 15 cc. of the solution obtained into an evaporating dish, and place on either a piece of fine meshed iron gauge or a piece of asbestos pad, as shown in Fig. 67. Apply a light to the Bunsen burner under the evaporating dish, and allow the liquid to evaporate [boil] till a white solid is formed, or in other words till all the water has been driven from the original solution.

The equation of the reaction which took place between the Sodium Hydroxid and the Hydrochloric acid when neutralized was:

\[ \text{NaOH} + \text{HCl} = \text{NaCl} + \text{H}_2\text{O} \]

Sodium Hydroxide + Hydrochloric Acid = Sodium Chloride + Water

Alcohol: Oil and Water

MERCURY

If two or more Liquids Which Have Different Densities and Will Not Mix Are Poured Over Each Other, They Will Stand in the Order of Their Densities, with the Surfaces Intersecting in the manner shown. Mercury, Water, Oil and Alcohol, When Poured in a Test Tube, Will Come to Rest in the Order Named.
FREEZING MIXTURES.

When ice or snow are not to be had and for those of us who do not have an up-to-date laboratory that is provided with apparatus, we can prepare a refrigerator. I assume the following mixtures will prove most convenient.

1. Nitrate of ammonia, carbonat of soda and water, equal parts by weight; the thermometer sinks 57°.

2. Phosphate of soda, 9 parts; nitrate of ammonia, 3 parts; titrate nitric acid (1 part, water 2 parts), 4 parts. Reduces the temperature from 60° to 21°.

3. 24-ammoniacal, 5 parts: nitrate of potash, 5 parts; sulfate of soda, 8 parts: water, 16 parts. Reduces the temperature 46° or from 70° to 24°. This latter is very cold and the sugar is not destroyed.

If you have ice and wish to reduce the temperature still further, use the following:

1. Finely pounded ice, 2 parts; salt, 1 part. This is a very common recipe.
2. Finely pounded ice, 2 parts; crystallized chlorid of calcium, 3 parts.
3. Finely pounded ice, 7 parts: dilute nitric acid, 4 parts. This reduces the temperature from 32° to 30°. The temperature when frozen is Fahrenheit. The material should be kept cool as possible.

Contributed by M. R. ROSE.

SOLUTION FOR MAKING WORK TABLE IMPERVIOUS TO ACID AND ALKALI SOLUTIONS.

Do many experimenters, especially those working with the various chemical reagents, desire some coating for the work table that is impervious to both acid and alkaline solutions. The writer has used the following method in his laboratory with decided success, and heartily recommends it to those who desire a similar formula.

Two solutions are to be made.

Solution 1. Iron sulfate, 4 parts; copper sulfate, 4 parts; potassium permanganate, 8 parts; water, 10 parts.

Solution 2. Aniline, 12 parts; hydrochloric acid, 18 parts; water, 100 parts, or aniline hydrochlorat, 15 parts; water, 100 parts.

Apply two coats of solution No. 1, while hot, applying the second coat as soon as the first has dried. After solution No. 1 has dried, the excess of solution which has dried upon the surface of the wood is thoroughly rubbed off before the application of solution No. 2.

Next, two coats of solution No. 2 are applied, and the wood permitted to dry thoroughly. The color is not apparent at once, but requires a few hours before turning to a rich brown-black color. A coat of raw linseed oil is to be applied with a brush.

The tables are cleaned very easily by washing with water or suds after any work that involves the application of another coat of oil puts them in excellent order for another experiment.

Contributed by A. W. WILSON.
Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light toned ones. We pay each month $3.00 prize for the best photo. Make your description brief and use only one side of the sheet. Address the Editor, "With the Amateurs" Dept.

AMATEUR RADIO STATION CONTEST
Monthly Prize, $3.00.
This month's prize-winner.

CEDRIC E. HART'S EXCELLENT RADIO OUTFIT

The switch panel and cabinet, etc., shown in the accompanying photo have all been designed and built by myself, and with this cabinet I have no difficulty in receiving all of the coast stations and the amateurs within a fair distance of here. I also hear Guam, Honolulu, Alaska, Panama, etc., quite regularly. I have a license and my call is 6SL. My receiving set comprises the following: Navy 3ohme, Blitzen tuner, Blitzen variable, Clapp-Eastham tubular fist condenser, Turney variable condenser, and an Audion cabinet.

My transmitting outfit comprises a 1K.W. Thorndarson transformer, K.1. preventer, commercial key, home-made condenser, Hallicrafters rotary spark gap, home-made Telefunken type oscillation transformer and a Blitzen hot-wire meter. The switches on the panel control the transformer, power, meter, condenser and inductance.

This set, so far, has proven very efficient and, being as the panel has not been completed two weeks yet, I think that Evanston, Wyo., is a pretty good distance to transmit for the short time I have had it. Here's wishing the EXPERIMENTERs prosperity in its chosen path.

CEDRIC E. HART.
Salt Lake City, Utah.

H. L. SCOTT TO RENEW HIS RADIO ACTIVITIES.

Just recently I bought a copy of THE ELECTRICAL EXPERIMENTER, the January number, and on reading it thru it has brought back pleasant memories of the days when I operated my station. In fact it has thrilled me so much that I am going to renew my operations with the old vigor. (Not until after the Winter—Ed.)

It was when I lived at 158 Hamilton Street, East Providence, R.I., in 1909 and 1910, that I had my best outfit. About that time I believe I bought a detector from the Electro Importing Co.

I am sending you a photo of my apparatus I used in 1910, which I still have in storage. I hope you will find space in the columns of your magazine to reproduce this photo. For sending I used a three ind. spark coil, run by six V. 60 A.M. storage batteries. The coil may be seen behind the loose coupler on the table; over the coil on the board is a plate glass condenser; above that is the spark gap and then the helix; to the right is an anchor gap.

The sending key may be seen on the extreme right of the table: the contact points are two dimes.

For receiving, I had a loose coupler of my own make, a Murdock tuning coil and a detector stand in which I used silicon, together with a pair of 3,000 ohm receivers, potentiometer, fist condenser and Massie scaled-point electrolytic detector with double pole switch to throw in either system. I have heard Key West with this station.

HERBERT L. SCOTT.
Blackstone, Mass.

(All radio men should read the nat. 's in "Radio Dept." and on opposite page—Ed.)

"NO MORE E.E.:") says the newsdealer. "Al sold out!" Did he tell YOU so last time? MORAL: Ask him to order a copy for you every month. Say "Ask you want me to do so. The tremendous cost of paper does not allow excess printing, so we furnish dealers only with a sufficient amount of copies to supply their regular customers. If you are one, be sure to tell your newsdealer so, and give him your name and address, so he'll notify you by postal: you forget to call.

THE MONTANA WIRELESS STATION OF HOWARD PASCOE.

I offer herewith a photograph of "The Montana Wireless Station" which consists of 1 K.W. Packard transformer, run on (110 volts A.C.) and a stationary spark gap.

The receiving set consists of a loose coupler designed to receive up to 20,000 meters and a loading coil for 4,000 meters. One (type D) receiving set of Marconi Wireless Telegraph Co. make which has a range of 2000 to 4000 meters or more. One pair of E. I. Co. Republic receivers, Standard wave meter, silicon and Audion detectors (Type R J 9).

With this receiving set I am able to hear all the coast stations such as NPE, NPC, and the amateurs 7ZC, 7JN and many others.

I have a little sub-station up in the mountains, 6,355 feet above sea-level. All my wiring is run in conduit. On account of the small space, the station had to be photographed twice.

I read THE ELECTRICAL EXPERIMENTER. It is a fine magazine for the "Wireless Bugs." I will be glad to correspond or exchange photos of my station with other amateurs.

HOWARD PASCOE.
Butte, Montana (1129 East Galena)

ATTENTION!!!
Has your station photo appeared in "The Electrical Experimenter"? Why not purchase the electrotype and have some "real" stationery printed with your station picture on it? All of the "regular radio-bugs" are doing it.

Uncle Sam May Find the Amateur Radio Station of Howard Pascoe, at Butte, Montana, of Valuable Assistance.

ELECTRICAL EXPERIMENTER.
June 1917

AMATEUR RADIO STATION CONTEST
Monthly Prize, $3.00.
This month's prize-winner.

CEDRIC E. HART'S EXCELLENT RADIO OUTFIT

The switch panel and cabinet, etc., shown in the accompanying photo have all been designed and built by myself, and with this cabinet I have no difficulty in receiving all of the coast stations and the amateurs within a fair distance of here. I also hear Guam, Honolulu, Alaska, Panama, etc., quite regularly. I have a license and my call is 6SL. My receiving set comprises the following: Navy 3ohme, Blitzen tuner, Blitzen variable, Clapp-Eastham tubular fist condenser, Turney variable condenser, and an Audion cabinet.

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CEDRIC E. HART.
Salt Lake City, Utah.
Amateur News

The club is progressing rapidly and is certain to obtain much more interest in the near future. As yet we have no set but expect to obtain one soon. Regular meetings are held every Thursday night at 7:30. All communications should be sent to Harold Eppert, 841 State Avenue, Kansas City, Kansas.

Y. M. C. A. Wireless of Salesburg, Ill., Sends Basketball Scores.

The wireless department of the Y. M. C. A. recently sent out the scores of the basketball tournament. These scores were sent out three times a day, at the close of the game, at 8:00 a.m., noon, and 6:00 p.m. The last call after the afternoon session and at 10:00 o'clock after the night session. The teams which

ALL RADIO AMATEURS
ATTENTION!

As all of you know the United States is now in a state of war with Germany, and as true-blood American citizens, we are, each and every one of us, duty bound to obey the mandates of the U.S. Government officials. The Navy Department has been delegated by your President to close all amateur or experimental stations. It is imperative that no matter whether equip for transmitting or receiving, licensed or unlicensed, and therefore we shall all have to observe this decree, whether we like it or not. Therefore, beginning with the next issue of "THE ELECTRICAL EXPERIMENTER," we will endeavor to feature the Electrical Laboratory and information to any radio stations in the awarding of the monthly prize of $3.00 in this department. Now is the time to get busy and freshen up your electrical apparatus, and incidentally improve your understanding of electricity. Perhaps you have unwittingly slighted to a large degree in your pursuit of radio-telegraphy. Let her go, boys!

DE FOREST GIVES $5,000 TO AMERICAN DEFENSE SOCIETY.

Dr. Lee de Forest, the wireless inventor, has offered the American Defense Society $5,000 as the nucleus of a preparedness fund.

A RADIO ECHO FROM
LARCHMONT, N.Y.

Herewith is a copy of my radio station. The sending set is composed of a 1 inch Bull-Dog spark coil, a sending condenser, spark gap, key, and transformer. In my receiving set there are three loading coils, two fixed condensers, a double slide loose-
The Table of Valence:

### Table 1. Metals and Positive Non-Metal and Neutral Radicals.

<table>
<thead>
<tr>
<th>Metal (Metallic)</th>
<th>Non-Metal, Neutral Radical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hg</td>
<td>Cl</td>
</tr>
<tr>
<td>Ag</td>
<td>Br</td>
</tr>
<tr>
<td>Au</td>
<td>I</td>
</tr>
<tr>
<td>Pt</td>
<td>S</td>
</tr>
</tbody>
</table>

Table 2. Solubilities.

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{KCl} + \text{H}<em>{2}\text{SO}</em>{4} \rightarrow \text{K}<em>{2}\text{SO}</em>{4} + \text{H}_{2}\text{O} )</td>
<td>Sulfuric Acid</td>
</tr>
</tbody>
</table>

The reaction for this experiment is:

\[
\text{Zn} + \text{H}_{2}\text{SO}_{4} \rightarrow \text{ZnSO}_{4} + \text{H}_{2}
\]

The gas which escapes from the tube is hydrogen, and, if the tube is connected to a source of electricity, a spark may be caused to occur. The reaction obtained in this experiment is Zinc Chloride [ZnCl₂].

### EXPERIMENT 59.

Pour about 10 cc. of dilute Sulfuric Acid [H₂SO₄] into an evaporating dish and heat to dryness. The water which has been added to the solution will evaporate. Place in a clean evaporating dish and proceed to evaporate.

The reaction for this experiment is:

\[
\text{Fe} + \text{H}_{2}\text{SO}_{4} \rightarrow \text{FeSO}_{4} + \text{H}_{2}
\]

One of the Single Stroke Call Belts.

### EXPERIMENT 60.

Mix 5 cc. of water with about 5 cc. of Nitric Acid [HNO₃]. Place about 5 grains of copper scraps in a test tube and add the 10 cc. of Nitric Acid, prepared as above. It action does not take place, but gently over a Bunsen burner. A green solution will form, and after the action has stopped, add about 5 or 10 cc. of water and slowly evaporate, as before. If the evaporate is caused to dry, the nitric acid will break up into the insoluble oxides, which will manifest a black color. To avoid this action the liquid need not be completely evaporated, but it may be slowly evaporated, as above.

(Continued on page 154)
An Electric Photometer (No. 1,218,446; issued to Clayton L. Loring.)

This device embodies a clever electrically operated photometer for use by photographers in accurately calculating the proper exposure for any strength of light and any size less opening. The instrument comprises a suitable light filter and cooperating shutters, so that ordinary diurnal light may be properly compensated with a standard of light incorporated in the photometer. The light standard is composed of a small electric bulb, and dry battery with suitable switch. With equal amounts of light penetrating two special transparent blocks, they appear as one block; two halves of the black picture give balance so that natural and artificial rays are of equal intensity.

Antenna for Aeroplanes (No. 1,219,550; issued to Water M. Haldeman.)

An improvement in design of wireless antennae for aeroplanes comprising a balance or other mast supporting one or more insulated flat-top aerials. The "ground" electrode is composed for by utilizing the metallic aeroplane structure; the "aerial" element being cared for by the special antenna here shown. The inventor has paid particular attention to the proper insulation of the stability and operating characteristics of the aerial system and claims that the addition of his antenna to an aeroplane will not cause it to be unbalanced in flight or in maneuvering.

Pool Table Register (No. 1,230,826; issued to William J. Heffelf.)

An interesting and practical electromechanical device for registering the results of a game of pool, etc., whereby the pool hall as it falls into action when an electrical contact. This causes a set of magnets to operate a pawl and ratchet connecting with the indicator which is in the manner shown and the dial may be marked off in any style and color desired. The device can be attached to any pool table and is not altering or damaging it, and each table pocket is connected up to the electrical scoreboard.

Electrically Gas-Generator (No. 1,219,966; issued to Isaac H. Levin.)

Electrically apparatus designed to produce hydrogen and oxygen gases by subjecting water containing a small quantity of a suitable electrolyte, such as, for example, potassium hydroxide, sulfuric acid, etc., to the action of an electric current, which loop circuit will have less resistance than the antenna circuit, as it is closed and practically all of the high frequency oscillations produced will flow in this circuit. When the key is opened, the arc oscillations will charge the aerial instead, etc.

Oscillating-Current Generator (No. 1,221,034; issued to Lee de Forest.)

An improved method of developing powerful high frequency oscillations in a vacuum tube generator, suitable associated with one or more oscillation circuits. The device provides an evacuated bulb containing two electrodes, which induce a mercury vapor arc within the bulb. Two cold electrodes 9, and 10, are utilized, 9 being water cooled, and 10 being a bent hollow glass. An oscillating circuit is associated with the two cold electrodes 9 and 10. A second oscillating circuit is provided thru inductance 20, and capacitance 21. With arrangement, the oscillations produced in the first oscillatory circuit are increased in intensity when the plate of the second oscillatory circuit is made equal to that of the first. The output or "load" circuit comprises around 24, inductance 22 and aerial 23.

