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THE ENEMY
SEE PAGE 90

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Silencing America's Wireless

As all our readers are aware the United States Government, the Navy Department, has issued orders throughout the land to cause the immediate dismantling of all radio stations, whether large or small, commercial or amateur, sending or receiving. All aerials have been ordered dismantled and apparatus removed.

This action came as a great surprise to all patriotic amateurs. In the past year or two it had been encouraged by the Government and 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 in a manner not entirely proper, and which has as yet to hear the first complaint on that score. But 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 is 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 italics are ours. Particularly the one word MAY. In the second paragraph the President's order 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. Now it is the Navy Department. Why? Because the President, it seems, had only the radio communications of the Navy in mind. If, therefore, the Navy Department had caused the closing of all radio stations, particularly sending stations along our sea borders, such action would have seemed perfectly logical. But the Navy Department should wish to close stations a thousand miles removed from the coast. Furthermore, it seems such an action would be very puzzling. Furthermore, it seems such an action would be very puzzling. Furthermore, it seems such an action would be very puzzling.
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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 delay 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 passed 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 sol-
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 learn it right. The naval electrician has unequaled 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 "land-lubber" may never become thoroughly familiar. U. S. naval electricians never need to fear that they can not find 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 many nearby 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-pointing 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 through their service aboard ship and elsewhere both academic and practical training to enable them to demonstrate their ability and to ad-

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. Recruits meeting 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 photophy productions.

One of the most novel ideas devised toward accomplishing this purpose is outlined in a recent patent awarded to William B. Vansize, 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, dated 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, that they 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 a corresponding record of their voices on the moving steel wire of the telegraphophone, which has been explained in detail in previous issues of this journal.

In brief, the telegraphophone operates upon the principle that if a moving steel wire is past by 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 telephone arrangement, as proposed by Mr. Vansize, 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 actors' 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 telegraphophone is unreeled at exactly the same speed. The impulses from the recorded telegraphophone 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 gasoline inventor.

The secret of this remarkable invention lies in the fact that if an electric current is passed between two plates submerged in water, it decomposes the water, evolving two gases, oxygen and hydrogen; the oxygen accruing from this process is liberated, while the hydrogen is collected and when suitably mixed with a proper amount of air, it forms a highly explosive mixture when ignited in the automobile engine cylinder.

The accompanying illustration shows how the proposed water-electric-gas-generating plant would be fitted to a motor-car, the special dynamo together with the decomposing chamber and gas storage tank being placed with the engine under the same bonnet. The small Unipolar type dynamo is connected by means of gears or driving chain to the timing gear on the crank shaft of the engine, and supplies a low voltage direct current. This current is passed then the electrolytic cell shown in the illustration, alternate plates being charged positively and negatively. The plates are preferably perforated so as to promote circulation in the gas-generating cell, and by the inherent arrangement of the positively and negatively charged electrodes the gas generation is both rapid and efficient.

As before mentioned the oxygen is liberated by suitable automatic valves, and the hydrogen is retained and passed thru a mixing valve, similar to the usual carbureter used on all gasoline engines and which can be controlled from the driver's seat. Following the standard practise in motor-car equipment a suitable quantity of air is taken in thru the mixing valve, and when combined with the proper quantity of hydrogen, forms a highly explosive gaseous compound. When this is fed into the engine the explosive gases are driven thru the cylinder and at the appropriate moment the spark plug ignites them, thus driving the engine.

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 equals 112 cubic inches; equals .0648 cubic feet. Then at 5000 revolutions per minute is 3,100 times .0648 or 194.5, and 60 times 194.5, or 11,670, is the number of cubic feet drawn into the motor per minute, running at maximum speed and under full load.

The gasoline entering into that mixture is 7 per cent by weight, and the amount by
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 diffraction grating,” said Doctor 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 plane 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 artisan; 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—this is nothing less than the generally well-known chain shot. In our 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, et cetera.

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 continue for the present on the Pacific. Trans-Atlantic traffic via Glace Bay will not be disturbed. The Director of Naval Communications, Lieutenant Commander Todd, at Washington, will have charge of stations operated by the government. Enrollments will be made by commands of naval districts.

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 attempt 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 helmet, 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 trenches, when overcome by the gas cloud. Each gas helmet and mask is fitted with a novel and specially designed telephone outfit, 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.

To Counteract the Poisonous Gas Fumes Blown Toward European Trench Rescuers Who Are Called Upon to Go Forth and Carry Prostrate Soldiers From Their Positions, They Have Guarded Themselves Against Being Overcome by a Novel Telephone Appliance Attached to the Gas Defying Equipment.

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 cars, and to prevent the fire from reaching the wooden structure on which the rails rested, as well as the wooden footpath, one of the firemen of necessity directed his stream on the third rail.

The stars are not intended to indicate what happened and what that poor fireman saw; rather they are meant to illustrate how long he remained unconscious. As a matter of fact the man was almost electrocuted. Since that time firemen do not fight elevated fires unless they are assured that the power has been turned off.

Now, the N. Y. Elevated Lines only carry 500 volts direct current, but this pressure is sufficient to pass from the third rail line, to the water of the fire hose, and from there into the metallic nozzle held by the fireman. Altho ordinary hydrant water is a poor conductor, a 500-volt current nevertheless finds but little trouble in passing thru the stream of water and thence thru the body of the fireman, with 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: 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 zinc 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 of the tank. This causes the acid 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 enemy), there remains little doubt but that the man would have been electrocuted instantly.

Upon this principle the writer has based his idea: to use up electricity at an enemy, impracticable as the scheme sounds at first thought. Many murderous ideas, of course, have been advanced for trench warfare, the German Flammen Werfe, whereby the result that he is knocked unconscious. If the stream had been sea (salt) water, there remains little doubt but that the man would have been electrocuted instantly.


The Germans found (10-H.P., gas engine driving a 5- to 8-H.P. Alternating Current Generator. The latter is connected to a step-up transformer delivering from 10,000 to 15,000 volts. A thin but extremely well insulated cable connects with the nozzle carried by the soldier. This cable is connected to one side of the transformer; is grounded to earth. If now the stream hits an enemy soldier (who is not insulated from the ground), the high-tension current passing thru the stream of highly conducting acid, runs thru the man's body and thence thru the earth, back to the transformer. In this case he probably will be electrocuted or else knocked senseless by the powerful current. Even standing on a piece of dry wood or a stone will not help him, for the acid running down from his uniform will turn the wood or the stone into an excellent conductor and the enemy will almost certainly be rendered unconscious. Probably the most efficient way of utilizing the new scheme will be found in directing the charged stream at a machine gun. The second the stream hits the metallic portion of the gun, the operators will be knocked unconscious or will even be killed. It is also understood that the entire electrocuting outfit, gasoline engine, dynamo, transformer, acid tank 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-
A FIXT military policy which will protect the nation and strengthen her resources 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.

Secondly, 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 that of universal compulsory training. It treats all alike, makes use of young men before they reach the age where their earning power is high and when they are yet unmarried, and gives them the maximum of intensive military training. Then it sends them back to the trade they are in.

These trained youth 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 convention where was the case in a measure the weight that is taxing our silent and conservative Brown Executive. It would be shameful to see his plans 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 to 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 disgraceful in a national military program, but it is decidedly unencomiumal and wasteful. In nine cases out of ten, the slackers are ailed to, and under proper tutelage would make good soldiers, while the armed fellows 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 precious lead alone to conduct the nation's affairs. This is fundamentally bad in a democracy.

Selective conscription no doubt may be necessary at times, but it never will be popular. Universal compulsory training, on the other hand, is, thru its very universality, plain, simple and fair. It says that all having the blessings of our institutions should, in time of war, contribute their share to defending these institutions. It says, further, that the untrained soldier is so much better used that the chances of the trained lad returning home in health from war are about three times greater than the untrained boy's.

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 Senators and Representatives to back President Wilson in all his emergency measures and to eradicate forever the doubt, uncertainty and weaknesses of present muddled 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 Being Trained for Five Months in the U.S. Army.

thru the eddies just ahead, I ask all patriotic citizens not only to strengthen his arm in this effort, but to aid the nation as a whole in supplementing the President's labors by the establishment of universal military and naval training.

The benefits resulting from such a democratic plan for raising an army in emergencies cannot be over-estimated. The last few weeks have shown how weak and futile other devices have been. The volunteer system is unfair, and because it is so thousands of young men who are as patriotic and loyal as the best in the land will not offer their services. They have come to realize that the strong, highest types of manhood go forward while the cowards and slackers only too gladly stay at home. The best blood goes to the front of several minutes. On the other hand, the high-tension current kills either outright, or otherwise puts the enemy out of the fighting for the time being, with little bad after-effects. The acid, plus electricity, does not cause horrible burning wounds or burned off limbs as does the liquid flame.

As with all war-schemes, the wise ones will now ask the usual question: What happens, if the enemy too uses the electrocuting apparatus?

In answer the writer asks another question: What happens, if the enemy too uses liquid flames, or if the enemy too uses machine guns?

*This show was described on page 24, May, 1917, issue of this periodical.

AUXILIARY SIGNAL CORPS UP-TO-DATE.