Combination Radio Receiver and Detector (No. 1,219,888; issued to Frank Wallberg.)

An extremely compact "pocket" wireless set, comprising a tuning inductance, crystal detector and telephone receiver, all in the space required for an ordinary watch. The telephone receiver and detector are connected in parallel, and this unit in series with the aerial, ground and tuning coil. The latter is adjustable by means of a screw; the tuning coil is wound about the shell of the receiver and the detector is extremely small, being placed within the receiver-magnet chamber as shown. The device is held to the ear when in use, and the switch turned until the signals come in the loudest.

Electric Land-Torpedo (No. 1,219,028; issued to Abraham Must.)

A novel invention comprising an electrically driven or propelled land-torpedo possessing several unique features. As shown in the illustrations, the design comprises two sections; the forward compartments containing the charge of gunpowder and detonating means, while the powered rear unit contains the electric driving motor and necessary gears. The land-torpedo is disengaged from a trench, and is under constant control of a soldier in the trench. It should prove useful in destroying barried wire, and other impediments as when it has attained the desired spot, the operator simply pushes the explosive charge in the war-head of the torpedo, thus destroying the obstruction. The torpedo hauls its electric feed wires after it, as it ambles away from the trench.

Electric Gas Buys for Submarine Warfare (No. 1,322,688; issued to Joseph A. Schmitt.)

Something quite new in the realm of war machinery and comprising a series of highly charged poisonous gas bombs, which may be attached to the interior of the submarine, and which are held in charge electromagnetically controlled from the interior of the submarine. The latter may submerge in proximity to a hostile war-ship and release one or more of the gas bombs. These float to the surface and even the struck by shell-fire, they will proceed to liberate a cloud of deadly gas fumes which will eventually overcome the crew of the war-ship. The gas bombs may be released and immediately cut free, or they may be maintained in position by a cable as shown, so that they will not drift away before their task is finished.

Head for Concealing Telephone (No. 1,221,915; issued to Lillian A. Strasburger.)

This invention provides a specially devised concealing hood for covering the telephone and comprising a wire framework provides the head. The attachment is designed to be invisible with a sliding curtain. To use the telephone, it is not necessary to strip the skirt of the figure and turn the whole outfit around 180 degrees, when the rear curtain can slide sideways and the receiver move from the book.

COPIES OF ANY OF THE ABOVE PATENTS SUPPLIED AT 10C EACH.

www.americanradiohistory.com
Phoney Patents

Under this heading are published electrical or mechanical ideas which our clever inventors, for reasons best known to themselves, have as yet not patented. We furthermore call attention to our celebrated Phoney Patent Office for the relief of all suffering daffy inventors in this country as well as for the entire universe.

We are revolutionizing the Patent business and OFFER YOU THREE DOLLARS! $3.00 FOR THE BEST PATENT. If you take your Phoney Patent to Washington, they charge you $20.00 for the initial fee and then you haven't a smell of the Patent yet. After they have allowed the Patent, you must pay another $20.00 as a final fee. That's $40.00! I WE PAY YOU $3.00 and grant you a Phoney Patent in the bargain, so you save $43.00!! When sending in your Phoney Patent application, be sure that it is as daffy as a lovesick bat. The daffier, the better. Simple sketches and a short description will help our staff of Phoney Patent examiners to issue a Phoney Patent on your invention in a jiffy.

No. (M.Y.A.C.) 800 S.G.

Phoney Patent Offer

S. T. Raphangr of Rushour, D. T.

Self Propelled Trolley

To Whomsoever It Might Concern:

Be it known to all unknown and all other straphangers at large, as well as all those confused in solitary confinement throughout the world, that I Salomon Tadicz Raphangr of the City of Rushour in the State of Deliriumcrenmen, have devised, designed, designated and developed an invention of the most far reaching consequence to a long suffering traveling public.

It is a well known, albeit deplorable fact, that the modern trolley car for economic reasons of all traction companies are equipped with rather oval as well as "flat" wheels. The tracks too, are of the same railway type, fashioned after the camel's back, i.e., hill and valley with 15 hills and 29 valleys to the running yard. These modern requirements are necessary to shock up and dump the cars vigorously, this action being required to pack the passengers tightly into the car and to jingle the passengers' nickels, so the latter can be extracted easier for the conductor's take-off.

Having in mind these points and knowing that passengers always sway to and fro in all our trolleys in a truly alarming manner, I conceived the brilliant idea of utilizing this prodigious energy, now going to waste, for a far more pleasing than being bumped up and down on hard seats. It is also very healthy, for the digestion is greatly improved, especially after heavy meals. It will "settle" the heartiest meal wonderfully, if the public comes to realize this it will patronize my new self-propelling trolley in a manner unprecedented by the most voracious traction company shareholders. No power house nor battery wires being required, the company will make enormous profits, and it will be able to issue a package of chewing gum and 10 trading stamps free with every nickel ride.

Referring to the patent drawing we find that 1 is the strap on which the straphanger navicrates. Every time he sways he exerts a pull of about 150 lbs. on the strap, and by means of a pawl and ratchet arrangement mounted on a common shaft passing thru the length of the trolley, the shaft begins to rotate. The power is then conducted by belts to dynamo which in gears 4 and the resulting power is also conveyed to the belts 3, this furnishing additional power.

What I claim is:

1. A wireless trolley, operated solely by straphangers.

2. A self-propelled car reducing trolley stimulating digestion and preventing indigestion.

3. A trolley car giving passengers all the experiences of a sea trip for a nickel.

In consideration whereof, I have therefore resolved and caused to be appended and impressed hereunto and hereunder the crest of my family shoe tree with my left uppermost hind, foot this 16th day after the advent of any deceased maiden aunt's German measles, in the presence of three witnesses.

S. T. RAPHANGR.

Witninesses: By his Attorney.
A. W. Gowan, Thomas W. Benson.
I. M. Indutch, Philo, Pa.
C. U. Thoost

Straphangers All Over the Universe As Well As Trolley Car Magnates Will Rejoice At This New Invention. Not Only Do the Swaying Passengers Now Propell the Car, But They Experience All the Variegated Experiences of a Sea Trip and All for a Nickel.
This department is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
2. Sketches, diagrams etc. must be on separate sheets. Any questions not conforming to these rules cannot be answered by mail free of charge.
3. A brief quick answer is desired by mail; a nominal charge of 25 cents is made for each question. If the question entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

RECORDING VOLTOMETER. (788.) J. Hassel, Baltimore, Md., asks:
Q. 1. What is a recording voltmeter?
Q. 2. A recording voltmeter is an instrument which permanently records the potential that exists between points in an electric circuit during any definite period. It consists of nothing more than an ordinary voltmeter, the armature or moving element of which carries a small writing pen, that traces a curve on a moving strip of paper. The variation of the e.m.f. in the circuit is indicated by the variation of the traced curve. The strip of paper which receives the record is moved by a special clock mechanism.

What is the purpose of these instruments most adapted?
A. 2. They are generally employed in power-stations, where it is required to know the exact voltage conditions of the line during certain periods of the day.
Q. 3. Are these instruments sufficiently accurate to warrant their use in laboratory work?
A. 3. No. Most of them require a large correction factors. Their accuracy depends upon the degree of voltage variations, as the friction between the pen and paper is somewhat great when the moving element is caged as frequently.
The wiring diagram herewith gives connections of a recording voltmeter for calibrating the same with a standard voltmeter.

IMPULSE EXCITATION. (789.) Paul Magdale, Hackenschack, N. J., desires to know:
Q. 1. What is meant by impulse excitation?
A. 1. Impulse excitation is a method of exciting the antenna by means of an oscillatory circuit which is highly damped and the coupled secondary or antenna circuit receiving an impact or shock from the primary circuit, and permitting this secondary circuit to oscillate with as little damping as possible. The primary oscillatory circuit is so adjusted or tuned that a single impulse will cause it to oscillate at the proper frequency.

Q. 2. Is the quenched spark gap system operated on the impulse excitation principle?
A. 2. Yes; but it is not an ideal impulse excitation, since the primary of the circuit is not permitted to be highly damped. Furthermore, the oscillations of the primary are periodically cyclonic and not impulsive or semi-period oscillations, as that obtained from an ideal impulsive excitation transmitter.

RADIO BOOKS. (787.) Andrew Colly, Oyster Bay, L. I., asks:

TO OUR FRIENDS.
Do you realize that not one day passes when we do not receive from 50 to 250 letters requesting answers to the "Question Box"? If we were to publish all the questions and answers we would have to write a monthly magazine five or six times the size of The Electrical Experimenter with no other matter but questions and answers. Of late the influx of letters has become so heavy that several of our associates have been forced to discontinue their important editorial work, in order to answer the mail. This we are certain you do not wish. You do not want your magazine to lose its present high standard. We want the best, the very best, and you know we never have failed you yet.

Moreover the multitude of letters are wholly unnecessary. Most of the questions we are asked every day have been answered before in the Question Box. Therefore ere you sit down to write to us, look over your back numbers and note times out of ten you will find the answer.

We strive hard to publish only such matter as has not appeared before in our columns, and for that reason only a small fraction of queries of those received by us are actually published.
Kindly note, therefore, that in the future we cannot, in your own interest, answer questions by mail, free of charge.

For questions requiring immediate answer our fee is $25 for the first ordinary question and $25 for each additional question. We will gladly advance fee for special questions entailing considerable calculations or research. Stamped and addressed envelope should be enclosed with the queries and, moreover, any sketches accompanying them should be made on separate sheets. And please be brief.

THE EDITORS.

WAVE LENGTH OF ANTENNA. (790-A) Thomas Lowman, East Pittsburgh, Pa., inquires:
Q. 1. Can you give me the wave length of an antenna which consists of four wires 100 feet long, and the wires separated 2 feet.
A. 1. The wave length of this antenna is 400 meters.
Q. 2. Suppose I desire to use this antenna with a transmitting station, which will comprise a 500 watt 60 cycle trans-

(Continued on page 135)
Who Gets $200,000,000
Tire Profits?

An amazing condition revealed in the tire business. Terrible waste shown by methods of selling automobile tires. How one tire man plans to cut the cost of tires to the consumer revealed

Tire Chain Stores Offer Solution of Problem

By M. E. PHILLIPS, “Staff Correspondent” (Home Magazine)

NOTE.—The following article, written by our staff representative, outlines plans for a giant chain of tire service stations and stores which it is predicted will greatly lower automobile upkeep costs, by unique co-operative plan which has been tested out and found successful. Output of splendid factory already secured, more to follow. The success of other chain stores and the tremendous growth of the automobile industry—consequently of the tire business—makes this one of the most attractive and interesting enterprises. We have made every effort to verify the statements made here and to the best of our knowledge the statements are accurate and the estimates conservative.—(Publisher Home Magazine.)

Who gets the $200,000,000.00 A YEAR TIRE PROFITS?

Do you know that the cost of producing a tire is possibly ONE-THIRD of the price you have to pay? That a small tire you pay $15.00 for costs about $5.00 to manufacture? That the tire costing about $20.00 to build has to retail for about $60.00? Do you know that the tire manufacturer is satisfied to sell his tires for very little over the cost, and at only a fraction of the retail price?

Where does the balance go? Who then gets this enormous “cut in” on the tires you buy?

DO YOU? Of course not. Who, then? Well, the JOBBER gets a BIG slice. The WHOLESALE gets another BIG slice.

The RETAILER gets HIS SHARE. The rest goes into advertising, dealer’s helps, adjustments, etc.

Meanwhile YOU, Mr. Tire Buyer, pay the 100 per cent price and worry about the high price of upkeep of your motor car.

WILL CUT TIRE COSTS

A clever tire man, a man with intimate knowledge of the tire industry, a man with breadth of vision and economic principles, has seen this enormous WASTAGE in the tire business and has evolved a PLAN that will revolutionize the tire selling business.

He argues that Tires COST THE CONSUMER TOO MUCH.

He says there is no reason on earth why the tire buyer should have to pay this enormous burden of profits and selling costs. If tires can be made for ONE-THIRD of the actual retail prices they can be sold FOR LESS than prices now charged for them and still pay legitimate profits. LARGE PROFITS, because of the volume of business a company offering such savings is bound to achieve.

This far-sighted man is a PRACTICAL TIRE MAN. As a manufacturer he has MADE GOOD. He is a PRACTICAL BUSINESS MAN, with all a practical man’s dislike for waste. He has proved his genius for organization and big things.

This man is Mr. J. C. Feist, President of the National Rubber Company of New York.

PLANS CHAIN OF STORES

Mr. Feist’s plan is to establish a chain of tire service and store stations from Maine to California, and Canada to the Gulf of Mexico. The National Rubber Company of New York has been organized with strong men behind it and it has already secured the output of one entire factory as the nucleus of this chain store plan. More factories will be added as the chain extends and the need of many tires becomes evident. The first factory whose product has been acquired is the National Rubber Company of Pottstown, Pa., manufacturers of the famous National Speedway Tires and National Red Tubes.

The NATIONAL SPEEDWAY REDWALL TIRES are so GOOD that they are sold under the strongest GUARANTEE to be had.

The company agrees to replace FREE any tire that does not outlast and outwear any tire of any make or price of the same size tested under the same conditions.

This company now has a production of 1,000 tires and tubes a day and is being enlarged to a much greater capacity when the distribution exceeds the capacity of this plant, new plants will be started or bought in different sections of the country, or their outputs contracted for in order to bring up the production to the necessary number of tires.

Mr. Feist proposes to sell tires at a MUCH LOWER PRICE than is now being charged for good tires elsewhere.

He plans to give SUPERIOR SERVICE to tire buyers.

He will give them a BETTER TIRE. He anticipates that in doing this his company will prove the greatest profit maker in the country.

EXPERIMENTAL PLANT A SUCCESS

Mr. Feist is not building his company’s future on imagination or theory. Before maturing his plans he opened in Philadelphia...
ECONOMY OF CASH BUYING

The chain store man uses his cash to buy everything. He buys everything the same way. He buys his fixtures, his delivery wagons—if he uses them—his every necessity at the lowest bulk price, and bulk with the chain store man means tremendous bulk. Thus chain stores sell articles that retail for such a small price, can earn such fabulous dividends, what will a chain of tire service stores earn with the big sales it will make; sales averaging $20 apiece? It doesn't take a prophet to look into the future and see the magnificent accumulations of dividends that should accrue from such an enterprise. It isn't hard to foresee what the earnings of such a chain of stores can pay in say ten years from today. By that time the chain should extend to every city of any importance in the country. This may mean thousands of such stores, because there are in the United States 1,442 towns of 5,000 or more inhabitants and over 100 cities having a population of 50,000 or over. The small towns, say the towns under 10,000, would require only one such service station, while the larger towns would require a number of them.

THOUSANDS OF CHAIN STORES

To give you an idea of how many stores some of the big chains have, it is enough to mention the Great Atlantic and Pacific Tea Company, with over 200 retail stores, the United Cigar Store, with over 1,000 retail stores; the Woolworth Company, with over 1,000 stores, etc.

The tremendous growth of the automobile industry—a growth that is gathering size and importance every day—makes this projected chain of tire service stores all the more important. At the beginning of 1917 there were approximately THREE MILLION AUTOS in the U. S. By the last United States census, there were in 1910 (date of last census) 91,972,266 inhabitants in the U. S. It is calculated that there are now at least 120,000,000 people in the U. S. At this rate, there is one auto in the U. S. for every 40 people. In many of the states, the ratio is higher than one for every 10 people. This means that THERE IS A TREMENDOUS POSSIBILITY FOR MORE MACHINES.

According to the best informed automobile authorities, it is calculated that there will be added at least 1,000,000 auto users during the year 1917, bringing up the total close on to FOUR MILLION AUTOS in use in the U. S. With such an enormous distribution of cars, and all the automobile factories of any account way behind in deliveries, an enormous supply of tires will be required to keep these autos running.

24,000,000 TIRES NEEDED

Very moderate estimates place the number of tires required on each car at EIGHT PER YEAR. Each auto MUST HAVE FIVE TIRES, four on the wheels and one spare tire. It is an ultra conservative estimate, therefore, that place, the required number of tires to meet the needs of 1917 at SIX PER CAR. At this rate 4,000,000 automobiles will require 24,000,000 tires. This is truly AN AMAZING FIGURE for an industry that is only fifteen, a dozen years old.

The distribution of these cars is centered at present in certain sections. When the other sections have awakened to the advantages and uses of the automobile and its economy for travel and convenience, the spares will no longer be so much more than likely that the distribution will be much more even.

It has been estimated by statisticians that there are OTHER TEN MILLION men in the U. S. who should be, and probably

Chicago Store of National Rubber Company, the Third in the Chain.
June, 1917

THE ELECTRICAL EXPERIMENTER 133

soon will be, auto owners. These are men who, because of their business, their financial condition and their position, should become automobile owners.

There are upwards of seven million farmers in the U. S., and of these a large percentage will probably become owners of automobiles. The farmer is today the KING MAN of the U. S. He has been getting the biggest prices ever paid for crops, he has by scientific farming increased the yield of his acres, and he has been fortunate in getting big crops when the price was highest.

For these reasons, THE FARMER IS USUALLY PROSPEROUS and he is putting some of his riches into the comforts and conveniences of an automobile.

With such prospects, with such a tremendous field to conquer, with the SUCCESS that has attended the FIRST UNIT of the National Rubber Company chain of service stores, it is not hard to visualize the ENORMOUS POSSIBLE PROFITS from this enterprise.

The National Rubber Company chain, of service stores, it is not hard to visualize the ENORMOUS POSSIBLE PROFITS from this enterprise.

Officers and Officials of the National Rubber Company of New York. These Men Have Made the Making and Selling of Tires Their Life Work. Both as Manufacturers and Branch Managers. They are Pioneers in the Tire Business. They Have Witnessed the Tire Business Grow from the Experimental Stage. Today They Are Large Factors in the Manufacturing of the Best Tires that Money Can Make. Mr. Walsh, Who is Superintendent of the Plant, Has been for 23 Years In Active Charge of the Making of the Best Known Tires in America. Mr. Sperry Was With the Doerr Plow Co. as a sons. Mr. Dougherty Has Been a Tire Representative for Years, Formerly With the Lee Tire Co. Mr. A. Lamoree Has Also Been a Bendix Tire Store Manager and General Tire Salesman With Several of the Big Companies.

HOW PROFITS FILE UP

Even a casual consideration of the subject makes the figures run into such amazing columns of profits that the very thought is staggering.

The great earnings of chain stores of all kinds has been in the aggregate.

When you take 1,000 stores and pile their profits in one great heap, you have a formidable aggregate—an aggregate which doesn't have to be very large in the individual case to make up this magnificent total.

Let us take into consideration one unit and then see how it works out.

Firstly, we must remember that these service stores are operated at a minimum of expense. Being administered from the central office, whose costs of operation are spread over the whole chain, the local stores require only inexpensive help. The man who operates a store of his own expects to make A GOOD LIVING out of it for himself AND A GOOD PROFIT besides; he has to pay for everything on the high price of individual purchases. He has to have efficient help, has to advertise and, of course, he has fixed charges for rent, light, taxes, insurance, etc.

CHAIN STORE SAVINGS

The chain store hires only the necessary help, it eliminates the owner's living and profits. It buys in enormous quantities at prices that make the prices the individual store owner pays seem preposterous; it pays the minimum for taxes, for insurance and the advertising expense of operating is carried in bulk by the parent company, and there is no credit earned by the individual store pays only a small sum as its share of the advertising expense.

Tires are bought at actual contract price from the manufacturer and charged again the store, much cheaper than the average tire store man can buy them.

We shall have EXPENSE REDUCED DOWN TO THE BONE, probably HALF WHAT THEY WOULD BE UNDER ORDINARY CONDITIONS. And we have the most attractive kind of a proposition to offer to the tire buyer—OLD TIRE ON THE MARKET that costs less than he would have to pay elsewhere; A SERVICE NO OTHER TIRE CONCERN GIVES or can give, GUARANTEED SATISFACTION backed up by a company operating on a NATIONAL SCALE.

With so much to offer and with such splendid profit-making advantages it is not hard to look into the future and see every store paying a big profit and the company earning dazzling dividends.

What may one store earn, you may ask?

Let us do a little figuring.

Firstly, the ENTIRE FACTORY SELLING EXPENSE IS ELIMINATED—the entire output of the factory being sold to one customer—the chain stores.

The saving of the traveling expense and salesman's salaries and commissions. The saving of advertising and promotion expense. The added office expense and credit expense, all things are SAVED by the chain stores. In these items alone is found a selling cost of at least 30 per cent.

On top of this the FACTORY DISCOUNT of 40 PER CENT IS WIPED OUT.

No thinking man or woman has to be told that the NET SUM the manufacturer receives is ALONE PROPORTIONATE TO THE QUALITY AND QUANTITY of materials used in making tires, because ONLY AND SOLELY from this NET SUM is the PROFIT derived.

Because of the Tremendous Overhead selling and distributing expense, the enormous discounts demanded by the jobber, the wholesaler and the retailer, if the manufacturing cost were TOO HIGH or even over his competitors, then added charges, as described here, increase out of proportion and the consumer's prices would be prohibitive.

Hence, in National Speedway Tires most of the factory selling cost is put in the tire in ADDED QUALITY AND QUANTITY, and the usual trade discounts are divided with the consumer.

PROFITS OF CHAIN STORES

We now come to the question of the profits of the chain stores of each unit and of the chain in the aggregate.

After a careful scrutiny of costs of manufacturing, of operating the chain store—each unit—and figuring a retail price on the tires at a sensible reduction over average price of tires of equal size and quality, and marking up the net margin of $3 per tire, AND REALIZING the fact that there is an average margin of $5 per tire. This is "AVERAGED" because some of the tires will pay more profit while some will pay less, but the average has been shown to be about $3 per tire told.

This is evidently a CONSERVATIVE ESTIMATE.

If each chain store sells only 10 TIRES PER DAY, we have each store earning a profit of $30 a day or $5000 a day profit for 1000 stores.

$5000 profit per day for 365 days in the year—tire service stations are busy Sundays and holidays. Then other days, FIGURES OUT THE ENORMOUS TOTAL OF $18,750,000 A YEAR PROFITS.

You will realize that an estimate of only ten tires per day is very small. When you consider the tremendous advantages of dealing with the National Rubber Company service stores, the high class product, the low price, the good service given in the way of instant special deliveries, placing the tire on the car and taking care of the repair, you will understand why these stores should do an enormous business.

Ten tires per day is a very low estimate of the possibilities, but to be even more conservative, let us cut down this estimate O/N. Let us organize that the stores only AVERAGE FIVE SALES PER DAY. Let us see how this figures out.

FIVE TIRES A DAY, showing an average profit of $25 per day per store, one thousand stores will, therefore, pay an estimated daily profit of $25,000. For 365 days in the year THE ENORMOUS TOTAL WOULD BE $9,125,000, and it would be a mighty small store that couldn't sell five tires per day.
These figures are staggering when you analyze the accumulated profits of hundreds of stores all over the country, each contributing its quota of profits from many sources.

A GOLD MINE OF PROFITS
You will note that no estimate has been made of profits from sale of tubes and from the repair department, which should also be profitable.

It will, of course, take time to build up such a large chain of service stations, but in a few years, with the growth of the chain and the enormous increase in the automobile industry and number of cars on the road, THE CHAIN OF TIRE SERVICE STATIONS SHOULD BECOME A VERITABLE GOLD MINE OF PROFITS FOR EVERY STOCKHOLDER WHO BECOMES INTERESTED IN THIS COMPANY NOW, when its shares can be acquired at a low initial price.

The National Rubber Company, of New York, is incorporated under the laws of the State of Delaware, with a capitalization of 500,000 shares of the par value of $10 PER SHARE, ALL COMMON STOCK, SHARING EQUALLY IN PROFITS AND CARRYING FULL VOTING POWER.

For the purpose of establishing the business on a right basis, the directors have set aside 100,000 SHARES OF THIS STOCK TO BE SOLD TO THE PUBLIC.

Their idea is that by obtaining a wide distribution for this stock, they will enlist local interest in the local distributing and service stations of the National Rubber Company.

UNDERWRITING STOCK OFFER
This UNDERWRITING SYNDICATE STOCK is offered in five different allotments.

The first allotment will be sold in lots of not less than TEN SHARES and not more than 100 shares at $5 per share, or half the par value of the stock.

This first allotment of 20,000 shares is the only stock of the UNDERWRITING allotment that will be sold at this low price.

The next allotment will probably be sold at from 40 to 50 per cent advance in price as soon as the first allotment of 20,000 shares is disposed of. Further allotments at further increases as warranted.

It is desired—as nearly as possible—to place every share of this UNDERWRITING stock in the hands of owners, or prospective owners, of automobiles, who will become immediate patrons of the chain stores and who ARE ALSO OFFERED AN INDUCEMENT TO BECOME BOOSTERS FOR THE TIRE SERVICE STATIONS. THIS INDUCEMENT CONSISTS OF A CASH DISCOUNT OF 25 PER CENT UNDER THE STANDARD LIST PRICES FOR ALL TIRES SOLD BY THE NATIONAL RUBBER COMPANY TO ITS SHAREHOLDERS.

An automobile owner, therefore, has a double interest in buying this stock.

The saving alone in tire bills for a year should pay for this ten shares if he buys at this price and he will have, besides the savings in tire costs, and dividends which the company declares,

IS THIS INVESTMENT WORTH WHILE, you may ask?

WHAT THIS MEANS TO AUTOISTS
Let us study it over. $50 invested in ten shares of this underwriting stock will save the automobile owner 25 per cent on his tires. If his bill for tires runs to $20 a year, he will be saved, therefore, $50. That means that the stock will have paid him 100 per cent on his investment or 50 per cent on the par value of the stock, which, computed on a stock’s ability to earn 5 per cent, will entitle the stockholder to receive AN INVESTMENT OF $1,000 FROM AN ORIGINAL INVESTMENT OF $50. Then if the company begins paying dividends, the stock should go to par and over if the dividends amount to more than 5 per cent.

When the company gets on a 10 per cent dividend basis, the stock he bought for $50 should represent an investment of $200. When it pays 50 per cent, it should have an INVESTMENT VALUE OF $4,000.

So when the company is in a position to pay 50 per cent dividends, this stock should represent an investment to the automobile owner of $2,000, figured on the basis of the dividends and savings it will give him on his tire purchases. And all from an original investment of $50.

When the company reaches its full development and its 1,000 or more stores begin piling up big profits, such as we have already figured on, profits that mean exceptional dividends, THIS ORIGINAL INVESTMENT WILL HAVE ACCUMULATED A PHENOMENAL VALUE.

NO AUTOMOBILE OWNER CAN AFFORD TO OVERLOOK SUCH AN OPPORTUNITY.

A blind man could see the possibilities presented in this underwriting offer, an offer so liberal that the directors had to confine it to a small amount of stock.

AN EXCEPTIONAL OFFER
The offer of the stock at $5 per share (par $10) is in itself a tremendous inducement, but when it is coupled with the offer of the company to extend a discount of 25 per cent on all tire and tube purchases made through the company, it becomes so extremely attractive a proposition that NONE CAN AFFORD TO IGNORE IT.

The savings in tire costs alone should pay for the stock of those who accept this offer.

This, in itself, makes the proposition attractive. But when the future of this company is analyzed and the possibilities it offers are considered, the offer becomes immensely more attractive.

YOU NEED NOT NECESSARILY BE AN AUTOMOBILE OWNER today to accept this offer. Your stock in the National Rubber Company will entitle you to this 25 per cent discount on tires and tubes JUST AS LONG AS YOU REMAIN A STOCKHOLDER. Later, when you buy an auto, you’ll be able to buy tires at this great saving.

You often hear it said that if you had a chance to invest with Ford, or Willys, of Overland fame, with Goodrich or Fisk or Firestone; with Westinghouse or Bell, or some of the others, whose companies have earned fabulous dividends, and made stockholders rich, you would today be ON EASY STREET.

This is very true but the pitiful truth is YOU DID NOT HAVE THIS CHANCE. VERY FEW PEOPLE DID. These com-
panies were all close corporations with the stock held in the hands of a small group of men. These stocks were not offered to the public.

Tire Fabric Cutting Machine. This Machine Can Cut the Fabric for 1,000 Tires a Day, Doing the Work of 10 Men.

A CHANCE IN A MILLION

BUT HERE IS A CHANCE. Here is a company offering UNDERWRITING STOCK, stock that can now be bought at the ROCK BOTTOM PRICE, that should in time become enormously remunerative. Stock in a company that promises to have tremendous growth.

Woolworth and Whalen and the others, who have made tens of millions out of chain stores, never gave the public a chance to come in on the organization. They have sold stock since, lots of it to the general public, but it has been stock in the developed proposition, stock that has been sold on the market AT THE VALUE IT PRESENTS NOW, a value figured on the company’s earning power.

LATER YOU MAY GET A CHANCE on the National Rubber Company stock on the open market but YOU’LL PAY THE PRICE OF DEVELOPED STOCK. If the company is earning 100 per cent on its capitalization, you’ll pay for it at that rate, which, in that case, would be $2,000 for every $100 par value, or $300 a share for $10 shares.

This is THE PENALTY THAT SHORT-SIGHTED PEOPLE PAY for not accepting opportunities that are offered them.

The poorhouse is FULL OF SUCH PEOPLE, “THE MIGHT-HAVE-BEENS.” They lacked the initiative and courage to back their belief with their money.

THOSE WHO HAD COURAGE

The others, those who are without fear, those who have the courage to back their judgment with their money, they are those you watch spinning past you on the boulevard in luxurious limousines, whose homes line the fashionable streets.

MONEY MAKES MONEY, but it takes an exceptional opportunity to bring you big returns from small investments. You read, for instance, that $500 invested in such-and-such stock has earned $250,000; that $500 invested in such other stock has paid $200,000; that $1,000 in Ford stock of the original company is now worth millions. THAT IS ALL TRUE, gospel truth, but did you ever get a chance to invest in the original $25,000 that started Ford on the highway to his present millions? Did you get a chance to invest in the $35,000 that John N. Willys has built up into the tens of millions of the Overland Company? Did you get a chance to get in on Westinghouse, or Bell Telephone, or Western Union, or Welch Allyn’s stock? Of course not. And very few people did because THESE STOCKS WERE NOT OFFERED TO THE PUBLIC when they were at a low price.

THERE’S A REASON

This stock is offered for a reason.

It is offered to the UNDERWRITERS of this company to start it with a nucleus of interested tire buyers and boosters in every locality.