Perhaps the finest single auxiliary signal corps posset of any army has been given to the United States by the American Telephone and Telegraph Company. About 300 engineers already have been selected and some of them have been sworn into army service. The differences between government pay and their salaries with the telephone 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 telephone, telegraph 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.

DATE OF ISSUE.—As many of our readers have recently become unduly agitated as to when they could obtain THE ELECTRICAL EXPERIMENTER, we wish to state that the newstands have the journal on sale between the fifteenth and eighteenth of the month in the eastern part of the United States and about the twelfth of the month west of the Mississippi River. Our publication is sent first-class mail and circulation in proportion of their copies to their dates. Kindly bear in mind, however, that publications are not handled with the same dispatch by the Post Office as a letter. For this reason delays are frequent, therefore kindly be patient and do not send us complaints as to non-arrival of your copy before the twenty-fifth of the month.
Electricity's Aid to Women

Who can remember anything done without electricity? There isn't any such thing. Each day we find new and wonderful ways of using electricity. This is one of the many things we are doing to put electricity to work.

Electricity is a great aid to women. It makes housework much easier. It is a great help in the kitchen. The electric motor is doing a wonderful work of cooking. It is doing a wonderful work of cleaning. It is doing a wonderful work of everything.

Electricity is a great aid to women. It makes housework much easier. It is a great help in the kitchen. The electric motor is doing a wonderful work of cooking. It is doing a wonderful work of cleaning. It is doing a wonderful work of everything.

Remember the fellow who told the waiter the steak was too rare? Said the waiter—"We cook by electricity." "Well, give that steak another shock," said the patron.
Electricity’s Place In Business

APPLYING PSYCHOLOGY WITH THE ELECTRIC “PSYCHOMETER.”

The latest device for testing speed and quality 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 Psychometer is operated by either alternating or direct current and may be attached to the telephone electric light socket. The clockwork attachments and electrical connections are operated by pressing a simple telegraph key which is connected with the telephone plug.

The instrument is built in a case and may be easily carried around. The readings are made by an electric light, which is mounted on the side of the small case box. The instrument is an accurate gage 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. The instrument is fastened to the key or machine used, and the needle marks the number of printed sheets that the machine has made during a given period. Each needle has its corresponding counting instrument and both are connected to a single switch. This particular form of apparatus 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 measures, President Wilson has appointed a number of prominent engineers in the country to positions in the army.

One of the appointments which will meet


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 Do Move.

Photo from Press Illustrating Service.

Here We See a Portable “Productograph,” Connected to Each Machine, It Enables the Young Lady in the Foreground to Readily Keep an Exact Record of Each Employee’s Output.

Electrical Engineers, and has always taken an active interest in the work of this association.
SOUND RELEASES TOY DOG FROM ITS KENNEL.

A very interesting toy has recently been introduced into the toy market and which is herewith 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 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 sounding a whistle or by the production of any other sound. This circuit-breaker 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 pressed 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 seen at the left and consists of a core 3/8-inch in length and 1/2-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 sound operated circuit-breaker is seen on the right. This consists of a rectangular metal box A, in which the sensitve 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 A, 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 (center). Two small 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 lower 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 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.

A trap drummer has discovered that electric lights installed inside his drums keep the moisture out and makes the drumsheads tight.

St. Patrick's Cathedral of Norwich, Conn., is lighted with six electric projector units, which bring out the chancel arch and altar in beautiful relief.

Buttons!

"Speakin' o' buttons," said Uncle Zeke, Shifting his gun to the other cheek, That melts your dollars like snow in spring, That I see them buttons, along the wall, Right in a bunch; mebbe six in all, "Twas gittin' too dark to see outdoors, An' 'I got to foolin' with them because There wasn't much else fer me to do, When Jimmey crickets; before I knew, I thought I had set the house afire, And as loud as our old town crier, Till the folks came rumin', lickety cut! I told them what wuz the matter, but They didn't do nothin' but laugh. Bout that dad blamed button I tried to pull, Then they showed me just how it worked, an' beamed, You beller a sou at me, two cents, Why, it made a blaze like a bonfire done! They said 'twuz invented by Eddy's son; I don't know just who Ed is, but say, His son is the feller that gits my pay" By Pauline Frances Camp.

AN ELECTRIC SELF-WAVING FLAG.

One of the most talked of features at the Electric Railway Convention at Atlantic City, N. J., was a waving flag which fluttered from a 27-foot flagstaff in front of the General Electric Company's booth inside the spacious convention hall. Not a breath of air was stirring, yet the flag stood out on the pole as if a thirty-mile gale was blowing. The flag pole was of ordinary dimension and there was nothing visible to betray the source of the breeze. The base of the pole was surrounded with banked palms. It was only when visitors got very close to it that the scarcely audible hum of a motor gave a clue to the source of the breeze.

The whole device is really quite simple in construction and easily explained, for the flagpole is a metal tube and an electric blower at the base shoots a strong current of air thru the flagstaff. The air escapes thru perforations in the top of the flagpole and imparts a waving motion to the flag.

PROCESS FOR DRAWING LAMP FILAMENTS.

A process for cold-drawn metallic filaments has recently been patented by Mr. K. Nishimoto, of Tokyo. Forming at first a consolidated mixture of tungsten and a small proportion of thorium, an alloy is obtained by uniformly heating the mixture at a sintering temperature and then gradually keeping its temperature at dull red heat. The consolidated stick is then subjected to repeated hammering or rolling until it becomes so ductile that it may be hammered into bars, rolled thru sheets or drawn thru dies into wires, much like the metals which are commonly treated in this manner at ordinary temperature.
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 conjured on the problem of raising sunken vessels. In fact, all of the hundreds of torpedoed ships which lie scattered along the European coast in comparatively recent years, not to mention the many sunken ships lying within the coast boundaries of our own country. It is not often that we hear of a sunken vessel being raised from the sea-bottom, but there are a few remarkable new schemes for raising sunken vessels of a marketable type. It is generally known that as long as they do not lie too deep a great deal of water, and which idea he intends commercializing at an early date. It goes without saying that if Mr. Linquist's idea, as outlined herewith, proves feasible and successful, that he will find one of the most profitable lines of 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 submerging chambers or 'frets' 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 expedition sets out from the nearest port with the necessary number of these large, adaptable 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 horizontal sections double up like a jackknife, permitting the several units of this equipment to be towed by tug boats to the scene of the wreck.

The present plans of the inventor considering 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 miles from the shore, the cylinders are employed, placing an equal number of them on each side of the sunken ship.

Surprising 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 float. As it does so, the upright cylinder naturally assumes the horizontal position, and moreover the base member obtains a very powerful hold on the bed of the ocean or lake 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. Linquist 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 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 to at once 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 cut by the floating members, and the ship is thus held while the floating cylinders refill and take a new line; the same operation is then repeated to the surface.

Mr. Linquist intends building these cylinders, not of steel but of narrow strips of wood—six inches thick, or may be used in certain cases, including commanders of salvage squadrons and stations, to a number of naval men, and has received unfettered recommendations from these, 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 practice but also of great utility in salvaging sunken vessels in times of peace, but it possesses according to Mr. Linquist, several valuable naval features. For one thing he holds that one of these hydrostatic units would prove very efficacious in the role of a "Submarine Base," the outfit 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 suction foot 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 lies in calm water, the action of the waves not reaching very deep. A means is provided for releasing the thing upon the ocean-bed when it becomes desirable to move the unit to some other location. U. S. Navy officers have been favorably impressed with this idea.

In closing, it is interesting to note that another valuable possibility of this device is that of releasing stranded vessels which

After the War There Will Be Thousands of Vessels Lying on the Oceans' Beds. If Only a Fraction of These Can Be Flotated and Repaired, Think What It Will Mean to Commerce. A New Invention Intended to Accomplish This Purpose Is Illustrated Here and Includes the Use of Two or More Powerful Cylinders Which, As They Are Emptied of Water and Made More and More Buoyant, Finally Exert Sufficient Upward Pull on the Cables to Lift the Vessel.
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 sawed a slot into it for a distance of a foot at the other end, this slot passing thru a hole bored in it of 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 upon it 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 case it is near one of the binding posts on the motor.

Mr. Joleen has inserted a small push-button switch for starting and stopping the motor. 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 lamp 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 equipped with an electric motor. The first motors employed were just the ordinary type, but later designs have resulted in the development of a motor having necessary speed control for use solely on sewing machines, and the efficiency and operating features of such motors have been greatly improved.

The latest and most desirable features are to be found in the special motor shown and described below.

This type can be readily attached to any make of stationary or drop-head sewing machine, new or old, with the exception of a few obsolete models. When not in use the motor, if mounted on a stationary head machine, can be pushed back out of the way and the cover put on. In drop-head machines the motor can be removed readily by loosening one thumb screw, as it is light and portable.

The speed regulator is slotted on the handle 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 cast steel and the privilege of operation is entirely new. When there is no pressure on the handle the circuit is open. With a slight pressure on the handle a contact is made and as a greater pressure is applied the resistance is cut out turn by turn. By varying the pressure, one, two, or several hundred steps may be obtained. 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, consists of a small electric motor which operates on either alternating or direct current, mounted on a nickel-plated base, a speed regulator with operating handle 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 and when in use is entirely surrounded by water. Thus all heat generated is efficiently utilized.