The directors set A MINIMUM OF TEN SHARES AND A MAXIMUM OF 100 SHARES on this offer. It would doubtless be more profitable to the company if every subscription for this stock was for $50 (10 shares), par value $100, because that would mean that the greatest number of people possible would be holding the stock and boosting for the company.

Ten thousand holders of stock scattered throughout the country would mean a veritable army of boosters, helping build up the business in which each one has a solid, substantial interest.

Ten thousand boosters, working to popularize and make known the high quality of National Speedway Red-Wall Tires and National Red Tubes—boosting this way because it is TO THEIR INTEREST to boost this way—would save the company tens of thousands of dollars per annum in advertising expense.

That’s the principal REASON WHY THIS STOCK IS OFFERED TO YOU AND TO EVERYONE WHO BUYS TIRES OR EXPECTS TO BUY TIRES.

It is WORTH IT to the company to make you EVERY IN- DUCEMENT to buy this stock and IT IS CERTAINLY WORTH WHILE TO YOU TO BUY IT. Remember you profit immediately because as soon as you are a stockholder you can save 25 per cent on all the tires you buy.

WAITING FOR A MIRACLE

Every man hopes, some day, that by some wonderful miracle he will be lifted out of the life of drudging toil he leads into one of affluence, comfort and independence. It is our nature to live in this HOPED-But the day of miracles is past. Good fairies do not run around with bags of gold and drop them into the laps of the worthy.

YOU’VE GOT TO HELP YOURSELF TO FORTUNE. You’ve got to save to get a nucleus of money to invest where
the opportunities for profit are large. BUT YOU'VE GOT TO INVEST YOUR SAVINGS, if you want them to pay big returns.

One of the world's greatest bankers has said that NO MAN WILL EVER GET RICH FROM THE SAVINGS OUT OF A SALARY OR WAGES. He must accumulate wealth by putting these savings to work, investing them to advantage.

Of course, it takes COURAGE to invest money that you have worked hard for, that has been slowly and laboriously accumulated by privations and sacrifices. But IT IS THE COURAGEOUS WHO WIN THE EARTH.

DON'T INVEST ALL YOUR SAVINGS. That wouldn't be the wise course. Keep a reserve of your savings for eventualities, for sickness or loss of position or unexpected calls, BUT IN-

VEST PART OF YOUR SAVINGS WHERE THEY CAN EARN YOU SOMETHING WORTH WHILE.

INVEST FUTURE SAVINGS
Or better still. HERE IS A PLAN BY WHICH YOU CAN ACQUIRE THIS STOCK WITHOUT TOUCHING YOUR SAVINGS.

BUY WHAT YOU CAN AFFORD TO PAY FOR OUT OF YOUR NEXT SAVINGS

The directors have made it EASY FOR YOU TO GET THIS STOCK AND PAY FOR IT OUT OF YOUR FUTURE SAVINGS.

You can pay down $10 ON EVERY TEN SHARES OF STOCK YOU WANT AND PAY THE BALANCE IN FOUR EQUAL PAYMENTS OF $10 a MONTH for each 10 shares, making the total of $50 for the ten shares, par value $100.

This liberal plan makes it possible for you to buy this stock and pay for it WITHOUT TOUCHING THAT PRECIOUS CASH RESERVE you have been accumulating in the bank so carefully.

BUT WHATEVER YOU DO, DON'T OVERLOOK THIS OPPORTUNITY. You'll never get another such chance. This first allotment of 20,000 shares at $5 a share (par value $10 a share) will be snapped up so quickly that WE CONFIDENTLY EXPECT EVERY SHARE TO BE TAKEN UP WITHIN TEN DAYS from the publication of this announcement. After that, there will be no more $5 shares. The price will jump perhaps 40 or 50 per cent. SO ACT NOW.

Fill out the convenient coupon attached. Mail it with your first payment, which will RESERVE the stock you want at this LOW PRICE. Then you can take fifteen days to investigate, to make sure that all the facts are just exactly as represented to you. If you, for any reason whatever, are not satisfied, you can release your reservation and your money will be returned to you, but if you find out that you have invested wisely—as we are confident you will find out—then you can either pay the balance in full or you can take advantage of the easy method of paying for it, a little each month. Either plan is equally satisfactory to the directors of the National Rubber Company of New York.

IF YOU WANT ANY OF THIS UNDERWRITERS' STOCK, YOU'VE GOT TO WRITE NOW, at once, OR YOU WILL LOSE YOUR CHANCE.

How You Can Buy This Stock

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APPLICATION FOR UNDERWRITERS' SHARES

NATIONAL RUBBER COMPANY OF N. Y., Pottstown, Pa.
Main Office: National Rubber Bldg., Broad and North Sts.
PHILADELPHIA, PENNA.

The undersigned hereby subscribes for __________ shares of the Common Stock of the National Rubber Company of New York, full paid and non-assessable, and tenders herewith __________ (Bank Check or Money Order) at the rate of $5.00 per share, for initial payment.

STOCKHOLDER'S DISCOUNT—It is understood that in consideration of this subscription as long as I remain a shareholder of record on the books of the Company, I am to receive a New Net Discount of not less than twenty-five Per Cent (25 per cent) from the Company's regular Printed Price List, on any goods listed therein which I may buy for my own use. I am to have 15 days from date in which to investigate all statements made by the Company.

The undersigned hereby certifies that at the time of subscription the undersigned owns __________ shares of the Common Stock of the National Rubber Company of New York or other securities which, in the aggregate, are worth ________ dollars and that the undersigned is in the business of __________.

The undersigned is desirous of purchasing shares of the stock of the National Rubber Company of New York in the aggregate amount of __________ shares. The undersigned states that the undersigned is __________ of __________ years and is __________ years of age.

The undersigned is __________ of __________ years and is __________ years of age. The undersigned hereby subscribes for __________ shares of the Common Stock of the National Rubber Company of New York, full paid and non-assessable, and tenders herewith __________ (Bank Check or Money Order) at the rate of $5.00 per share, for initial payment.

APPLICATION FOR UNDERWRITERS' SHARES

R. S.

Date.

E. E.

Local Address.

(Street Address).
QUESTION BOX.
(Continued from page 130)

former, consisting of a capacity of 10,000 volts. This charges up a pair of Murdock block condensers that will be connected in parallel. The discharge to take place in a meshed loop of wire or spark gap linked to a primary of an inductive oscillation transformer. The secondary to be connected in the usual way to the antenna and ground terminals. What I desire to know is what size of capacity of condenser is required to reduce the wave length of my oscillating system so as to conform to the Government's 200 meter wave length regulation? What formula do you employ in determining this capacity?

A. 1. The required formula is:

\[ C = \frac{\lambda}{4 \pi L} \]

Where \( C \) is the capacity of the series ground condenser for reducing the wave length \( \lambda \) = wave length desired (here it is 200 meters) \( L \) = the capacity of the antenna \( L' \) = Inductance of antenna

Having calculated the values of the capacities of the antenna and \( \lambda \), we then determine the desired capacity by substituting in the above formula and we get:

\[ C = \frac{355 \times 200,000}{4 \pi} \]

Solving, we get .003 micro-farad, the capacity of the condenser necessary to reduce the wave length of the antenna to 200 meters.

ELECTRON DISCHARGE.
(730) Louis Bradenburg, Little Rock, Ark., wants to know:

Q. 1. Does the effect of light upon selenium crystal produce a purely electronic discharge?

A. 2. Dr. J. A. Fleming, the inventor of the Fleming Valve, has built electronic tubes employing an exhausted vessel in which an amalgam of Sodium and Potassium was placed in such a manner that it produced an electronic field when a beam of light was focussed upon its surface and in addition a secondary plate was placed within the focus of the electronic stream. The secondary and sodium-potassium plates were used for the rectifier circuit of the electronic tube. The two most generally used of the metal and alloys for the production of an electronic field are chemically pure, and highly polished rubidium metal and an alloy composed equally of sodium and potassium metals.

TONE CIRCUIT.
(791) Roy Jansen, Houston, Tex., asks:

MEDICINE HAILS ELECTRICITY.

"The day of the healing power of electricity, the medicine of the future," declared Dr. S. Soots Colen in the recent meeting of the Philadelphia County Medical Society, and the science now has a definite, distantly placed in the estimation of the medical profession, and of the public."

"We must confess with shame," said Dr. S. L. Witzke, "that the greatest advantages in the application of electricity to medicine have come thru laymen and not doctors."

Dr. A. R. Hirsch traced the history of electro-therapeutics, and declared that an astonishingly large number of diseases responded to electric treatment.

Q. 1. What does a "tone" circuit consist of and how is it connected to a radio transmission circuit?

A. 1. A tone circuit consists of nothing more than an oscillatory circuit shunted across the gap. This circuit is shown here and it is only used in an impulse exciting transmitter usually. The tone circuit is represented by the oscillatory circuit L.C. A large capacity and a small inductance is used.

Q. 2. Is this circuit tunable? If so, how?

A. 2. The tone circuit is tuned to some multiple or sub-multiple of the impulse frequency. This is usually accomplished by varying the inductance of the condenser capacity. It should be kept in mind that a tone circuit does not improve the tone but is emitted by the transmitter in every type of gap, as it was found by actual experiment that at times it is even detrimental to the tone. They are usually employed on low tension arc or spark transmitters such as the Von Lepel or Chaffee Arc.

MAGNETIC TELEPHONE.
(792) William Olsen, Jamaica, L. I., desires to know:

Q. 1. What is the principle upon which two ordinary telephone receivers when connected together can transmit the human voice from one place to another by talking to the diagram of either of the two receivers?

A. 1. The principle of operation of such a telephone is identical to the production of electric current by a dynamo-electric machine, in that when a magnetic field is permitted to be interrupted by a wire or field, a current of electricity is produced in that wire and the intensity of the generated current is dependent upon the rapidity with which the magnetic field is interrupted and the intensity of the field.

It is identical with the magnetic telephone where the permanent magnet of the receiver furnishes the magnetic field, the core of wire or electromagnet represents the wire, while the interruption of the magnetic field is obtained in this case by the vibration of the magnetic diaphragm. When the diaphragm of the receiver is caused to vibrate by "talking," the magnetic flux is varied; generating a current in the coil which operated the distant receiver.

Arrangement of Tone Circuit in the Von Lepel and Chaffee Arc Radio Transmitter.
Save Dictating Time

USE THE DICTAFORM

If you are at present keeping one or more stenographers busy—you need the Dictafon. It will mean the saving of valuable time in the handling of your correspondence. Surprisingly few letters require special dictation. The Dictafon enables you to build a letter-writing system to fit your own business, and gives you stronger, more forceful letters.

SOME USERS

Carton Pirie & Scott
Bryant & Stratton
Addressograph Co.
Henry Bosch Co.
Wm. J. Wriceley, Jr.
Link Belt Co.
Kunstdr. Bros.
Royal Taylor
Commonwealth Edison Co.

Banish Dictating Bother

The Dictafon places at instant reference paragraphs, phrases and arguments sparkling with your own individuality. You think out your strongest answers to a question, classifying the argument under its proper heading, and put it into the Dictafon. Through continuous use of these rearranged paragraphs and letters you will be able to get out, at a fraction of the former cost, ten times the volume of correspondence possible if each letter was dictated separately.

A Score of Other Features

It makes an ideal tickler—on the back of the first thirty-one cards is our patent clip for the holding of memos, etc. The DICTAFORM also places before you your prices, sizes, weights, descriptions, ideas, campaign schedules, proofs of cuts, cost estimates, time tables, lists, addresses, phone numbers—in fact everything to which you have occasion to refer.

Buy the Size that Fits your Business

With DICTAFORM sizes at $6.00 and $9.00 for small companies—at $12 for the average company—and larger sizes at higher prices for bigger offices—every business is enabled to select the size best adapted to its needs.

MEILICKE CALCULATOR COMPANY

420 Thompson Building

CHICAGO, ILL.

HIGH FREQUENCY PHENOMENA.

(793.) S. Kohn, Brooklyn, N. Y., asks:
Q. 1. Can you explain the following phenomena which I recently observed in certain experiments which I have carried on with a Tesla high frequency coil?
A large primary of a loose coupling was located near the Tesla coil; this was about 3 feet away from the same, and it was not connected to anything. As the Tesla transformer was set in operation, I have noticed streaks of sparks escaping the winding of the isolated coil. If it is possible, I should like you to enlighten me on this phenomenon.

A. 1. The phenomena which you have observed is due to the striking resonance effect existing between the Tesla coil and the primary coil; since the resonance was pronounced, due to the effect noticed, the electrical energy transformation between the produced oscillations of the high frequency coil and that of the isolated coil is at maximum; consequently, the discharge of sparks from the coil was produced. These resonance high tension and frequency experiments were carried out first by Nikola Tesla, and he was able to obtain sparks which reached in magnitude from five to six feet in length.

TRANSFORMER FORMULA.

(794.) L. Kennedy, Los Angeles, Cal., wants to know:
Q. 1. In the design of a radio transformer, what are the most important precautions that must be taken in order to build an efficient transformer?
A. 1. There are a few important steps that the designer must observe in designing a transformer, namely: the voltage transformation between the primary and secondary, the latter should be made to correspond with the proper sending condenser capacity, and this must be obtained beforehand; the proper arrangement of secondary windings, separated with proper insulation, and finally, the magnetic circuit in which goods care must be exercised in designing the same, as 75 per cent. of the efficiency will be in this magnetic circuit. The proper number of cubic inches of core is at first found; this is then split up into suitable form, the legs of which should correspond to the primary and of the secondary windings.

2. What is the relation existing between the primary winding and voltage of a transformer?
A. 2. The relation of the two factors is expressed by the following formula:

\[ N' = \frac{10^3 \times E_p}{\sqrt{2 \times f \times B}} \]

Where

- \( N' \) = Number of turns on primary winding
- \( E_p \) = Voltage across primary
- \( f \) = Frequency
- \( B \) = Magnetic flux of core (per sq. cm. of cross-section of the iron core)
- \( A' \) = Area (express in square centimeters of the cross-section of the iron core)

Q. 3. What do you consider the best insulation material for covering the core when the winding is to be made?
A. 3. Empire cloths are very excellent, this work and it is universally employed for this purpose.

THE "BROWN" TELEPHONE RELAY.

(795.) Frank Vontair, Philadelphia, Pa., desires to know:
Q. 1. Is the "Brown" relay, which is used in England, a microphone device?
A. 1. This type of instrument is a
purely microphonic device and the microphone is controlled by a super-sensitive telephone relay. A more complete detail of this device was published in the August, 1912, issue of this journal.

MERCURY RECTIFIER.

(761) Thomas Pierson, Richmond, Va., wants to know:

Q. 1. What is the efficiency of a mercury arc rectifier?

A. 1. The efficiency of this device varies with circumstances and depends largely upon the load voltage. There is a certain drop in load voltage in the tube usually 15 to 25 volts, which is practically independent of the load and the energy thus represented appears as light and heat. So if a set was delivering current at a potential of 15 to 25 volts, its efficiency under these conditions would be, roughly speaking, about 50 per cent. But this is rarely the case, and in most commercial installations of constant potential sets, the full-load efficiency is 80 per cent and the efficiency of most constant current sets will be over 90 per cent at full load.