The tea kettle head, which forms a half-pint, is made of drawn copper, spun into shape; spout of white metal; has bail handle, sides of which are steel, grip made of ebonized wood comfortably shaped for convenient pouring. The lid has no hinge to come off and no locks on it, a feature which forms an integral part of the metal lid.
THE PROPERTIES AND COMMERCIAL APPLICATIONS OF SELENIUM.

By W. F. Alder.

Selenium was discovered by the Swedish chemist, 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 4.978, its vapor sp. gr. at 2.58°F, being 5.0.

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 brick-red powder, when a solution of selenium acid is precipitated by sulfur dioxide gas, or when the acid is reduced by suitable agents. Amorphous selenium has a sp. gr. of 4.20 and is soluble in carbon disulfide.

2. (a) Semi-colloidal red amorphous Selenium is formed when solutions of dextrine and selenium or selenium acids are gently 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.

3. Vitreous selenium is formed 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 regarded 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 exposures. The general belief, also erroneous, seems to be that the short wave lengths, 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 5000 units.

The writer encountered innumerable difficulties which were, however, overcome in the type of cell illustrated herewith.

Electro-Deposited Mirrors Now Used for Photographic Work

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. Partly 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 transparencies 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 13 pounds per square inch) amounts 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 5,000 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 deposited.

In Fig. 2 is shown a set of interesting curves obtained in a typical run with a cathode of 70 per cent platinum and 30 per cent iridium, measuring 120 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 34 milligrams per square decimeter.

Photos courtesy of Eastman Kodak Co.
A New Optical Pyrometer

The new pyrometer here shown is a practical and accurate instrument, which can be successfully used by unskilled workmen. Temperatures from 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 admirably well adapted for research purposes and in many processes in steel, pottery, glass and other works. It has been developed by an English concern.

The instrument may be regarded as a photometer, in which, by simply rotating the eyepiece, a beam of selected monochromatic 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 consistency. 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; 4-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 semicircles. One semicircle is filled by an image of the hot body under observation, while the other is uniformly illuminated by the electric lamp. The two semicircles are brought to an equal intensity of illumination by turning the eyepiece to which the scale pointer is directly attached as seen, scale instruments, 700-1400°C; single scale instruments, 900-2000°C; double scale instruments, 900-2000°C; and 1200-2500°C.

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

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

ELECTRIC COUCH INDUCES CURRENT 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 similar ailments: a number of sufferers who have tried the device claim that they have been greatly benefited thereby. While the apparatus has been constructed in various forms, the one described has the advantages of simplicity, lightness, neat appearance and ease 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 220 volts and in series-parallel in groups of four in series when operating on 110 volts. At a convenient point at the head 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 gage iron strips 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 saged 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 beneath 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 direct action of this magnetic field upon the human system, but in looking at the subject from the engineer's standpoint, the physician's viewpoint, the following theory suggests itself: Do the blood circulatory 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 66th 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 Peckull, 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 L.L.D., from St. Andrews, Glasgow and Aberdeen.

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 coupler was the first instrument used for successfully receiving radio waves.

He discovered in 1890 that two metallic surfaces in perfect contact, were welded together when an electric discharge past 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 expounded 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, 1895, Lodge applied for a provision patent protection in Great Britain for improvements in Syntonizing 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 patent 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,” “Signalling Thru Space Without Wires,” “Life and Matter,” and “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 however was received coldly by the scientific world.

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.
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 hotly:
"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 blasts, 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-
tion crew, had come to board at his home.

It was Pete who had answered his hour
and pray about the plant and its opera-
tion, 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 conversa-
tion 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 ques-
tions 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 Merwin
to complete preparations for the trans-
formers in the sub-station there. And so
Joe sat on the porch and listened to the
faint hum of the generators below him,
AST month we published 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 mist. The facts related in this story are human, pertinent every-day affairs. Similar obstacles to those 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.

Of what use would this power be if there were no transformers at Merwin? Without the intervening coils the big magnet's fields would split, and they would be striped from him. He thought of this and tried to answer for himself the question that was puzzling the chief of construction. "What do you suppose Mr. Robertson will do?" he asked Pete as the latter started upstairs for bed.

Joe knew that the sixteen thousand volt current could not be turned directly into the low voltage that the Mr. Robertson and company transformers ran down to fifteen thousand volts. He knew that burned out electrical equipment and people would be the result. The voltage had to be lowered, but he was unused to it and tried to think what Mr. Robertson was going to do, as he sat on the porch and listened to the men talking, and far away the faint hum of the generators in the power house, tittering up their bearings.

Joe was looking back to the existence of those transformers in his mind, when Pete said: "What are you, to be able to, or try anyhow," Joe protested.

"Let Robertson do that, Joe's paid for worryin'," Pete returned energetically.

But that did not satisfy Joe. The plant below him had grown much since 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 for solution? He ought at least to attempt to solve it now. So he puzzled his brain over the rest of the day, and the next day, suggesting, rejecting, scheming and pondering. But by the eve-ning he had not reached an answer.

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

He remained at Portage Falls directing bits of finishing work, while he hoped and almost prayed for the momentary arrival of the big details 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 was told 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 up fine points of the work there. The plant was in order, each great machine ready to send its thou-sands of kilowatts of power out, to be used for every sort of work, provided the intervening transformers were there to step down the deadly high tension to a safe voltage. But at noon a message to the Falls reported that no transformers had arrived.

Joe looked 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 food awaiting him.

But five minutes after he had sat down leisurely inside, he dashed out, leaped off the porch, and raced down hill-side, recklessly speeding toward the company's tool shack at the bottom. A minute later he swung open the doors of the building, and was presented with a Chief auto-mobile. Two minutes later and the pebbles were flying in a stream from his tires as he bumped away over the rough roads toward Merwin.

An hour and a half later he stopped Mr. Robertson's big high-power rodeo before the building, while the chauffeur 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 dressed directors, engineers, and workmen in overalls. (Continued on page 120)
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.

This, like other inventions of Mr. Hartman, is really quite simple in construction and performs its functional duty just as well, or perhaps better, than many existing and more complicated similar devices. The sole purpose of this instrument is to warn an automobilist in which direction the machine ahead of him is going to turn, either to the left or to the right.

It consists of a magnetic field having two moving coils similar in design to the field of a motor. An armature coil is placed in this field, and its shaft is attached to a pointer, a signal or semaphore arm. The field and armature arrangement is a pivotable proof metal case which is seen on the left. One end of the pointer is fitted with a red lamp to serve as a danger signal.

The armature and field coils are connected to a storage battery and a simple switch, so that the automobilist can throw the arm either to the left or to the right, whichever the 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 thru 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. Automobilists 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.

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 tractor aeroplane. Prior to the advent of this clever device the Pilot-Instructor, occupying the rear seat of the machine, depended on twitching the various controls, at times attracting the attention of his pupil-passenger by kicking the back of the forward seat, for imparting such instruction as was necessary. This crude method of communication is very 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 a battery case, and when the pieces are of light and compact construction, the complete installation weighing but six pounds, without batteries, they have 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 which threads and left correspond extending engraved plates, bearing all of 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 snap back to the central vertical position. The twelve instructions themselves, neatly lettered, have been chosen with great ingenuity and are so placed that actual air work necessitates the use of only two of the directions, placed by each of the keys, at the same time. The case itself can either be fastened by the side of the instructor, or

NEW METHOD OF MEASURING PRESSURE OF LIGHT.

In a paper to the Physical Society, Mr. Gilbert D. West describes the measurement of the pressure of light by a method requiring few of the elaborate precautions generally necessary, and is simple. 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 measureable deflection of the end.

The pressure of normally incident radiation on perfectly reflecting surfaces has been shown by Maxwell and others to be numerically equal to twice 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. A 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 gas action; but, as gas action had to be taken into consideration, 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 means of an attached copper eureka thermo-junction. Due allowance was made for cooling corrections, 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 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 142)
NEW TELEPHONE SIGNAL A PATIENCE SAVER.

Patience vanishes rapidly while holding a telephone line. Save your time and attend to other important matters while waiting for the other party to resume conversation, say the sponsors of the new Hold-the-call-signal here illustrated. This clever device will let you know when the speaker is ready. No electrical connection is needed. It simply 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 discs form in 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:

Water or Surface Waves, in which the elliptical motion of the particles of water, the advancing of the crest tendency to form breakers, the recession of the trough tending to form the undertow are exhibited.

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.

Ether 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 lately 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. This 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 irons 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 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 flows to 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.

Comparison of Phases. The apparatus admits of a ready comparison of similar phases in the three systems of wave motions, a very desirable feature not possessed by any other form of wave machine. By means of the covers resting upon the framework of the apparatus any one or two of the wave systems may be hidden from view, thus leaving the remainder for special examination when desired. The front of the apparatus exhibits the conversion of rotation into direct and lateral reciprocating rectilinear motions. On the back, the action of the crank handle, the rod connecting the individual cranks, and the operation of the shocking parallel rule mechanical motion, first used in this apparatus, are clearly exhibited. Its large size is especially advantageous, since the wave forms can be clearly seen across a large lecture room.