Q. 2. What is the life of a mercury rectifier tube?

A. 2. The average life is about 700 hours, but many cases are known where the tube will run much longer.

Q. 3. What is the power-factor of such a rectifying system?

A. 3. On a 50 light set the power-factor on the primary of the constant current transformer is about 65 per cent. On constant potential systems it may reach as high as 90 per cent.

MEASUREMENT OF IRREGULAR AREA.

(797) Paul Ander, New Orleans, La., asks:

Q. 1. What are the principal methods for determining the area of an irregular plane surface such as those obtained from die-cast cards, etc.?

A. 1. There are three general methods for obtaining the area value of irregular plane surfaces and the simplest of the three is by employing a "plasimeter" instrument, a device which automatically figures out the area of the plane in question. Such an instrument consists of a wheel of definite circumference, which revolves when the lever attached to this wheel is caused to trace the perimeter of the irregular surface.

A second method is by forming a large number of small squares within the

Connection of the "Brown" Amplifying Relay in the Circuit of a Radio Receptor.

Q. 2. What is the hind leg connection of this relay? How is it connected to a wireless receiving set?

A. 2. The accompanying diagram gives the connections.

Q. 3. Are these instruments used extensively in this country?

A. 3. They are mostly used abroad, especially in England.


The American boy is always interested in a good book on the experiments of a practical and interesting nature. There have been great many books written in the past few years, intended for the electrically inclined youth of the land, but we do not remember seeing a more worthy volume in a long time than here presented by Mr. Seaver. The volume is profusely illustrated with clear-cut drawings, which can be readily understood by young boys of from ten to fourteen years. The important fundamental magnetic and electrical laws with their accompanying diagrams and reactions have been clearly and interestingly woven thru the experiments described.

A number of excellent half-tone illustrations are inserted, showing modern electrical appliances, so far as the experiments and simply explained laws, he will also be given a clear understanding of the behavior of such experimental apparatus and the commercial instruments and apparatus. Mr. Seaver has in to be congratulated upon the adaptation with which he has combined these two important fields of electrical endeavor. Every reader will not become confused or discouraged by his failure to understand the underlying theory of the apparatus described.

The book describes how to build substantial experimental apparatus such as small dynamos and motors; induction or spark coils; telephone and telegraph apparatus; a complete wireless station of improved design; how to do simple house wiring in accordance with the standard rules; how to wire ignition circuits on gasoline engines of the single and the triple type; how to build small transformers and the principles upon which they operate; how to build primary and storage batteries, lightning discharges and how to protect buildings from them, and also a considerable number of interesting experiments in static electricity. We strongly recommend this book to the American boy.

EXAMPLES IN ALTERNATING CURRENTS. Vol. I. Second Edition. By Prof. F. E. Austin, B.S., E.E. Flexible green leather covers, pocket style; size 7x95 inches; 324 pages, 75 illustrations with numerous tables. Price, $2.40. Published by the

Author at Hainworth, N.H.

The second edition of this valuable treatise on alternating currents contains a number of useful and practical experiments.
THE ELECTRICAL EXPERIMENTER

June, 1917


This work by Prof. Miller treating on the science of musical sounds is one of the most original and interesting science works that we have ever reviewed. A vast array of forms and analyzing apparatus of both simple and complicated structure are described and illustrated. The subject matter is exceedingly clear and can be readily understood by any student of music or physics. The author starts with the demystification of sound, and proceeds to give many illuminating details that the average physics student will find both new and interesting.

Every conceivable form of tuning fork and sire for producing sounds of any pitch or frequency is precisely illustrated and described. The subjects discussed in a popular scientific manner, so that they may be enjoyed by the lay reader as well as the student of pure physics, are the action of the organ pipe, including a scale pipe, and the mode of throwing the air out of the pipe into vibrations.

The subject of harmonics has received special attention, and considerable discussion is given on the different types of harmonic analyzers, including the remarkable machine as used by the U.S. government for predicting the rise and fall of tides. Among other interesting subjects covered in this book, we find oscillogram curves of the voices of such famous singers as Signor Caruso and Amato. Also such an interesting subject as the influence of horns on sound, and the importance of diaphragms in certain instruments. The fundamental principles of musical instruments such as the piano, flute and violin are discussed, and the music produced by them is graphically shown by means of curves. One particularly interesting chapter is that treating on synthetic sounds and music which is illustrated by many remarkable diagrams. A remarkable illustration is that showing the large group of organ pipes necessary, which when put together, make up the organ in "mat," and still another illustration shows the vast number of organ pipes required to reproduce the principal sounds synthetically.

WHEATSTONE BRIDGE CIRCUIT.

(798) John Brown, San Diego, Cal., wishes to know:

QUESTION BOX

(Continued from page 139) boundary of the plane surface, and determining the area of squares, by multiplying the area of each by the total number of them within the surface. This will give an approximate area, since it is impossible to erect squares close enough to the irregular curves of the plane surface.

The third and most accurate method is by means of higher mathematics: where a limiting value of the maximum and minimum peaks of the perimeter of the surface is obtained by rectifying the curve and substituting this value in an integral equation as used in the Calculus. Some engineering school, it is said, in the book by Prof. C. E. Wheatstone, published by the Macmillan Company, New York City, 1916, is illustrated by reverse engineering a Wheatstone Bridge.

How a Reversing Key is Connected in a Wheatstone Bridge.
Q. 1. How are the connections made of a Post Office type of Wheatstone bridge so that the resistance arms are reversed in the circuit? I understand this arrangement is used in eliminating errors in measurements which may be due to polarity interferences acted upon the galvanometer.

A. 1. The diagram herewith gives the proper connections of the instrument you mention. The reason for reversing the connections of resistance arms is to eliminate the errors produced by cross-currents in the circuit. By obtaining two sets of readings for both reversed positions of the arms, such errors are limited to a minimum.

ALUMINUM QUERIES.

(299.) Joseph Hassel, Boston, Mass., asks:

Q. 1. What are the ores used in the production of commercial aluminum?

A. 1. Aluminum oxide is the main source out of which aluminum is extracted. Bauxite, a hydrated oxide of aluminum, is extensively used.

Q. 2. How is the metallic aluminum obtained?

A. 2. The only process used at present for the extraction of aluminum is an electrolysis. The electrolyte consists of a solution of aluminum oxide in molten cryolite. The cryolite is not decomposed, but serves as a solvent only. The mineral Bauxite is reduced to aluminum oxide by the passage of the current; the dissolved aluminum oxide is separated into aluminum and oxygen by the current. The aluminum collects as a molten mass in the bottom of the melting pot, while the oxygen is liberated at the anodes, which are oxidized by it. The weight of the anodes consumed amounts to the weight of the aluminum liberated.

TELEVISION.

(89.) Thomas Jelinder, Hartford, Conn., asks:

Q. 1. Was television ever brought to a practical stage?

A. No.

Q. 2. What method did Mr. Ernest Ruhmer of Berlin use for his television apparatus?

A. He employed a large number of selenium cells placed before a similar number of lenses. Each of these cells corresponded to a "single eye," similar to the human eye, and the reflection of light from the object, the image of which was to be transmitted, was caused to fall upon the various selenium cells. These cells were connected to a corresponding number of electro-magnets which controlled a number of deflectors. These deflections were set in operation in unison with their proper selenium cells at the transmitting station. A rectangular image was possible with this arrangement. It was used to transmit letters, as it was imperfect enough to be used to differentiate the actual colors of a photograph or image of a human countenance. A number of suggestions have been made to develop a television scheme, but the inventors only went as far as making suggestions, but never went into the trouble of bringing out their ideas experimentally.

TRANSPACIFIC RADIO COMMUNICATION SUSPENDED

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CHANCES FOR ELECTRICIANS IN THE NAVY
(Continued from page 86)

reciprocating steam engines, steam turbines, internal-combustion engines, magnetism and electricity, dynamos, motors, motor-generators, alternating currents, interior communication, lighting, batteries, etc. Members of the radio class are trained in all the duties of a radio operator and are given constant practice in the use of all the apparatus employed in radio and especially in receiving and sending by the systems employed in the Navy.

Enlistments in the Navy are for a period of four years. A man will not be advanced to chief electrician (with rank of 'chief petty officer) during his first enlistment, but he may be recommended for that position towards the completion of his first enlistment, with a view to advancement upon re-enlistment if any vacancy exists.

NEW METHOD OF MEASURING PRESSURE OF LIGHT
(Continued from page 102)

The 32 c.p. lamp was enclosed in a metal box whose front face had been replaced by a glass screen covered with a very thin wire. Inasmuch as it is required that the radiation should be normally incident, the lamp was not brought too close to the tube, but instead was placed a little in the middle of the tube and the current passing thru the lamp was maintained at the same value throughout all the experiments. The reflecting and transmitting powers of the foils used were then tested. Gold and aluminum reflected 90 per cent of incident radiation.

Calculation of the Deflection of the Strip.
—Since the foil reflects 90 per cent of the incident radiation, and since 7 per cent is reflected from the glass of the tube, the total pressure of the radiation is given by

\[ I(1+0.07x0.9)(1+0.9) \]

where \( I \) is the energy density of the incident beam.

A certain amount of radiation, however, strikes the back of the glass tube, and some of this is reflected to the back of the strip. For a strip three-quarters the width of the tube it is estimated that the normal component of this radiation is about 1 per cent of that which is incident on the strip. It is, therefore, necessary to substitute 2.02E for 2.0E.

It can be shown that a uniform flexible strip when deflected by a small uniform pressure still remains straight. To a close degree of approximation, therefore, we may use the following formula for the deflection of a strip of uniform thickness.

\[ \text{Deflection} = \frac{4El}{3bh^3} \]

where \( E \) is the modulus of elasticity of the material, \( l \) is the length of the strip, \( b \) is the breadth, and \( h \) is the thickness.

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DENVER WIRELESS STATION WINS PRIZE LOVING CUP. (Continued from page 107) the good times they used to have while working on all the relays which we have run for their benefit. Next month we will start by giving some special attention to Washington's Birthday Relay, and also give the first installment of a complete set of instructions about how to make a Half Wireless Relay, as this information was shown in this magazine some time ago, under the list of patrons issued; and as the writer has received a great many letters from wiresmen concerning it, we believe that you will all be interested in reading about this instrument, which is very simple in construction, and which all of you may make, with just such tools and material as is always at hand in a radio laboratory.

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C. Linsweiler, 8 LJ, Dayton
(No Name), 8 ATG, Tin-foil
C. Candler, 8 NH, St. Mary's
J. Hargem, 8 ML, Cincinnati
Scott High School, 8 J, Toledo
Mr. Sager, 8 SW, Tin-foil
V. Thomas, 8 FX, Marietta
M. M. With, 8 AEE, Lima
J. F. Buck, 8 PL, Cincinnati
J. O. Hiltz, 113, Ottawa
L. M. Clausing, 8 YL, Lima

OKLAHOMA

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W. S. Shoop, 8 AEG, Undergriff
F. J. Anderson, 3 QD, Reading
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C. H. Stewart, 3 JS, St. Davin's
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R. C. Clement, 8 JTT, Washington
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M. V. Polly, Jr., 1 EM, Bristol
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The Electrical Experimenter

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a clear glass jar. A (See diagram.) into the bottom of this jar some bitumen is poured while in a hot condition. This serves to fix the porcelain base, B, in position. This base forms the support for the sack, C, keeping it in a central position, and also a support and spacer for the zinc cylinder, D, keeping always the correct distance from the sack. It is this narrow space between the zinc and the sack which, to a large extent, makes the internal resistance of these cells so much less than Lechac'hé batteries. The top of the sack has a rubber ring, E, round it in order to further safeguard the cylinder touching the sack. Above the sack a specially shaped porcelain ring, F, is slit over the carbon rod, G, and this serves as a support for a wax cardboard disk, H, which supports the sealing compound. Two holes are arranged in the sealing compound and the cardboard washer; in one of these is a fiber tube. This tube forms the funnel thru which the water is poured when the cell is required for use, and is normally sealed with a cork. The other hole contains a small glass tube to allow the gases generated when the cell is in action to escape. A lead connection strip, I, is soldered to the zinc cylinder, and this is brought up at the side of the cardboard washer and thru the sealing compound. This lead strip is provided with a punched hole to allow of connection to an adjacent battery. A brass cap, K, is forced on to the carbon rod, and the nut for wire connections screws on to a pin riveted and soldered to the cap. The ammonium chloride crystals, L, are placed in the cell at the time of manufacture; so that all that is necessary to make the cell ready for use is to remove the cork, fill the cell with water, and replace the cork.

POWERFUL HYDRO-ELECTRIC SALVAGE APPARATUS TO RAISE SUNKEN SHIPS.
(Continued from page 95)
may have gone ashore in shoal waters. Supposing that a vessel has become embittered in the sand. Upon arriving at the scene with one of the Linquist hydrostatic lifting units of the type already described, this is set up in the deep water at a considerable distance, say one thousand to 1300 feet from the vessel in distress, and a heavy cable is attached to the oceanbed side of the vessel. In certain cases, and when necessary a line may be shot over the vessel to carry out this part of the operation. The cable, which is secured to the stranded vessel is carried from the Linquist apparatus, and passes thru two large pulleys secured to a stationary truss on the base of the "fort" and in proximity to the vertical member of the lifting apparatus. The free end of the cable is secured to the top of the telescopic movable cylinder of the Linquist device, and this is made to rise by becoming more buoyant thru the agency of the electric pumps (supplied with electric power from the lines on shore), water being pumped out of the movable telescopic cylinder causing it to rise, and when this occurs a force of thousands of tons is brought into play, giving sufficient upward pull on the cable passing thru the stationary pulleys to haul the vessel off the shoal.

The inventor of this truly remarkable scheme for raising sunken boats, etc., says that if his device had been available at the time the U. S. Submarine F-1 sunk in the Honolulu harbor some time ago, that he could have raised the submarine in four days instead of taking four months, which was the time required by the only method available, when this deplorable accident
and air will eliminate all carbon deposits, and in so doing will add to the life and power of any motor, and that is not all, for we now have in our gas from water, which nature has provided abundantly, and so easy to secure that the cost is practically nothing.

Those interested in this electrolytic generator used for a substitute for gasoline in driving automobiles will undoubtedly find interesting a U. S. patent on a similar cell, concerning the number 1,209,660, which is disent the "Latest Patents" department on page 128 of this issue.

**DECISION IN THE "HETERO-DYNE" RADIO RECEIVER CASE.**

On April 2 Judge Mayer, of the United States District Court for the Southern District of New York, handed down an opinion in the suit of Samuel M. Kintner and Halsey M. Barrett, receivers of the National Electric Signaling Company, plaintiff, vs. the Atlantic Communication Company, August Merekens, P. C. Schnitzler and K. G. Frank, defendants, in which he found for the plaintiffs. This suit was based upon a charge of infringement of United States letter patent 1,050,728 and 1,050,441, being respectively for the method and apparatus employed in a receiving station of a radio telegraph system. These patents, issued January 14, 1913, cover the invention known to the art as generally the "heterodyne" or beats method of receiving radio telegraph signals.

The court found that Reginald A. Fessenden, the inventor of this system, had produced a machine of great merit and entitled to a broad interpretation. He found that the prior art cited by the defendant as anticipating the Fessenden invention did not teach the art anything in respect to the use of beats and, at most, merely disclosed a local source for operating some particular form of receiver. He decided against the defendants' contention that the invention should be given a narrow construction, in view of an earlier patent of Fessenden.