AN AUTOMATIC EXTENSION REEL FOR DROP LIGHTS.

The automatic extension reel here illustrated is intended for drop or portable electric lamps. It is simple in construction and positive in operation.

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 fastening 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) merily 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 by which to select experiments for public lecture demonstration. In his lectures 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 Ethereal Force—and with matter of a supergaseous 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 super-normal 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 ½ 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 ½ K.W. transformer is used instead of the heavy 1 K.W. (See Fig. 2.)

The writer also employs a standard Clapp-Eastham ½ 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 quinine 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 quinine solution with a pale blue light, the fluorescein with a beautiful apple-green. The di-charge 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.)

Photos from Jacques Toorx

The "Efflueve" or High-frequency Brush (or Spray) Treatment Has Proven Highly Efficacious in the Treatment of Nervousness (Nerve and Brain Exhaustion)—"Neurasthenia." American Electro-therapeutists Find It Very Valuable.
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. "Diathermic." 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 "case-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 "D'Arsonval" 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 nickeld wire will answer). In this way the current is distributed to the skin over the affected part for from five to twenty minutes, a very short spark-gap being used with the local effects from the vacuum electrode.

For the past few years the writer has been in the habit of connecting the Tesla coil with an Auto-condensation pad (as used in the "D'Arsonval" and "Diathermic" methods). This is formed of two plates of Bakelite, ¼-inch thick, hinged to the seat and back of an ordinary chair. To the back of each plate is cemented a sheet of tin or copper foil, covered with leatherette. Suitable flexible conductors connect these metal plates with each other and with the Tesla terminal. This folding pad may be used in both "Tesla" and "D'Arsonval" treatment, and is quite as efficient for ordinary use as the cumbersome and expensive condenser chair or couch.

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, smooth "effleuve" or purple brush discharge, when the electrode is held from four to eight inches from the patient.

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 ozone-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 central station. The effect therefore, is not merely superficial but systemic as well. Tuberculosis, etc. (Continued on page 122)
HYDROSTATICS.

LESSON FIVE.

WATER is so plentiful, and we are accustomed to use so much of it, that very few of us ever stop to 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 to keep forever the WB Beach or "the old swimming-hole in the creek"? We naturally ask what is water anyhow? One could never guess the answer. Water is nothing 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 held in the water after being inverted full of water and are placed over the electrodes, immediately, and with a rapidity dependent upon the strength of the battery used, bubbles will form at the electrodes and rise to the top of the test tubes. These bubbles are the result of the decomposition 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 tube as in the other. Call the 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, which is 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 of different levels. A is higher than B. The vessels are connected by a piece of tubing: bb' indicates the level of the top of the tubing and aa' the level of the base of the tube. A, bb' indicates the level of the end of the tubing. If the tube is placed in position as indi

ated in the figure, and A contains water (or any liquid) at a level aa', nothing happens. However, 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 upward pressure in the short arm of the tube, is due to the atmospheric pressure (dissect in the last two lessons). In the tube b, this pressure is equal to the atmo-

spheric pressure minus the downward pressure due to the weight of the column of water ab. 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 corres-

ponds to the weight of the column a'd. Evidently if a were at the level aa', the siphon would not operate; and if above aa', 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 interested should make one. 6, is a piece of lamp chimney about 3 inches long, 5, is a piece of glass tubing about % 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 b, should be about a foot and a half. 1, is a small hole drilled thru the lamp chimney 6. 5 and 4, should be about % 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 rushes up 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 said 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 Relays, 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 equipped 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 star stations 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. 448 South Emerson Street, Denver, Colo. Mr. Doig 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, altho 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 shift 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 its 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 18th, 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 long wave position in the Washington's Birthday Relay of February 24th, 1917, and without the assistance of this station it would not have been equipped with what 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 throughout the United States can well pattern their installations, as far as general arangement and efficiency is concerned, after Station 9ZF. Another point in favor of 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 coupling for reception of long wave stations like WY, GW, SL, OUI and FOZ, as well as the Government are 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 regenerative 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 but what have had the chance to read about this outfit.

The 1 k.w. outfit which is used mostly, radiates from 12 to 14 amperes on a wave length of 425 meters, and the oscillation transformer is made with edgewise 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.

This station has been working regularly with amateur stations on both the Atlantic and Pacific coasts. Working with GEA in Los Angeles, Cal., has been a continual 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 wireles 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 one's 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 through the country and are now assigned to the various war-ships, we will continue these write-ups each month, with something of interest to them, and something to remind them of home and

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THE ELECTRICAL EXPERIMENTER

June, 1917

RADIO
DEPARTMENT

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 any 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 all 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 landsman for electrician (either general or radio) and are detailed for a course at the Electrical School. The pay of landsman for electrician is $17.00 per month while under instruction and in addition he is furnished with a complete outfit of uniform, board lodging, text books, tools, and materials with which to work. The length of the course is about eight months. Upon completion of the course the men who are qualified are given the rating of electrician third class (radio). In both courses the following subjects are covered: machine shop work, electricity, magnetism, alternating currents, dynamos, motors, and batteries. It also embraces the principles and management of radio stations and installations. The general course covers the application of electricity to shipboard appliances.

Competent operators of the Morse code or men with a sufficient foundation in radio telegraphy may be enlisted as landsman for Radio Electrician. The applicant must be able to take dictation at the speed of twenty-five words per minute and pass a creditable examination in spelling and penmanship.

The problems in arithmetic include multiplication, division, simple proportion, percentage 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. The applicant must be able to receive about twenty words a minute.

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 landsman for electrician or 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), $60 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 the transmitting 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 buzzer of the receiving set. A set of binding posts are furnished for connecting the aerial and ground with the set, and these are seen at 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 radiophone we find that Messrs. Wichi

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 transferred, if he desires, to such rating in the general service as he is qualified to fill or he will be discharged from the Navy for inaptitude.

(Continued on page 153)
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 and motion device used for timing unskilled persons out of their savings, 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 latches and clasp. It must have cost at least $800, according to the estimate of experts.

As soon as Sergeant Pierce recognized the circuit 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 sputtering and flashing sparks that attend the operation of wireless outfit were in evidence.

Wax persisted, despite the effectiveness of the demonstration, in his assertion that the batteries, tiny dynamo and inductance coils were placed in the box by him to make the apparatus "look pretty." Eventually he said he intended to use them to give color to a motion wireless 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 the 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 "Frank" and had met him only a few times.

When the examination of Wax had proceeded that far, the chief radio officer of the federal government for the New York district, arrived at Police Headquarters. He examined the apparatus contained in the box carefully and then verified Sergeant Pierce's declaration 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. Kramp and the police declared 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 expressed 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 transformator, both of which would be necessary. The machine itself was to be used for sending wireless messages. Wax, however, is described by persons who stayed in the same quarters 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 fudgered several parts of the mechanism for a moment or two and then succeeded in causing a short circuit, which effectually 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. Hamburger, of the German Consul's offices, 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 disclosed by the police that Wax received some of these papers from 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.**

One-fourth of all the fires occurring in Watertown, Conn., for a year might have been avoided by the use of electricity, according to the report of Fire Chief Heitman.

**A NEW VACUUM CURRENT GAGE FOR RADIO.**

Hereewith we present the vacuum amperage 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 maximum current gage to indicate the condition of synergy 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

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**U.S. Government and Police Experts Were Much Surprised to Find That the Cabinet Here Shown, Which Was Recently Seized with Max Wax, a German Spy, Was Capable of Receiving Secret Radio Messages from Germany.**

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 found the police had learned the real nature of the intricate contents of 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 one-thousand dollar bill in the "press" 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 after Wax was arrested the police learned that he had sold the box in a machine shop in New York City. The police finally located the box in a trunk which they said was equiped 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 defence
rotation of which is controlled by a spring acting against the tension of the filaments. When a current passes thru the filament, 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 sensitiveness 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 that 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 using a long instrument.

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 this 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 maximum reading. In this way the point can be tuned rapidly as well as accurately.

**MISS WINSIFRED DOW A RADIO ENTHUSIAST.**

Miss Margaret L. Campbell, of Rockport, Mass., has long been a Radio Enthusiast and Has Operated the Apparatus Shown on Frequent Occasions Made on Her Father's Yacht. She Has Achieved a Distinct Success with Her Station, Having Become Thoroughly Conversant with All Radio Matters.

**‘THE CRUISE’—A RADIO STORY.**

By MARGARET L. CAMPBELL.

Early in August, 1916, I transferred my wireless set from my radio station to my father’s new sixty-foot yacht, the Wabash. She is a flush deck cruiser with all modern improvements and powered with a large four-cycle 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, Ferron, 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," when 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 equipped 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.

I regarded 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 THE ROYAL YACHT.**

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 receiver consists of a type "106" tuner and a crystal detector. This receiver 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 of 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 sensitivity. A battery furnishes current for both 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 Units varies the inductance in one-turn steps. The switch marked Transformer Secondary 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 as a condition. It is often found advantageous 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 marked Potentiometer varies the current thru the crystal detector. The detector is situated between the coupling and condenser handles. A switch marked Battery is provided, so that the crystal may be used either with or without the battery. A buzzer is mounted on the front of the panel and is operated with a button marked Test. Terminals are provided to connect to the battery; they are marked Battery. Two terminals are provided for connecting to the telephone receivers, and are marked Telephones.

The internal as well as the external connections of this receiver are shown in Fig. 3. Fig. 2 is a back view of the panel.

This hook-up is of interest to all radio amateurs and students who expect some day to become commercial operators. Among other things, note that the buzzer test is linked up with the aerial-ground circuit inductively by a iron core transformer. Note how the secondary coil is marked in and out of the primary by a rack and pinion arrangement, giving great precision to the coupling adjustments as well as rotary control.
The How and Why of Radio Apparatus

NO. 4—SPARK GAPS.
From time to time we have described one particular instrument used in either the radio transmitting or receiving circuit, explaining the way it works, and why. We have received so many requests from new readers asking for such explanations, that we have decided to publish this matter in serial form. In the course of several issues all of the principal transmitting and receiving apparatus will have been covered. The fourth issue for the fourth paper is the SPARK GAP.

The spark gap forms one of the most important 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 tone and a number of other vital points.

The proper size of the spark gap in an oscillatory circuit is to allow the condenser in the 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 exhausted. 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 the piece of apparatus perform its function. While 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 say sixty ampere passes across the gap. If the spark length is about one and one-fourth inch, the resistance with the same oscillatory current flowing, can be taken as approximately proportional to the spark length. However, in a condenser circuit the quantity of electricity is stored up in the condenser, and in consequence, the amount of oscillatory current is increased 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 occurs, and if this metallic vapor is not quickly removed from the gap, the insulation in consequence be 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 may indefinitely 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 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 any larger than a single electrode point on the rotary disc.

One of the most efficient spark gaps used very successfully by commercial stations, 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 semi-circles. 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 air-tight. Further, not over 1,000 to 1,200 volts should be applied to each individual gap, and for high efficiency 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 similar manner by Mr. Charles R. Till, in The Electrical Experimenter, in the March, 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 out, resulting in a partial vacuum in the gap. This conduces to the rapid quenching of the spark at the discharge, due to the condenser, and gives rise to a very ideal set of conditions for the most efficient radio transmitting circuit, and it is because the oscillations in the spark gap-condenser circuit are cut off after the first few beats of 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 upon the secondary circuit—a condition which is invariably found in ordinary radio transmitters fitted with a short spark gap, and a condition which mitigates seriously against the best efficiency of such an equipment. The quenched spark gap usually consists of a number of gaps built as above described, which are placed in a suitable frame so that considerable me-

(Continued on page 153)
The Clock Craze
By Thomas Reed

Being cooped up in a flat, late years, I've had to give up experimenting. Mine's a nice 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 EXPERIMENTER. 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 everything 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 came to the electric clock, though, that nearly beat me. There's a thing that looks easy, and isn't; 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 turned 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 all 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 accurate 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


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 pawi 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 up 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 been 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—I had hated to, they looked so pretty—and with my pendulum swinging easily from a spring, I looked to see her go. But no! Good strong magnet, clean contacts, and
THE ELECTRICAL EXPERIMENTER

June, 1917

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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 it possible to make ready-to-use heater sections for electric heating stoves and opens to them a much wider field of usefulness than has hitherto existed. The tungsten and molybdenum ribbon is made in widths of about $\frac{1}{6}$ (6.35 mm.) and in lengths of several yards. In this shape the ribbons ought to be ideal material for the manufacture of heaters 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 wireless outfits to be used on its Mosquito Fleet.

KINKS FOR THE DRAFTSMAN.

The first "kink" shown is a new section-liner. There are a great number of appliances on the market for this purpose, but the one described will do the same work as the most expensive device, its advantage being simplicity. It consists of a sheet of celluloid cut as shown. The parts shown in black are cut away with a sharp knife, leaving a kind of grid. To use this section-liner, 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-liner, 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, fastenings, etc., that are used over and over again in numerous sizes on a sheet of tracing cloth and ink it in. It will make a mark, in the case of nuts and bolts, from where you strike the radii; see point "X" of line "7." "X" 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 hundred bolts, bearings, screws, detail work, etc., the savings of time will be several hours and a much neater drawing will be 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)

THE change in resistance of crystalline selenium and other light sensitive substances, such as sibunit, cuprous oxide, etc., under the action of light and other radiant 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 oxide, 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 -0.04 volt. At about -0.5 volt, i.e., the surface becomes more negative on being illuminated. With cuprous oxide, of which but one specimen has been examined, 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 and a lamp voltage of 25 volts (normal 110) the change amounts to about 0.005 volts, yet at 110 volts, at which 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. Pfund, of Johns Hopkins University. According to this theory, the effect of light is in the nature of a photoelectric phenomenon. In other words, of the atoms of selenium exped 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 above mentioned inadequate. An hypothesis which better fits the facts is that contained in a theory recently given the subtitle by Professor H. 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, or, in other words, it decreases the potential energy of the electrons in the inter-molecular space.

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. To give the name "Helium". Helium was discovered on the earth in 1895 by Ramsay and Tatlock.

Iodination Method of Measuring Contact Potential. This Method is Also a Null Method as the Diagram Indicates. It Is a Copper Strip Coated with Polonium, the α-Particles from Which Ionize the Air Above the Selenium, etc., But Do Not Strike the Selenium Surface. In the Other Method, A Brass Gauze Connected to the Electrode.

Travers, who obtained it by heating the rare mineral Cleveite, to which it was then found that this element is a companion to Arlong. Lastly, it was also discovered in the atmosphere.

Helium has an atomic weight of 4.00 and is monatomic, i.e., that is—the helium molecule consists of only one atom. At ordinary temperatures, helium is a colorless gas; it boils at about 269°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 remarkable. A new light was thrown on the 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 ejected, the substance changes into a new and different element: this is known as the phenomenon of radioactivity. Upon looking for a disintegration product, the presence of helium is noteworthy, for helium is found in minerals. Rutherford and Soddy suggested that helium might be a product of disintegration. Ramsay and Soddy made about 250 grams of radium bromide and dissolved it in water. Radium bromide 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 bromide was...
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 Olden coil will be the best for all-around work, and it may be made in the following simple manner. Procure an ordinary pasted mailing tube, about 2½ 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 coil 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 tin-foil, and placing them in a cigar box, to hold them in an upright position. A spark gap of any type will answer. A 1½ 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, upper 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; 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 headache 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. Insulate 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 high 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 possess. 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

June, 1917

By Prof. I. Thornton Osmond

A RESEARCH PROBLEM AND OUTLINED SOLUTION.

SUPPOSE all the electrical energy
erised in the world for power, heat
and light. What is the gain? How
the world would be changed.

Energy in electrical form, of limitless
amount and absolutely free, is falling over
to a world provided with apparatus and appli-
cances for the use of electrical energy. But
the world does not use this constant, ex-
hensive, and inexhaustible source of energy; it gets cool
out of the earth and depends on that for its
power, heat and light.

The answer any experimenter can seek is the direct utilization of solar
energy as the source of power for the
world's work.

The following outline of experimental research may enable sone
circumstances that they
make the discoveries, to make
this discovery. In this work I seek to
obtain energy from solar radiation, by
casting it to produce
orderly acceleration of electrons about, and in, a con-
ductor—electric
current.

Problem:—To Obtain Electrical Energy "Directly" from Solar Radi-
ation.

1°. The solution here proposed is based on the following principles:
1. The solar radiation is electromagnetic.
2. The flow of energy is in the direction of propagation, even
periodic action, vibration, is at right
angles to the radiation, and is cyclic
variations of two vector magnitudes, elec-
tric, and magnetic force. 4. Solar
radiation produces acceleration in electrons in
a direction that has the component of motion in a
certain relation to it. 5. Acceleration of an electron produces an (opposite)
acceleration of surrounding electrons.
6°. The experimental solution is rendered
difficult by the complexity of the sol-
lar radiation. Take a small area in a plane
at right angles to the solar beam. At every
instant there are passing thru this waves of
millions of different lengths and periods, and at every instant they are inversions of
different phases, and the electric and mag-
etic vectors in these waves at any instant
are in millions of different directions and
continually 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 con-
formed to one direction may be obtained by
the use of a single mirror, or a pile of
plates; or to two directions, giving elliptic
resultant by an additional mirror or a
rhomb.

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, sperical or circular, 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, or on 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 in-
stant has values that vary from zero to
four times that of the single beam.

7°. Take a vessel with water readily
versed by the solar radiation and that may
be exhausted to high vacuum if desired, and
bring into this vessel electrodes to receive the radiant energy

Fresnel Mirrors, one 40x40 cm., the other
40x80 cm.; the latter serving for a Lloyd
Grating, 25 cm. wide, 40 cm. long; small
angles 7°, large angle 166°. 3. Polarizers,
selecting metal plate, plate of glass or
sulfur; fine grating; Fresnel Mirror, 80
5. The transferring, or receiving, apparatus
described in 7 above (which may not be
necessary). 6. Accessory, such as cap-
cacity, resistance, inductance, and indicating
instruments.