The defendants' sole effort was directed towards securing a narrow construction of the patent. The court held that the Fessenden patents were not entitled to a broad interpretation but should be restricted to the use of the particular form of apparatus shown in the issued patents. The court decided against this, holding the invention to be of such merit as to entitle it to a broad interpretation of equivalents.

The court also stated that Fessenden or his company, the National Electric Signaling Company, were the only ones to teach the art anything of value in this method of operation between the date of application of his original patent in 1902 and the date of applications for the patents in suit, 1905.

To overcome the difficulties of navigation in the Kara Sea the Russian Government has established three wireless stations that inform vessels of ice conditions.

**A COMPACT FARM LIGHTING PLANT.**

The farm lighting plant illustrated is rated at 1,000 volts and operates at 30 volts. In most cases a 2, 3/5 or at most a 4-h.p. engine is required to run this system. The generator has a heavy fly-wheel pulley with tapered shaft.

A feature of this equipment is that regardless of variation in the number of lights being used, the generator will automatically furnish the current necessary for these lights, in addition to that which it has already been furnishing for charging the battery, thus allowing the battery to receive its normal charging rate automatically, regardless of the number of lights being turned on or off. An additional feature is that the governing winding is incorporated in the design which prevents the variation in the lighting load from affecting the amount of current going into the battery. Lights may be used at all time either directly from the generator, if the engine is running, or direct from the battery, if the engine is not running.

The manufacturer also claims that by using this self-regulating winding for starting, the engine, regardless of its type, can be started without abnormal strain on the battery plates. This condition applies specifically to engines of 8 h.p. or less. Twice the starting torque with one-half the current is said to be produced by means of this winding. In a test recently made, this unit, with an 80 amperes current, easily started a 4-h.p. special electric engine. The engine was turned over and after the ammeter reading 140 amperes, the engine permitted the lights to burn practically the same brilliance at all times. If the lights are being used direct from the generator and should the engine stop, the electrical connections will be broken automatically so that the lights will then receive their energy from the storage battery. The switchboard is equipped with large scale instruments, an automatic reverse current circuit breaker and only one lighting switch. All internal connections are made at the factory. The battery will with this plant are made in both the Faure and Planté types, assembled in either rubber or glass jars.

**Mesco Wireless Practice Set for Learning the Wireless Code.**

The practice set comprises a regular telegraph key, without circuit breaker, a special back pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk-covered flexible cord. The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes, as illustrated on page 24.

For the beginner, the set is of exceptional value, for it may be used either as a practice or for operation of a two party line, which is an excellent method of learning the code. After the beginner has mastered the code, the set may be used in his wireless outfit for setting the detector in adjustment, and then the key may be used to control the spark coil.

Recommended for schools, as it gives excellent service for class instruction in code work. Full directions with each set.

The main object of the set is to enable the beginner to master the wireless code, and the buzzer reproduces the sound of the signals of the most modern wireless stations perfectly.

Every beginner needs one of these sets, and as it is the equivalent of five different sets, the price is very low. List No. 342. Wireless Practice Set, with Battery and Cord 3.25

List No. 344. Wireless Practice Set only, no battery or cord 2.00

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SHIPS WHICH THE RADIO SAVED.

The U.S. Government cites the following marine disasters in which wireless figured during the period July 1 to December 31, 1916:

July 11.—Steamship Ramos founded in a gale off Philadelphia while en route from Cartagena, Colombia. SOS calls were answered by the Miami land station and the steamships Van Hagenor and Illinois, all but five persons on board being saved.

July 22.—Steamship Astoria, stranded on rocks seven miles south of St. Mary's Light, Cape Race, was towed to shore and passengers and crew were removed. The distress call was answered by the steamship Stephen's, Red Cross Line, which stood by until passengers were safely removed.

September 15.—Steamship Congress, with 45 persons on board, caught fire off Coos Bay, Marshfield, Ore. The vessel was headed toward shore. SOS calls being sent out continuously, which were received by the steamship Massfield; Oreg. Cape Blanco, Oreg. and Eureka, Cal., and the steamship F. A. Kilburn. Rescue vessels were dispatched by the Marshfield station, and all persons on board were saved.

September 23.—Steamship Bay State ran ashore off Cape Elizabeth, Me.; total loss. Distress call was answered by the Coast Guard cutter Osprey and the naval station at Cape Elizabeth, which dispatched the tugs Portland and Cumberland. All persons on board, approximately 200 in number, were saved.

October 7.—Steamship Antilla, with sixty-six persons aboard, caught fire off the Virgin Islands while en route from Guantánamo, Cuba, to New York. Approximately twenty-five vessels responded to the distress call, and all persons were saved.

October 19.—Steamship Arola has lost her rudder twenty-five miles north of Cape Lookout. SOS calls were answered by the steamship Henry R. Manley, and the Coast Guard cutters Seminole and Tampa, which towed the vessel to Norfolk.

October 28.—Steamship Chicago, with 265 passengers and crew, caught fire at sea and arrived safely off the Azores Islands. Communication was established with vessels, but assistance was not needed.

October 29.—Tug I. B. Jones disabled 150 miles off Cape Hatteras. SOS call answered by the steamship Ryndam, which towed the tug to Queenstown.

November 25.—Steamship Potomac, en route from Paracel to New York, caught fire off Block Island. Fire was controlled before arrival of Coast Guard cutters, which answered the distress call.

November 27.—Steamship Niels Nielsen lost propeller in heavy gale. Distress calls were answered by several vessels, which assisted the vessel.

November 28.—Steamship Caronuda lost propeller off Tillamook Head. Distress calls answered by Astoria, Oreg. station, which dispatched a tug to assistance of disabled vessel.

December 3.—Steamship Carolina, Goodrich Transit Co., struck rocks off entrance to Sturton Bar Canal. SOS calls were received by the Manitowoc, Wis. station, which dispatched a tug to the assistance of the disabled vessel.

December 7.—Steamship Summer grounded in fog off Barnegat, N.J. Six vessels responded to SOS calls, and all persons on board being saved.

December 14.—Steamship Powhatan, en route from Norfolk to Boston, sank in collision with unknown vessel on way to open sea. Several United States destroyers, Coast Guard cutters, and steamship James

DO YOU?

By Albert W. Wilson.

RECENTLY I bought a copy of the ELECTRICAL EXPERIMENTER and I read it through DURING THE time.

THAT I HAD to spare EVERY day that I could.

EVERY time in the WHOLE three months ELECTRICAL magazines which I thought CONTAINED news THAT would help the READER in his work, I always found CERTAIN articles that were ALWAYS vague and which LEFT me in the dark.

EVER thinking that EXPERIMENTERS like myself PURCHASE magazines EACH month for the purpose of READING articles THEREFORE I bought, MANY new wrinkles, EACH new, and NOVEL, are to be found. TWAS for this reason that EVERY month I now READ the ELECTRICAL EXPERIMENTER.

THEREFORE BE IT ENACTED by all experimenters and the general public, that every Experimenter who has read the ELECTRICAL EXPERIMENTER do so at once, without delay.

THE PENALTY for failure to do so is a fine of 15 or 20 cents, which is paid for other magazines, as well as the loss of articles which cannot be found or obtained elsewhere.

Apologies to “Casey Bee.”

town answered SOS calls. Crew transferred to Coast Guard vessels and passengers were taken to New York on the steamship New Commodore.

December 25.—Steamship Maryland sank at sea, position as given in SOS call 380 miles east of Sandy Hook, with crew of thirty-four. Distress calls answered by several Coast Guard cutters, but they were unable to locate the disabled vessel.

750,000 HORSEPOWER WASTED IN NEW YORK.

Electric power sufficient to turn every wheel and illuminate every dwelling and factory in New York State could be developed from the water power which is running to waste every day in the rivers, streams and canals of the State. Attorney General Woodworth made an annual report submitted to the State Legislature. He estimates a daily waste of 750,000 electric horsepower on the Long Sault Rapids and along the line of the barge canal. He urges the Legislature to establish a policy by which the State will reap some benefit from this stupendous resource, the value of which has been estimated by conservation experts at $250,000,000. Attorney General Woodworth points out that the Long Sault Rapids in the St. Lawrence River, control of which was recently regained by his office after a fight which was carried to the United States Supreme Court, could harmonize with over 700,000 electric horsepower, while the dams and other structures along the course of the barge canal impound an excess of water over navigation requirements sufficient to generate 50,000 horsepower.

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June, 1917

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be mounted at any position.

CERTAIN articles that were ALWAYS vague and which LEFT me in the dark.

EVER thinking that EXPERIMENTERS like myself PURCHASE magazines EACH month for the purpose of READING articles THEREFORE I bought, MANY new wrinkles, EACH new, and NOVEL, are to be found. TWAS for this reason that EVERY month I now READ the ELECTRICAL EXPERIMENTER.

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SPRAGUE DEFENDS ELECTRIC DRIVE FOR CRUISERS.

After consultation with Secretary of the Navy Curtis, Frank J. Sprague, Chairman of the Naval Consulting Board Committee on Electricity and Ship Construction, has come out strongly against the criticism of electrical drive for the new battle cruisers.

In a letter to Senator Swanson, Chairman of the Senate Committee on Naval Affairs, Mr. Sprague says he has been reluctant hitherto to join in public discussion of the decision of the Navy Department to adopt electric drive.

"I feel that perhaps I am now justified in so doing," he adds, "in view of the fact that such discussion, which I assumed was begun from patriotic motives, seems to be taking on the nature of an active commercial propaganda, incidentally supported by a number of gentlemen, most of whom, however representative and endowed with experience along the lines of their individual professions, are utterly untrained in naval affairs, and hence are not possessed of sufficient knowledge of this particular subject to indulge in the avalanche of criticisms which have been leveled at the department."

Referring to what he describes as "the successful installation of the electric drive on a comparatively small scale on the collier Jupiter and the adoption of similar power for three battle cruisers," Mr. Sprague reminds Chairman Swanson that the Navy Department, reinforced in their opinion by what had been done in electrical development in great power plants, decided upon electric drive also for the battle cruisers, each of which is to be equipped with engines of the large total of 180,000 horsepowers.

"The wisdom of this decision," Mr. Sprague continues, "was challenged by Charles Curtis of the International Curtis Marine Turbine Company, which company would, if geared turbines were adopted instead of the electric drive, be a beneficiary by a large amount of royalties. It is, of course, difficult for any engaged in a commercial enterprise which may be seriously affected to be, even if unconsciously so, unaffected in his judgment by personal interests, but I prefer to believe that Mr. Curtis was actuated by a desire that our cruisers should be the best afloat, even if I disagree somewhat with his methods and conclusions."

"Failing to get a reconsideration of the Navy Department's decision, a number of prominent engineers have been requested to write, and several have written, letters based on certain adverse information supplied them, some condemning without reserve the decision of the department and others urging that the matter be referred to the Naval Consulting Board or some other board of civilian engineers.

"Among those other than Mr. Curtis, who have been quoted as authorities are Dr. S. S. Wheeler, President of the Crocker-Wheeler Company, manufacturers of electrical machinery, who has been voluntary in his criticisms; Dr. Francis Crocker, an associate of Dr. Wheeler; George Gibbs, Consulting Engineer of the Pennsylvania Railroad; Dr. Michael Pupin, a distinguished scientist and inventor of a system for increasing the efficiency of the long-distance telephone; Isham Randolph, a well-known electrical engineer; Prof. William II. Burr, a widely-known consulting engineer; President Falk of the Allis-Chalmers Company, etc."
manufacturers of electrical machinery; Luther Lovekin, Chief Engineer of the New York Shipbuilding Company, and Calvin Vonkin, Former Dock Commissioner of New York.

Observing that this list "contains many names not only of men of prominence but of men standing high in their professions," Mr. Sprague says: "But the question may properly be asked to what extent are these gentlemen qualified to criticize, what is the training and experience which would warrant them to sit as judges in so vital a matter, and what is it they really seek to accomplish."

"The discussion," Mr. Sprague continues, "seems first to seek to condemn the adoption of electricity on the score of increased weight and cost, or impossibility of construction, or safety in operation, and second, a reference of the whole matter to the Naval Consulting or some other board.

A PRESENT-DAY ELECTRIC GIANT

While we may not have the human giants of old with us, their places are admirably filled by the gigantic mechanical and electrical apparatus that modern genius has evolved, as for instance, the device shown in the accompanying illustration. This picture shows the largest self-control induction, feeder voltage regulator that has ever been built. The regulator is of the oil-immersed, self-cooling type, and was built by a Pittsburgh concern. It is rated at 600 kva. (kilowatts) 3-phase, 60 cycles, 13,200 volts, with 10 and 20 per cent regulation at 202 and 131 amperes. It is designed for operation outdoors with full-automatic control self-contained.

This regulator was built for the Southern Power Company and is to be connected to the low voltage side of a 6000 kva. (kilowatt) bank of 44,000 to 13,000 volt transformers on the power company's line at Spray, N. C. By the use of this regulator the power from the line will be delivered to the Thread Mill Company mills owned by the Marshall-Field's interests, with the voltage maintained continuously at normal value.

"It is inconceivable," says Mr. Sprague, "that with all the known facts in hand the Navy department would or could surrender to outside advisers, directly or even inferentially, the selection, design and accepted methods of drive, with their varying influence upon the distribution of weight, cost, position of parts and armor, size and disposition of compartments and the results of flooding, the distribution of fuel, the distances of machinery from the skin of the ship, provision against fire and explosion, the necessities of handling ships in emergencies and the results of failure of any part."

Mr. Sprague declares that generators and motors of the size indicated can be built, and that if necessary they can be controlled by a push button from the bridge.

"I am," he says, "generally credited with being the pioneer of the modern electric railway and am certainly the creator of that system of train control, now used the world over, which makes it possible to aggregate any amount of power required under a single control."

One reason why Mr. Sprague was selected for the Naval Consulting Board was that he had served as President of four technical societies—the American Institute of Electrical Engineers, the American Institute of Consulting Engineers, the New York Electrical Society and the Inventors' Guild.

JOHN J. CARY, TELEPHONE ENGINEER, NOW MAJOR CARY.

Mr. J. J. Carty, chief engineer of the American Telephone and Telegraph Company, New York City, and recognized as one of the foremost authorities in the world on wire communication, has been commissioned second lieutenant, Army Officers' Reserve Corps, the reserve auxiliary of the Signal Corps, U. S. A. The addition of Mr. Carty to that organization will be a decided accession and one which will be widely applauded. It is believed other appointments will follow from the ranks of leading American engineers. The importance of the telephone system in any plan of national defense has been accepted by officials of the War Department.

The adaptability of the American telephone lines was thoroly proven last summer when the entire A. T. & T. Company service was put in and the Government for a test under hypothetical war conditions. In 45 seconds Secretary Daniels was in conversation with the President, Fla., N. Y., and 45 seconds more was talking with the navy yard at San Diego. The Secretary of the Navy later expressed his pleasure over the "wonderful success" of the experiment. When the country's National Guard was mobilized last summer a complete telephone exchange was established at Camp Whiteman, in New York State, in less than 24 hours after the troops were called out, connecting Washington with Y. M. C. A. and all the vital points necessary to the movement. The commissioning of Mr. Carty as an officer in the Reserve Corps may be taken as a further step to have this important branch of the country's defensive system ready, not only in material, but in personnel.

"E. E." WAR NEWS!!!

DON'T THINK, NOW THAT WE ARE AT WAR, THAT YOU CAN DO WITHOUT THE MONTHLY VISIT OF THE ELECTRICAL EXPERIMENTER. KEEP UP TO DATE IN ELECTRICITY BY READING IT "EVERY" MONTH.
BELL SOFTENER.