Wherever wave length enters into the
design of these pieces of apparatus it is
taken as from 0.6 cm. to 1.2 cm., as being
the lower limit of waves well above the
longest heat waves, i.e., waves producing
molecular motion. Greater wave
lengths, with corresponding changes in de-
sign may be found to give better results.
10°. Apparatus Combined For
Experiments, consisting of various kinds of
radial beams. 1. Grating, Lenses, or Lens. 2. Grating, Polarizer, and
Filter. 3. Grating, Polarizer, and Lens. 4. Grating, and Ellipsio-
er. 5. Grating, Polarizer, and
6. Lens and Biprism or Lens and Mirror. 7. Grating, Lens and
8. Grating, Polarizer, and

For this work it would be desirable, perhaps necessary, to have a complete-
metal iron enclosed in the space
of the room in this case is not available, an
iron case 24 meter (m.) long 0.5 m. wide,
0.8 m. high will contain the part of the combina-
tions of apparatus given above and the
transferring, or receiving, apparatus. The mounting of the complete apparatus should permit following the sun or directing
any point within 90° of it.

An electrolytic process of deoxidation has been patented in the United States by
Pascal Marino of London. The objects to
be treated is made the cathode in an elec-
trolyte containing phosphoric acid. In ad-
dition to its normal function of carrying
the current, this acid acts as a solubility for metal
rust without attacking the steel or iron
body beneath. It is in this last detail that
its chief availability lies, since nitric, sul-
furic or hydrochloric acids would not dis-
play such moderation. Finally the phos-
phoric acid is beneficial in preventing sub-
sequent further rusting.

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

Due to the advent of the war, we are
particularly desirous of obtaining manus-
cripts describing original, and practical
"Electrical Experiments," and we shall continue to publish Radio articles, but
what we need is snappy "Electrical" articles. Be on guard for the enemy—
Repetition!
HOW TO MAKE IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.

The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly prize of $3.00 is awarded. For the second best idea a prize of $2.00 is awarded, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

**FIRST PRIZE, $3.00**

**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 Cuts Thru the Second Gong 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 E 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.

**SECOND PRIZE, $2.00**

**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 C. F is an electro-magnet wound with No. 12 silk insulated magnet wire. The magnet F is always magnetized from an electric bell. The spring G, and the adjustable 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 C. 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.

**THIRD PRIZE, $1.00**

**THE SIMPLEST FLASHLIGHT.**

Here's the simplest flashlight one can make: A flash 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.

**WALNUT STAIN.**

The following stain is excellently adapted to the finishing of wireless and electrical cabinets and instruments, and for various other wooden articles which is desired to have a uniform color or finish.

Prepare a solution of 6 ounces of a solution of potassium permanganate, and 6 ounces of sulfate of magnesia in 2 quarts of hot water. The solution is applied with a brush and the application should be repeated. In contact with wood the potassium permanganate decomposes, and a lasting walnut color results. If small pieces of wood are to be thus stained, a very dilute bath is prepared according to the above description, then the wooden pieces are immersed and left in the solution for from 1 to 5 minutes, according to whether it lighter or darker color is desired.

Contributed by ALBERT W. WILSON.

**ELECTRIC FURNACE MADE FROM PLUMBAGO CRUCIBLE.**

An interesting and practical electrical furnace can be made of a plumbago crucible (used by jewelers) 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. But some method 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.

Contributed by TOM RIEBE.
"ELECTRO"

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.

Can you qualify? Can you send and receive at the required speed, when your country calls you?

The Radiotone Codegraph is positively the only instrument made that will send such an unbelievably close imitation of a high pitch Radio Station, that it has baffled experts. The outfit replaces the old-fashioned learner's outfit, consisting of key and sounder. The Radiotone Codegraph comprises our famous Radiotone High Frequency Silent Buzzer, a special loud talking receiver with horn, and a key all mounted on a base. Operated on one or two dry cells, the phone will emit the characteristic high pitch sound, which while not harsh, is heard all over the room. With little trouble you can learn the code correctly in 30 days—

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. 600 sold in New York in 10 days. Get our proposition today!

Radiotone Codegraph complete as described, each, IMMEDIATE SHIPMENTS $1.75

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 button-níere 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 flash-light) $0.60 (postage 10 cents), be connected to any 2 cell flashlight.

Illuminated flag, flashlight case and battery, cord and plug, complete as per illustration, $1.00 (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 IMPORTING CO.
The “Electro” Rheostat-Regulator

(Product Base)

This illustration represents our little current
regulator which is used everywhere to regulate
battery currents. It will prevent the burning out
of your battery luggers, or will regulate the speed
of your motor, etc.

It makes an excellent automobile lamp dimmer,
where it can be turned down to the point of the
lamp, or to any degree of brightness.

This little instrument is to be shipped
ENTIRELY
OF PORCELAIN, metal and hard rubber.

The resistance of our Rheostat is 10 ohms.

No. FK5000. Rheostat Regulator. Price $6.00

IMMEDIATE SHIPMENTS

“Electro” Pony Receiver

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

Points of superiority:

Hard rubber composition: a shell beautifully
polished. Powerful
magnetism; an elastic spring; a strong
iron core; fibre leads; very thin dia-
phragm; brass posts. It also

No. FK 1024

“Electro” Pony Receiver

IMMEDIATE SHIPMENTS

The “Electro” Radiotone

HIGH FREQUENCY SILENT TEST BUZZER

The RADIOTONE IS NOT a mere test buzzer,
but is infinitely more. Mr. Gernsback who de-
signed this instrument labored incessantly to
produce an instrument which would imitate the
sound of a high-power Wireless station as heard
in a set of phones. This actually has been
achieved in the RADIOTONE.

This instrument gives a wonderful high pitched MUSICAL NOTE
in the receiver, impossible to obtain with the
ordinary test buzzer. The RADIOTONE is built
entirely new lines; it IS NOT an ordinary
buzzer, but constructed in some manner. The
RADIOTONE has a single fine steel reed vibrating
at a remarkably high speed, adjusted to its
most efficient frequency at the factory. Hard
diamond contacts are used to make the instrument
last practically forever.

Yes, the RADIOTONE IS SILENT. In fact,

No. HK 1800

HERCULES DYNAMO

The Hercules Dynamo is a

name: shipping weight, 40 lbs. Price... $17.50

We carry these machines always in stock and

HERCULES DYNAMO

name; shipping weight, 40 lbs. Price... $17.50

We carry these machines always in stock and
can make immediate shipment.

BNDING POSTS

No. B-1

Each $0.15

Weight

2 lbs. per doz.

No. B-3

Each $0.05

Weight

2 lbs. per doz.

No. B-8

Each $0.10

Weight

2 lbs. per doz.

No. B-11

Each $0.15

Weight

1 lb. per 12.

No. B-12

Each $0.15

Weight

1 lb. per 12.

No. B-27

Each $0.07

Weight

1 lb. per 12.

No. B-28

Each $0.07

Weight

1 lb. per 12.

No. B-25

Each $0.07

Weight

1 lb. per 12.

No. B-6

Each $0.15

Weight

1 lb. per 12.

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THE ELECTRO IMPORTING CO.

231 Fulton Street, New York City, N. Y.
A NOISELESS "ALARM" CLOCK.
By K. M. Coggeshall.

Have you ever stopped to wonder what your friend in the next room thinks when your discordant alarm clock rings each morning? Have you ever wished you had some method of waking yourself without disturbing your neighbors? Perhaps you may arise at five-thirty in the morning while the rest of the household do not find the necessity of opening their eyes 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 before-dawn start on a fishing expedition but do not want 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 and mounted in its rear end the clock 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. 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.

The spot light is then so adjusted that the full power of the light can be concentrated on the face of the sleeper. The alarm should be wound and adjusted as usual.