(152) E. T. Jones, New Orleans, La., writes as follows:

"I, a subscriber to your wonderful magazine, would greatly appreciate your opinion on the following 'phone-attachment, printing same in your Patent Advice department in one of the following issues this year, as soon as possible.

"After reading over your article on patents wanted, I devised a scheme by which any tourn desired can be had instead of using bells. I have drilled and tapped the armature knob of the ringer and screwed thereon a certain ring on a prolonging stand. I have a mandolin string, which is adjustable (any note can be had); when the phone (rings) the device passes over the string which has been secured to a dial, soft-pitch tune which is audible three rooms away.

"I would appreciate your opinion on the above arrangement, and I highly recommend more suggestions on your part in a magazine which I and a million or so others cannot do without, as it is the only live one out to-day. I read it from cover to the last page and find old copies interesting even after they have been fully read.

Ans. The idea, while a very good one, does not seem very practical for the reason that it would take up too much room. If an arrangement were obtained whereby the long string could be done away with, we think a more practical arrangement would be had, but we believe a patent can be obtained on the idea.

INVISIBLE PERISCOPE.

(153) Jose L. Moreira, Lowell, Mass., submits a design for a glass periscope, his idea being to make it invisible.

Ans. While this is a good idea on paper it does not work out in practice for two reasons, one of which is that glass is too dangerous a substance to be used for a periscope which has to stand enormous strains due to rushing thru the water as it speeds on. Furthermore a periscope sticking out of the water can never be invisible, that is, while the periscope itself may not be seen at a distance, it forms a white spot as it runs in the water, which is very noticeable. It is not the periscope itself that the enemy will see, but the water trail which the periscope leaves behind. As long as nothing is found to do away with this white spot, it is useless to make the periscope itself invisible.

AUTOMATIC TUBE CLOSER.

(154) James D. Miller, Montreal, Que., Canada, submits to us several drawings of collapsible tubes such as are used with tooth-paste and shaving creams, the idea being to do away with the annoyance of unscrewing and screwing on the cap which so often exasperates us.

Ans. The drawings submitted to us of the device are very ingenious indeed and hold out a possibility of a good invention. We, however, would advise our correspondent to simplify the idea, as at present it seems too complicated, having too many parts. We would also advise our correspondent to submit the idea to a patent attorney with a view to obtaining copies of prior patents on this particular class of work.

INTERRUPTER.

(155) Geo. Shaw, Talmage, Neb., has conceived an idea for the improvement of interrupters for small wireless sets and other outfits requiring the use of a small transformer or spark coil. The idea is to use a certain form of interrupter in an air-tight chamber, under sufficient air pressure to prevent the burning of the contacts. He thinks that a small hand air pump could be secured to the chamber to pump up such pressure. Is the idea good one and is it patentable, and would there be a demand for it?

Ans. A scheme of this sort is decidedly not satisfactory because it has been shown that compreset air will retard an ordinary vibrator spring or, for that matter, any moving part which is supposed to operate under high speed. If instead of using compreset air you use a vacuum, enormously better results are obtained, as, for instance, in the Morse ElectrontInterrupter. Personally, we have no faith in compreset air interrupters, as we have never seen one work satisfactorily.

ELECTRIC CIGAR MOISTENER.

(156) Charles Bicker, Salina, Kan., says that he has an idea in the construction of a device to moisten cigars and tobacco in show cases. The idea is to make steam by heat developed from storage batteries, and to evaporize the steam in a certain manner.

Ans. While a patent might be obtained on a scheme of this kind, we do not know how valuable it will be without knowing full details. There are some very good and cheap electric tobacco moisteners on the market which are very useful, but we believe a patent can be obtained on the idea.
the market to-day and we have one in mind which seems to have the greatest sale, whereby an electric incandescent lamp is placed in a basin filled with water, which, owing to the heat of the lamp, is made to evaporate.

AMPLIFICATION TRANSFORMER.

(157) A. J. Camille, New York, N.Y., sends in a sketch and description of a transformer which is supposed to amplify alternating current, or more or less without any other means. He proposes in a sketch and description, that it will transform 110 volts 2 amperes into a current of 110 volts and 1 ampere. Ans. No matter what scheme of this kind may consist of, it is absolutely impossible, to do anything for nothing and you might just as well try to lift yourself by your own boot straps. It simply cannot be done.

PATENT ATTORNEYS.

(158) Edmund von Szpunpin, Paterson, N.J., writes as follows: "Wishing to obtain my patents, who services Edison, Maxim, or Lewis obtained their patents. I sent for the literature of a good many patent attorneys. "Many Laws with their considerable number of names and addresses of their clients who, however, are almost all unknown to the world at large. Matter how I tried, I failed to find the names of Tesla, Hammond, etc., in any one of their lists."

"This makes the impression upon me that inventors of this magnitude do not care to intrust their inventions to the advertising patent attorneys. "Will you kindly inform me what means or what agencies this—say Edison or Tesla—uses when wishing to patent one of their inventions?"

Ans. The answer is a simple one indeed. "We have good reasons to believe that several of the greatest inventors of this country patronize the advertising patent attorneys, but they usually restrict advertisements from their name for obvious reasons. As to whether it is natural to their interest not to disclose who does their work for them. Personally, we think you will get cheaper and better service from an advertising patent attorney than from those who do not advertise. For the simple reason, that the former do a larger business and can therefore charge cheaper. The quality of a patent obtained certainly does not make a lot of difference whether it is turned out by an advertising attorney or by one that does not advertise."

"The editor, who is the owner of some eighteen patents, might state that nearly all of these were obtained from advertising patent attorneys."

TOY ELECTRIC HAMMER.

(159) R. DeWitt Dufield, Van Wert, Ohio, has submitted the idea of a toy electric hammer and wants to know if such an article is on the market already and if it is there patentable. Ans. This indeed is a very excellent idea and one of the best schemes for a cheap electric toy that we have seen lately. While there are many early new in the principle, we are certain that a patent may be obtained on the construction of same. Our correspondent also submits us a sketch of an electrolytic interrupter on which he desires our advice. Ans. F. E. Edelman, 250 East 13th St., New York, has submitted his ideas in writing for Private Laboratory, etc. Circular Free.

S C I E N T I F I C S T U N T S G A L O R E

(Continued from page 101) forming the circle which surrounded the erect and alert chief, his pale face drawn and anxious as he eyed the watch he held in one hand. "Do you think they'll stand it?" he asked in haggard, worried tones.

"I reckon there is much load on," Pete Foley assured him.

It was just a minute before twelve. The guitarist cleared his voice, presently, and in his steady hum, filling the whole building with a vibrant, steady hum.

Five seconds past—ten—twenty—the great gray silent voltaic hammer set itself. Mr. Robertson, as he squared himself in front of the main control panel, Twenty-five seconds past twelve. Mr. Robertson reached for the push-button in the center of the panel marked, "Main Switch." His hand rested on the metal disc for a moment and then as the watch held in his left hand marked five seconds before twelve, he pressed the button.

There was a purr of mechanism behind the marble panel as the big man switched into place. The generators dipt a note or two in their hum, and then the hammer came thrum on their turbines. The group watched the voltmeter on the panel attentively, and sure enough, it did not waver. Mr. Robertson heaved a great sigh of relief and satisfaction.

"It works! It works!" he shouted, in sudden released exuberance. "They've got their power and we've got our franchise." A white-linned, diamond-pinned director reached for the chief who, he seemed to say, "Do not congratulate me," Mr. Robertson hastened to forestall him. "We're saved because some one thought of a very simple expedient. Here, I'll show you.

He stepped to a panel at his right, followed by the interested group. He paused before the dial, glistening in bright metal. From its connections two wires led down to a coil of wire on the floor. "This coil," he said, indicating it, "is a resistance coil. It is connected in series with the field windings of the exciter. In this way the voltage of the exciter has been lowered, thereby reducing the strength of the hammer's power when the side rods are hit."

"For that," the chief remarked, "we are to thank Mr. Edelman of San Francisco for his advice." Pete Foley interrupted, as Mr. Robertson turned to him. "Here's the boy you want to thank. He saved your plant and not by chance. He finished forward Joe Benson from the shelter of the post where he had been standing. The chief turned to the youth and asked me to tell you. So just give him the thanks and the reward." Pete went on, evening in triumph the astonished faces of the group about him.

"It wasn't much. Any electrical man could have thought of it," Pete said modestly. "I suggested having the group. "And anyhow I couldn't have done it, if Pete hadn't showed me things so well the day I was here looking around."

"Yes, that was the way," Pete said, with a significant glance toward Mr. Robertson.

But the chief had recovered from his surprise and had stepped forward to the blind

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and European countries. Stations in Germany
and all important Government stations are
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and materials. It is designed for use on
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The windings are of silk covered wire, sup-
plied wound on substantial malleable iron
tubes. The primary tube is 2 in. x 13 in.
The secondary tube is 7 in. x 12 in. The in-
stallation of the winding is varied by switch,
all windings being interlabeled. The primary
is varied in steps of two turns each and the sec-
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every close tuning.
The accuracy of vertical mounting are
evident and inspection of the cut will
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June, 1917

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Hand-Skeeter 40. Tandem 44. New Bicycles at Factory Prices.

JOE'S EXPERIMENT.
(Continued from page 150)

boy, before the circle of directors could close in on him.

"Shake," he cried, gripping his hand.

"Any boy who can think of a thing like that deserves a chance to learn more, whether he can see or not. So if the company doesn't out of gratitude, I'll see to it myself that you go to the best technical school in the country.

ELECTRICITY AND LIFE.
(Continued from page 105)

mest reliable. Best dealers. Catalog conveniently, it is not, can be

DUPLEX COASTER BRAKE
There can be no improvement on this brake. It is powerful, it is durable, it is simple, it is reliable.

With a Corbin Duplex on your hub you are in a position to handle quickly and conveniently any situation that might arise upon road or street. Elbow turns, dizzy hills and traffic loaded thermopolis presents not the slightest difficulty. It gives you complete mastery over your bicycle, a freedom and control that doubles the pleasures and possibilities of riding. It has no equal.

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ELECTRICITY AND LIFE.
(Continued from page 105)

culois and other pulmonary troubles often yield to the "efficue" treatment.

3. Perhaps the most remarkable therapeutic effect of heavy high-frequency currents is their power to liberate heat in the tissues of the body. For this purpose the so-called "D'Arsonval current" is used. This is a secondary current of high amperage derived from the heavy coil of copper strip shown in Fig. 6. The lower terminal of this coil is connected with the condenser and the patient is seated; the tubular metal electrode is held in both hands and connected thru a Milliamperemeter to the lower turns of the coil. The clip is moved to different turns as in wireless tuning, until the meter shows the highest reading for a given amount of exciting current. The patient's circuit is in this way tuned in perfect resonance with the primary oscillations. After a few moments the patient feels his body hot, the heat rapidly extending up the arms and into the body until profuse perspiration is produced. Ordinarily we do not carry the treatment as far as to the safe dose for an average patient being not over 700 milliamperes for twenty minutes. This is "D'Arsonval Autocondensation" and is applied with great benefit to patients suffering with Arteriosclerosis ("hardening of the arteries"), and in a variety of other diseased conditions involving malnutrition.

4. In diseases in which we wish to induce a regenerative inflammation, promote circulation and absorption, and increase cell activity, the so-called "Diathermie" is employed. Instead of the hand electrode and condenser-pad the D'Arsonval current is applied thru two small sheets of block in about 2 x 4 inches, and are applied to the skin either side of the affected part and a current employed which gives the patient a decided sensation of penetrating heat. Average treatments use from 1000 to 1600 milliamperes. In treating consumption (pulmonary tuberculosis) the electrode is placed on the back and the other on the chest over the affected lung. One Tuberculosis Hospital in which this treatment was given daily to a number of patients reported 85 per cent of cures! The author is working on an apparatus which will make possible the use of Diathermic treatment in the homes of patients suffering from this disease.

For office use and for the Electro-medical specialist ("Electrotherapeutist") the writer has recently designed an apparatus from which remarkable results are being obtained (see Fig. 6). The Tesla and D'Arsonval coils are excited by a wireless transmitter which controls the amount the voltage fluctuates. The rotary wheel gap with its exceedingly high spark frequency produces an almost sustained wave in the high-frequency coils. Both for the Tesla and D'Arsonval treatment the writer believes this apparatus superior to any that he has used up to this time. The vitalizing and exhilarating effects are extremely pronounced. The machine has the added advantage that there is no commutator, and the strength of the current being regulated by a many-step rheostat in the primary transformer circuit.

Much has been done in adapting high-frequency currents to the treatment of disease, but much remains yet to be done before we shall be able to avail ourselves of the wonderful healing and vitalizing powers which these currents undoubtedly possess. The writer hopes to continue his studies along this line, believing that when we can scientifically apply to our patients pure undamped waves of definite form, frequency and voltage, we will obtain results far surpassing anything that we have dreamed of up to the present time, and that in the future the scientific use of high-frequency currents will become the greatest method ever discovered for the healing of disease, the promotion of health and the maintenance of a "More Abundant Life!"

EXPERIMENTAL PHYSICS.
(Continued from page 106)

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EXPERIMENTAL PHYSICS.
(Continued from page 106)


goes out solidly, so that now our siphon has its "arms" filled and acts the same as the ordinary siphon.

EXPERIMENT 28—The following is an interesting and amusing experiment. It can be made to appear mysterious, and is important because in it lies the principle of the submarine. In Fig. 24-A, 3 is a jar or other cylindrical glass vessel about two-thirds full of water. Use a small glass bottle, or better, a small glass vial. 1, is a piece of sheet rubber stretched over the top of the jar. Before placing 1 in place, put a piece of sheet rubber or a thin rubber cap over the stopper of the jar and inverted so that it just floats upright. On pushing down on the sheet rubber the vial (Cartesian diver) sinks and on releasing it rises again. When we push down on the sheet rubber, we compress the air in the jar and hence it forces more water into the vial. Since it was originally adjusted so that it just floated, the addition of more water into the vial makes it heavier and hence it sinks. On releasing the sheet rubber the pressure in the jar becomes normal again, and hence the weight of the vial causes the excess water to come out and the vial returns to its original position. Fig. 24-B, shows a more mystifying form of the same experiment. Make a flask, while 2, is the same vial adjusted exactly as in Fig. 24-A. 1, is an ordinary cork stopper. After the vial is adjusted, the stopper is put in carefully. (It may be necessary to adjust the vial so that it floats almost upright so that on pushing in the stopper, a little more water enters the vial and it just floats upright.) On holding the flask in the hand it is apparent that one can, by squeezing it, compress the air and make the diver perform. Thus one can make the diver obey one's command to rise or sink, without the audience perceiving the cause. Obviously this thing that will yield to squeezing is necessary for this experiment and the ordinary Florence flask answers the purpose very well. The real submarine boat is constructed so that the occupant with the vial can enter it, even if it is wholly submerged, except at the will of the occupants. It is able to float like any other ship just as our vial can float. To make the boat to submerge, water is allowed to enter into special compartments until the weight of the boat slightly exceeds the weight of
June, 1917

THE ELECTRICAL EXPERIMENTER

the water it displaces. When they wish to rise again, some of this water is forced out.