When the predetermined hour has ar-
Experimental Chemistry

By ALBERT W. WILSON

Thirteenth Lesson

ACIDS, BASES AND SALTS. (Continued)

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

chloric acid \([\text{HCl}]\), from which only one replacement is possible. Di-basic acids contain two hydrogen atoms, as Sulfuric acid \([\text{H}_2\text{SO}_4]\), from which two replacements are possible. Tri-basic acids contain three hydrogen atoms, as Phosphoric acid \([\text{H}_3\text{PO}_4]\), from which three replacements are possible. Penta-basic acids contain five hydrogen atoms, as Perchloric acid \([\text{HClO}_4]\), 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, or Hydrochloric, acid can form but one salt with Potassium Hydroxid, the reaction being:

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

Potassium Hydroxid

Nitratic Acid

and

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

Potassium Hydroxid

Hydrochloric Acid

Chlorid

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 \([\text{H}_2\text{SO}_4]\) has been found to have the power to form two salts with Potassium Hydroxid \([\text{KOH}]\), in one of which there is twice the amount of the metal as in the other. The reactions being:

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

Potassium Hydroxid

Sulfuric Acid [Sodium Sulfate]

and again:

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

Potassium Hydroxid

Sulfuric Acid [Sodium Sulfate]

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 used, 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 \([\text{HCl}]\) as in Nitric acid \([\text{HNO}_3]\), 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 \([\text{H}_2\text{SO}_4]\) 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, \(\text{MHSO}_4\), 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-, Tribasic, Tetrabasic, etc., with the basicity of the acids, but as these names represent the number of hydrogen atoms in the molecules, it may be well to memorize the following:

<table>
<thead>
<tr>
<th>Acid Basicity</th>
<th>Names</th>
</tr>
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<tbody>
<tr>
<td>Mono</td>
<td>Mono</td>
</tr>
<tr>
<td>Di</td>
<td>Di</td>
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<td>Tri</td>
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<td>Tetra</td>
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<tr>
<td>Penta</td>
<td>Penta</td>
</tr>
</tbody>
</table>

Sodium Hydroxid solution in an evaporating dish, and immerse it 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 case, add a little more Sodium Hydroxid, by allowing to drop 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 gauze 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 reaction of the reaction which took place between the Sodium Hydroxid and the Hydrochloric acid when neutralized was:

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

We perceive from this equation, that the hydrochloric acid no longer is contained in the solution, and that the Sodium \([\text{Na}]\) 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 Hydro-

(Continued on page 127)
Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry. We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

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 agencies of co-0.10 power, I am sure the following mixtures will prove most convenient.

1. Nitrates of ammonia, carbonic acid of soda and water, equal parts by weight; the thermometer sinks 57°.
2. Phosphates of soda, 9 parts; nitrates of ammonia, 6 parts; dilute nitric acid (1 part, water 2 parts), 4 parts. Reduces the temperature from 40° to 21°.
3. Salt 5 parts; nitrate of potash, 5 parts; sulfates of soda, 8 parts; water, 16 parts. Reduces the temperature 40° to 70° to 24°. This latter is very cheap and easy to procure.

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

1. Finely powdered ice, 2 parts; salt, 1 part. This is a very common recipe.
2. Finely powdered ice, 2 parts; crystallized chlorate of calcium, 3 parts.
3. Finely powdered ice, 7 parts; dilute nitric acid, 4 parts. This reduces the temperature from 22° to 30°. The temperature remains uniform, and easily procured. The materials should be kept as cool as possible.

Contributed by MIX-ARD ROTE.

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

Do you require a work table, especially those working with the various chemical reagents, desire some coating for the work table that is impervious to both acid and alkali 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.

Solution 2. Aniline, 12 parts; hydrochloric acid, 18 parts; water, 100 parts, or aniline hydrochlorate, 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 washed with water, and from the aniline. Next, apply the two coats of the solution No. 2, and water the work permitted to dry thoroughly before the application of the solution No. 2.

Next, two coats of solution No. 2 are applied, and the wood permitted to dry thoroughly before the application of another coat of oil. In this way the table is im pervious to the action of oil paints, and will be beautiful and of much advantage in a laboratory.

Contributed by ALBERT W. WILSDON.

RECIPIES FOR KILLING FLIES.

The United States Government makes the following suggestion for the destruction of house flies: Formaldehyde and sodium salicylate are the two best fly poisons. Both are superior to arsenic. They have their advantages for household use. They are not a poison to children, and they are convenient to handle; their dilutions are simple, and they attract the flies.

Preparation of Solutions: A formaldehyde solution of approximately 5 per cent. The correct strength may be made by adding 3 teaspoonsfuls of the concentrated formaldehyde solution, commercially known as formalin, to a pint of water. Similarly, the proper concentration of sodium salicylate may be obtained by dissolving 3 teaspoonsfuls of the chemical (a powder) to a pint of water.

A container such as shown below has been found convenient for automatically keeping the solution always available for flies to drink. An ordinary, thin-walled drinking glass is filled or partially filled with the solution. A small plate, in which is placed a piece of white blotting paper cut the size of the dish, is put bottom up over the glass. The whole is then quickly inverted, a match placed under the edge of the glass, and the container is ready for use. As the solution dries out of the sauce, the heat of the sides of the glass is broken and more liquid flows into the lower receptacle. Thus the paper is always kept moist.

Other Simple Preparations:—Any odor pleasing to man is offensive to the fly and vice versa, and will drive them away.

Take five cents' worth of oil of lavender, mix it with the same quantity of water, put it in a common glass atomizer and spray it around a room where flies are. Draw the door and window tightly, or in the dining-room spray it lavishly even on the table linens. The odor is very disagreeable to flies but refreshing to most people.

Germasil, mignonette, heliotrope and white clover are offensive to flies. They especially dislike the odor of honeysuckle and hop blossoms.

According to a French scientist, flies have intense hatred for the color blue. Rooms decorated in blue will help to keep out the flies.

Mix together one tablespoonful of cream, one of ground black pepper and one of brown sugar. This proviso is poisonous to flies. Put in a saucer, darken the room except one window and in that set the saucer.

To clear the house of flies, burn pyrethrum powder. This stupefies the flies, but they must be swept up and burned.

Receipts for Stables, Barns and Out-of-doors:—Borax is generally used on farms and out-of-doors. One pound of borax to twelve bushels of manure will be found desirable in preventing jarring its manurial qualities on farm stock. Scatter the borax over the manure and sprinkle with water.

Lime, chloride of lime, or copperas (sul fate of iron) dissolved in water, crude carabolic acid, or any kind of disinfectant may be used in vats.

HEKTOGRAPIES.

What are they, do you ask? The Century Dictionary defines it as follows: "A copying process by which the writing or drawing to be copied is made on smooth paper in aniline ink, and is then pressed upon a slab coated with gelatin, to which a part of the ink is transferred by which from a number of duplicate impressions can be made; also, the special application of chemistry to the copying of text or drawing, using successfully and agreeable to this contingency, we have some students who want a number of copies of text or drawing, are using successfully.

Contributed by ALBERT W. WILSDON.

Receipt No. 1.—Soak an ounce of fish glue in cold water. Drain off the water; put the softened glue and gelatin in a double boiler and boil it, but do not bring it to a boil. Obtain six ounces of gelatin, warm it and add it to the melted glue. Add a few drops of carbolic acid. Mix thoroughly and pour into your pan. A caramel pan is best.

Receipt No. 2.—Add three ounces of water to 1 1/2 ounces of white glue. Heat in a double boiler until glue is melted. Then add six ounces gelatin and pour into pan. If too hard, add gelatin. If too soft, add glue.

Receipt No. 3.—Dissolve four ounces of gelatin in one pint of cold water; then add one pint of glycerin and pour into a double boiler, and when it comes to a boil pour into your pan. Mix with a non-poisonous

Ink.—Use hektograph ink and a coarse stub pen. See that every stroke of the pen leaves a metallic luster when dry, else the work will not take. When the ink is dry, lay the face of the sheet which you have written or drawn, down on the h科教仪 plate, and then gently over the whole surface with the hand or soft cloth. After from two to five minutes (according to how many copies are desired) gently peel the paper off.

From the impression thus made, reproduce all the copies desired, laying one sheet on the other, and thus a number of impressions around the whole surface of the paper are made. This will remove them.

Hektograph ink all prepared may be bought, or your druggist will put it up for you. The following is the receipt.

Contributed by F. H. SWEET.
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 War—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 inch spark coil, run by six V. 60 A.H. 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 Mrs. Thordarson transformer, K.B. preventer, commercial key, home-made condenser, Helmi 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 the panel has not been completed two years yet, I think that Evans- ton, Wyo., is a pretty good distance to transmit for the short time I have had it. Here's wishing the Experimenter prosperity in its chosen path.

Cedric E. Hart
Salt Lake City, Utah

THE MONTANA WIRELESS STATION OF HOWARD PASCOE.

I offer here with 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 2,000 to 4,000 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 Z7C, Z7N and many others.

I have a little sub-station up in the mountains, 6,555 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.

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 'phones, Blitzen tuner, Blitzen variable, Chapp-Eastham tubular fixed condenser, Turney variable condenser, and an Audion cabinet.

My transmitting outfit comprises a 1 K.W. Thordarson transformer, K.B. preventer, commercial key, home-made condenser, Helmi 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 the panel has not been completed two years 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 Experimenter prosperity in its chosen path.

Cedric E. Hart
Salt Lake City, Utah

Uncle Sam May Find the Amateur Radio Station of Howard Pascoe, butte, Montana, of Valuable Assistance.
A PROGRESSIVE CHICAGO RADIO EXPERIMENTER.

My receiving set included a 1/2 K.W. Blitzen transmitter with rotary spark gap, op- erated on 110 volts A.C. with a lamp bank in series. Receiving set is result of reading Modern Electrics and The Electrical Experimenter for over 25 years and is home made.

The receiving transformer is designed for 3,000 meters with two variable condensers: one across secondary and one shunted across transmitter. I have two crystal detectors, Ferron and galena, operated with a three point switch. Also a three element vacuum detector for long range work. The two D.T.D. switches on each side of Audion make a complete switch-over from crystal to Audion apparatus. Also to amplify weak signals there is a Multi-Valve Tone and 2,000 p. station call 9NV.

A. R. R. GATES

AMATEUR HEARS SPY RADIO CODE.