EXPERIMENT—We are all familiar with the fact that objects weigh less in water than in air and that some things float in water. No one who has ever taken a bath has failed to notice this, and as a matter of fact the great Archimedes, who first formulated the law of buoyancy, first noticed the buoyant effect of water while taking a bath on a chilly or yearly day (I do not know which). If a block of wood, a piece of stone or marble, or a brick and a piece of cork of the same size and shape are weighed it will be found they have different weights. If then each is weighed in water (see Fig. 25-A) they are again found to weigh differently but they all weigh less, and as a matter of fact it is noticed that the LOSS IN WEIGHT is in each case the same, except in the case of the cork which floats and does not weigh anything. If next we fill a can until it nearly overflows and immerse one of our objects except it into it in the water, the over water in another can and weigh it (subtracting the weight of the can), we find that the weight of the water displaced by the object and the bodies were immersed in the first part of the experiment. In Fig. 25-B, the same, represents the cross-section of the can used in practice. Here, at each, is equal to the weight of the column, read. The difference between the two is the resulting buoyant force at each, and is equal to the weight of a column of water which, of course is the amount of water displaced. The cork being lighter than water, if it were immersed the buoyant force would be greater than its weight and it would rise to the surface. Hence the cork sinks only until enough water is displaced so that the buoyant force equals its weight, i.e., only part of it will sink. The ordinary ship floats because it is constructed so that if it were immersed, the buoyant force would be greater than its weight.

(Te be continued)

THE NAVAL RADIO OPERATOR.

(Concluded from page 109)

Members of the Electrical Class are graduated at the navy yard in Mare Island, New York. The school buildings are situated in the Navy Yard. Outside of the regular school hours, a course of instruction is contemplated whereby they will be instructed in the regular duties of a man-of-war's man; this is necessary, as every man aboard ship, irrespective of rating, is a member of a military organization. Shore leave is granted in accordance with the regular Navy custom, usually from 4:30 p.m. to 7:30 p.m. every other day. Leave of absence is granted after completion of course.

The Naval School Electrical School comprises twenty-two weeks of advance work and three weeks of examination. The schedule is based on a perfect and a final average of 28 is necessary in order to obtain the rating of electrician upon graduation. Each man is assigned daily oral recitation and weekly written examinations. The final examination is in writing. In the radio work, emphasis is placed upon the ability to send and receive the Morse and Continental codes, also radio regulations.

OUTLINE OF THE RADIO COURSE.

The outline of the course is as follows:


Review and Examination.

To the above course is added several weeks of practical work and special details. Students enter the Electrical School at any time and commence the course on the Monday following their date of entrance. Each week corresponds to a class or grade and should the student not be present, he is studied, and the lapse of time since entrance to the school.

The first eight weeks of the radio course are devoted to methods of transmitting and receiving wave of the radio wave, chief electriccurrent and serve as the ground work for the study of radio. Text books in the first eight weeks are "Swoope's Lessons in Practical Electricity" and "Bullard's Naval Electricians' Text Book." Both the Continental and Morse codes are taught. Two operating tables, each with a capacity of twenty men, are fitted with head phones, sounders, and transmitters, and the instructors are Chief Radio Electricians. Each instructor is assigned an operating desk having control of two operating tables. The students are assigned to tables according to skill in receiving and are advanced to faster tables whenever necessary. Final examinations are held after the completion of the twenty-second week. The average operating ability of the students completing the course is a word per minute. A great many of the students, however, approach a speed of 30 words per minute.

It is believed that men completing the radio course at the Electrical Class successfully have obtained an excellent general knowledge of radio and have fitted themselves for promotion in this branch of the Naval service.

THE HOW AND WHY OF RADIO APPARATUS.

(Concluded from page 113)

Mechanical pressure can be exerted axially upon them, in order to make the gaps thereby larger or smaller than one-half the gap. The gap often becomes unheated, and it is common practice to place a small motor-driven propeller or fan opposite the gap, in order to cool it by carrying off heat from the cooling flanges.

At Fig. 4, we have what is known as a rotary-slip type of spark gap. This particular design of gap has met with considerable favor, especially for small radio transmitters. From one-quarter to several kilowatts, this gap possesses the distinct and remarkable quality of producing a high-tone in the telephones at the receiving station, when it is used on a low frequency or 60-cycle transformer at the transmitting station.

In the first place, this gap operates with a remarkably small clearance between the two semi-circular flat spark electrodes and its rotary electrode, or having a gap about

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three-thousandths of an inch in length. The gap operates in an air-tight chamber formed by a heavy metallic casting, which carries suitable cooling vanes, and besides which there are provided a number of auxiliary cooling vanes as shown in Fig. 4, at the rear of the gap. Being air-tight at the start, this gap operates in the same manner as the design shown in Fig. 3, known as the Telegraphen gap. To obtain a high spark note with the rotary quenched gap of Fig. 4, the two fixed and also the rotary electrodes have their faces carefully machined or milled-out with radial distances, resulting in a number of teeth, between which the spark occurs. These gaps have to be built very accurately of course, as the gap itself measures about .003 inch, and it is desirable to have the sparking distances constant and similar. A typical gap of this class has the ends of stationary and rotary elements milled with thirty-six radial slots, so that when rotated by a small motor at 1,800 r.p.m. the resultant tone corresponds to that of a 40-cycle alternator. It is necessary that the width of the spark segments are so proportioned that sparks will occur during not more than one-half of the total time, as otherwise the telephone diaphragm at the receiving station is retarded in its excitation away from the magnet, thereby resulting in a decrease in the sound intensity.

[Those interested in this spark gap will do well to look up the matter in the excellent paper by Mr. Melville Eastham, entitled "The High-Tone Radio Telegraph Transmitter" in the December, 1914, issue of the proceedings of the Institute of Radio Engineers.—Editorial Note.]

HIGH-FREQUENCY APPARATUS AND EXPERIMENTS.

(Continued from page 117)

so rapid that it will not produce an audible sound in the receivers, so that the discharge of the Quintin coil will not be of much use for the transmission of wireless messages, although who can say, if it is properly conducted to the small motor at 1,800 r.p.m., as far or farther, than an undamped wave.

It is very probable that high frequency current of a periodicity which is not destroyed that sparks will occur during not more than one-half of the total time, as otherwise the telephone diaphragm at the receiving station is retarded in its excitation away from the magnet, thereby resulting in a decrease in the sound intensity.

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HIGH-FREQUENCY APPARATUS AND EXPERIMENTS.

(Continued from page 117)

be left in a closet, or some place else for a week, or until the water has disappeared. The reaction for this experiment is:

\[ \text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu(NO}_3)_2 + 4\text{H}_2\text{O} + \text{2NO} \]

Copper Nitrate Copper Water Nitrogen Oxide

MADE FROM ACIDS AND SALTS.

EXPERIMENT NO. 61—

Put 5 or 10 grams of marble chips into a wide test tube and add about 10 cc. of dilute Nitric acid, \(\text{HNO}_3\) (half acid and half water). Apply the splint test by applying a lighted splint to the mouth of the test tube, after the action has progressed for a short time. After the action has stopped, and if not clear, filter, and evaporate most of it.

EXPERIMENTAL CHEMISTRY.

(Continued from page 127)
EXPERIMENT NO. 62—

Put 2 or 3 grams of Ferric sulfid [FeS] in a test tube and cover it with water. Place this near an open window, or set it back of a screen. The gas will be created and carried away the escaping fumes. Add 5 cc. of Hydrochloric acid [HCl] [keeping in a draft of air]. When the action stops, filter and evaporate. Equation—

\[ \text{FeS} + 2 \text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2 \text{S}\]

EXPERIMENT NO. 63—

Put 10 grams of fine salt [Sodium Chloride, NaCl] in a test tube, add 10 cc. of concentrated Sulfuric acid [H_2SO_4]. Carry on this experiment near a window or where a draft of air can be created. Heat the solution over a Bunsen burner very cautiously, and moderately. After the action has prograded for 5 or 10 minutes let it cool, then pour in 13 or 20 cc. of water, to dilute or dissolve the solution. If the liquid is not clear, filter it, and wash the filtrate [the liquid which passes thru the filter paper]. If concentrated sulfuric acid is present, it will destroy the filter paper.

Equation—

\[ \text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{HCl}\] 

Soluble and Insoluble Substances.

All the common acids are soluble. Some of the bases are soluble, some insoluble. An insoluble substance is one which does not dissolve, or which dissolves very slowly in water. Besides water, there are many other solvents, as, alcohol, chloroform, ether, carbon disulphide, and the various alkalies. A substance, unless a certain solvent is mentioned, is the one referred to. To be able to distinguish clearly between soluble and insoluble substances, is the basis of chemical analysis.

Soluble salts, are usually prepared by [1] neutralization, as in experiments 54, 55 and 56; [2] by the action of an acid on a salt, as in experiments 61, 62; and [3] by the action of an acid on a salt, as in experiments 63.

In experiments 54, 55 and 56, we prepared a soluble salt by Neutralization. Upon making a mixture of the acid and base, the reaction took place, and a salt was formed. As a salt usually gives a neutral reaction, a point is reached, in the mixing, if it is done very carefully, as a whole mixture neutral to litmus. If the solvent water was evaporated at this point, the salt should be obtained as a solid, which in some cases may break up owing to excessive heat.

In experiments 58, 59 and 60, we prepared a soluble salt by dissolving a metal by an acid. The result which we obtained is called a chemical solution and consists of the metal and the solution. Suppose we wish to make some calcium chloride [CaCl_2]. We know that it is soluble, and suppose that Hydrochloric acid [HCl] will probably dissolve the calcium. But we also learn that calcium is not a common metal in the laboratory, so we look for an inexpensive compound upon which the Hydrochloric acid will act. The Carbonat [CaCO_3, limestone, or marble], is plentiful, and hydrochloric acid attacks it with great vigor. The reaction would be:

\[ \text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2\]

EXPERIMENT NO. 64—

Put in a test tube 50 grams of iron [Ferrum, Fe] and 100 grams of water. We found that this mixture was not a homogeneous mixture, as is the mixture of a salt, but form a precipitate. Thus it is formed a precipitate of ferric hydroxide [Fe(OH)_3], a precipitate of ferric hydroxide [Fe(OH)_3].

Sodium hydroxide is made from Sodium Carbonat [Na}_2CO_3] and Calcium Hydroxide. Insoluble bases are made by mixing two solutions, one a base, the other a compound of the metal of the base required. Ferric Hydroxide [Fe(OH)_3] cannot be prepared by adding Sodium hydroxide to a solution of Ferric chloride [FeCl_3]. Any other soluble ferrous (but not ferrous) salt would do as well, and any other soluble hydroxide. Ferrous hydroxide [Fe(OH)_2] requires a soluble ferrous [not ferrous] salt.

SOLUTION—

In Experiment 5 [August, 1916, issue of THE ELECTRICAL EXPERIMENTER] we illustrated Solution 61. We found that by dissolving the sugar in water, we formed a Solution. Sugar is said to be Soluble in water, and the water is termed the Solvent. This is the meaning of the Solution. A substance is said to be in solution in a given liquid, when it is evenly distributed throughout the liquid in such fine division that its particles cannot be seen, and which do not settle or precipitate upon standing.

The most important property of water is its ability to dissolve a large number of substances. Liquids which do not separate but form a uniform mixture when

(Continued on page 136)
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June, 1917

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Daniel M. Mcary
in the evening:

A mixture composed of most substances is decidedly affected by the temperature. Solids and liquids differ in this respect, as solids usually melt at a lower temperature than liquids, while in the liquid state, they are more susceptible to the influence of heat. In Experiment 5, we found that sugar was more soluble in hot water than in cold. Sodium Hydroxide, used in the preparation of lime-water, is more soluble in cold water than in warm water.

The solubility of gases decreases as the temperature increases. This is a general proposition, as different substances vary very much in their solubility, and their solubility may differ in their power to dissolve the same substances.

SATURATION:—If a small portion of salt is dissolved in a large quantity of water, such a solution is then said to be Dilute. The substance is uniformly distributed in all parts of the liquid solution, and is in one containing a much larger proportion of the dissolved substance. By slowly adding more salt until a measured volume of water, it can be shown that there is a limit to the quantity which the water will dissolve. One liter of water at 20° C. will take up any quantity of salt up to 360 grams, and no more.

At this point the solution is said to be Saturated; or in other words, the water has dissolved all the salt it can under given conditions. If any more salt is thrown into such a solution it will simply fall to the bottom, or powder, no matter how thick, does not increase the amount dissolved.

EXPERIMENT NO. 64—Take 100 cc. of water and saturate it with sugar at 20° C. It will take up 204 grams. Now heat the liquid to 100° and dissolve more sugar in it. It would probably take 32° C. to dissolve 20 grams, but only add about 20 grams. Allow the liquid to again cool to 20° C. This solution must be allowed to cool without any disturbance and kept perfectly quiet in a clean bottle: the separation of the extra 20 grams of sugar may not occur for a long time. This liquid contains more sugar than the same temperature, and when in such a condition is said to be a SUPER-SATURATED SOLUTION. Drop a tiny grain of sugar into the above super-saturated solution, and if the experiment has been performed correctly, this crystal will precipitate, or settle down, the extra 20 grams of sugar, and the saturated solution will be formed.

DELIQUESCENCE:—If Potassium Carbonate is exposed to the air, it absorbs water and changes into a compound which is known as Deliquescent. This substance which absorbs moisture from the air is also said to be Hygroscopic.

EFFLORESCENCE:—This term should not be confused with Efflorescence, which is the escape of a gas from a liquid in which it is either generated or has been held by pressure. If a crystal of washing soda is exposed to the air in a dry room, it absorbs water and becomes covered with a fine powder. This is called EFFLORESCENCE. Copper Sulphate (Blue Stone) in a dry room will absorb air but in very dry air it turns white and EFFLORESCENCE rapidly.
Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of The Electrical Experimenter, published monthly at New York, N. Y., for April 1, 1917.

State of New York, County of New York, ss.

Before me, a Naturalization Officer for the State and county aforesaid, personally appeared Hugo Gernsback, who being duly sworn according to law, deposes and says that he is the Editor of the Electrical Experimenter and that the following is to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication as shown in the above caption, required by the Act of August 24, 1912, as amended.

J. W. Seest, City and County Clerk.

The Electrical Experimenter is published monthly at New York, N. Y., by the Electrical Experimenter Co., 233 Fulton St., New York City; and published by Hugo Gernsback, at the place and addresses of the publisher, editor, managing editor, and business manager: Publisher, The Experimenter Publishing Co., Inc., 233 Fulton St., New York City; Editor, Hugo Gernsback, 233 Fulton St., New York City; Manager, Electrical Experimenter Co., 233 Fulton St., New York City; Business Manager, Hugo Gernsback, 233 Fulton St., New York City.

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, The Experimenter Publishing Co., Inc., 233 Fulton St., New York City; Editor, Hugo Gernsback, 233 Fulton St., New York City; Manager, Electrical Experimenter Co., 233 Fulton St., New York City; Business Manager, Hugo Gernsback, 233 Fulton St., New York City.

2. That the owners are: The Experimenter Publishing Co., Inc., 233 Fulton St., New York City; Hugo Gernsback, 233 Fulton St., New York City; Mrs. H. Gernsback, 233 Fulton St., New York City; W. H. Seest, 233 Fulton St., New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of the total amount of bonds, mortgages, or other securities are: None.

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5. That the undersigned has examined each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months immediately preceding the date shown above in the above caption, and that the said circulation is true and correct.

H. GERNSBACK, Editor.

This issue is of daily publications only.

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(My commission expires March 30, 1917.)

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