Federal authorities hope to locate the sender of mysterious letters to German spies thru the disloyalty recently of Malcolm Ronberg, who has (or had) an amateur radio plant at his home, 6220 University Avenue, Chicago, Ill. Ronberg failed to obey the government mandate to dismantle radio stations. He decided to cease before complying.

There was no sound for several minutes, then a peculiar unfamiliar call, repeated over and over again. Then there followed an even stranger grouping of letters, a code message.

Ronberg hurried to the federal building, confessing he had been listening and turned over the message. It was sent to federal operators at Great Lakes station. They, too, failed to make out the fact that Ronberg received it in his small amateur station has helped the searchers to trace it. Ronberg was promptly arrested to dis- mantle his plant by midnight or go to jail, and a squad of detectives was hurried out under orders of John C. Dillon, chief radio inspector of Chicago.

Young chickens treated with electricity by a London experimenter grow more rapidly than those raised without treatment.

FORT WAYNE RADIO ASSOCIATION OF INDIANA.

The Fort Wayne Radio Association of Indiana began the New Year with the installation of the following new officers: G. Carter, President; R. Parrin, Vice-president; D. W. May, Secretary and F. Hall, Treasurer.

Fort Wayne has had some very successful meetings during the winter months. Our best and most recent meeting was held last Wednesday night at 7:30. All communications should be sent to Harold Eppert, 641 South Avenue, Kansas City, Kansas.

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

The wireless club of the Y. M. C. A. recently sent out the scores of the basketball tournament. These scores were sent out three times a day, the closing one being after the lunch hour, 3:00 o'clock after the afternoon session and at 10:00 o'clock after the night session. The town which was.

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 our President to close all amateur or experimental radio stations and Letterhead, with no matter whether equip for transmitting or receiving licensed or un-licensed, and therefore we shall all have to abide by 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 a reference to any radio stations in the awarding of the monthly prize of $30.00 in this department. Now is the time to get busy and freshen up your electrical apparatus, and incidentally improve your understanding of electrical theory. Perhaps you have unwittingly slighted to a large degree in your pursuit of radio-telegraphic. Let her go boys!

One of the Honor Sets Among Chicago Radio Amateurs.

A. R. R. GATES is One of the "Old Guard Boys." Having been a Reader of "Modern Electrics."
experimental chemistry
(continued from page 123)

chloric acid, and proceed to neutralize them in the same manner. After they are neutralized, and after applying the litmus test, place in a clean evaporating dish and evaporate the solution to dryness. The equation for this reaction is practically the same except that Potassium is substituted.

Table of Valence

<table>
<thead>
<tr>
<th>Metal</th>
<th>Non-Metal</th>
<th>Radicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>As</td>
<td>S</td>
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</tr>
<tr>
<td>Si</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

As we have been constantly referring to metals, non-metals, and radicals in the preceding experiments, and neutralize the above table is given now, before the study of valence is taken up, that readers may refer to it when metallic and non-metallic elements are mentioned.

for the Sodium, As:

KOH + H₂SO₄ = K₂SO₄ + H₂O

Potassium Hydrochloric Potassium Water

Hydroxid Acid Chlorid

EXPERIMENT NO. 56

Dilute 1 part of Sulfuric acid with three or four parts of water, and place in a small-lit break or test tube as in the preceding experiments, and neutralize. When neutral, filter, and place in an evaporating dish and evaporate to dryness. Either of the following equations will take place:

KOH + H₂SO₄ = K₂SO₄ + H₂O

Potassium Sulfuric Potassium Water

Hydroxid Acid Sulfate

or

Zn + 2HCl = ZnCl₂ + H₂

The reaction for this experiment is:

Zinc Hydrochloric Zinc Hydrogen Chlorid

The gas which escapes from the tube is hydrogen, and by applying a lighted splint to the mouth of the tube exploding should be causes to occur. The product obtained in this experiment is Zinc Chlorid [ZnCl₂].

EXPERIMENT NO. 59

Pour about 10 cc. of dilute Sulfuric acid [H₂SO₄], made by pouring 3 or 4 cc. of strong Sulfuric acid to the water, about 10 cc. stirring the liquid constantly, and adding the acid in small quantities [Never add the water to the acid], on about 5 grams of cream and adding the silver nitrate solution, and by heat remove the solution from the base in order to produce better action. After the silver nitrate solution has been added for some time remove from the flame, and add about 5 or 10 cc. of silver nitrate solution, and by heat the reaction has been filer. After the water has been added to the solution, place in an evaporating dish and proceed to evaporate. The reaction for this experiment is:

Fe + H₂SO₄ = Fe₂SO₄ + H₂

Iron Sulfuric Ferric Hydrogen Acid Sulfate

EXPERIMENT NO. 60

Mix 5 cc. of water with about 5 cc. of Nitric acid [HNO₃], about 3 grams of copper scraps in a test tube and add the 10 cc. of Nitric acid, prepared as above. If action does not take place, heat gently over a Bunsen burner. A deep 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 evaporation is carried to dryness, the nitrate will break up into the insoluble oxide, which will manifest a black color. To avoid this action the liquid need not be completely evaporated but it may

(Continued on page 154)

"Man-Hunting" with the Electric Calling System

测评了"Man-Hunting" Machine。它可向最近的电话所询问。制造"Man-Hunting" Machine的目的就是给电报员的号码打电报。此系统使用在电压为300, 200, 100, 20 V。这个系统也是通用的，不论何处都可以使用，它总是安全的，因它有标准的信号。
An Electric Photometer (No. 1,216,446; issued to Clayton L. Lang.)

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 lens opening. The instrument comprises a suitable light filter and cooperating shutters, so that ordinary daylight may be properly compared 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 penetrate two special transparent blocks, they appear as one block; the two halves of the block perform balancing that natural and artificial rays are of equal intensity.

Antenna for Aeroplanes (No. 1,219,595; issued to Walter H. Hafeman.)

An improvement in design of wireless antenna for aeroplanes comprising a ballast or other mass supporting one or more insulated flag-top aerials. The "ground" element is compensated 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 correct design of aeroplane antenna, with respect to the proper maintenance and operating characteristics of the aeroplane itself and chains that his antenna to an aeroplane will not cause it to be unbalanced in flight or in maneuvers.

Pool Table Register (No. 1,230,438; issued to William H. Heffley.)

An interesting and practical electrical mechanical device for registering the results of a game of pool, etc., whereby the pool hallman, when he casts his form, into a pocket, closes an electrical contact. This causes a set of magnets to operate a pawl and ratchet with the indicated number of revolutions in the manner shown, and the dial may be marked off in inches or other style and color desired. The device can be attached to any pool table while the ball is in play, and each table pocket contains an electrical contact. Each table pocket is interconnected to the electrical solenoid shown.

Electrolytic Gas-Generator (No. 1,221,061; issued to Isaac H. Levin.)

Electrolytic apparatus designed to produce hydrogen and oxygen gases by subjecting water containing a small quantity of a suitable electrolyte, such, for example, as 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 gas oscillations will charge the aerial instead.

Oscillating-Current Generator (No. 1,221,634; issued to Lee de Forest.)

An improved method of developing powerful high frequency oscillations in a vacuum tube or not suitably associated with one or more oscillatory circuits. The invention provides an evacuated bulb containing many electrodes, which produce a vapor arc within the bulb. Two cold electrodes 9 and 10, are united, 9 being water cooled, and 10 being a benign hollow grid. An oscillating circuit is associated with the cold two electrodes 9 and 10. A second oscillating circuit is provided through inductance 20, and capacity 21. With the inductance, the oscillations produced in the first oscillatory circuit increased in intensity when the potential of the second oscillatory circuit is made equal to that of the first. The output or "loop" circuit comprises a ground 21, inductance 22 and aerial 23.

Combination Radio Receiver and Detector (No. 1,219,588; 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-case. 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 switch; the tuning coil is wound about the shell of the receiver and the detector is extremely small, being placed within the receiver-magnet-chamber shown. The device is held to the face and mouth in use, and the switch turned until the signal comes in the loudest.

Electric Land-Torpedo (No. 1,214,083; issued to Abraham Malt.)

A novel invention comprising an electrically driven or propelled land-torpedo possessing several unique features. As shown in the illustration, the design comprises two sections: the forward compartment containing the engine and detonating means, while the propel rear unit contains the electric driving motor and necessary gear. The land-torpedo is dispatched from a trench, and is under constant control of a soldier in the trench. It should prove useful in destroying barbed wire, and other impediments, as well as it was designed to give the desired spot, the operator simply pushes an electric button which detonates the explosive charge in the warhead of the torpedo, thus destroying the obstruction. The torpedo hurls its electric feed wires after it, as it ambles away from the trench.

Electric Gas Balloons for Submarine Torpedoes (No. 1,223,348; issued to Joseph A. Stetmers.)

Something quite new in the realm of war maneuvering and conducting a series of highly charged poisonous vapor balloons, which may be released to the exterior of the submarine, and which are automatically 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 balloons. These float to the surface and even the struck by shelling, they will proceed to liberate a cloud of deadly gas fumes, which are maintained in position by a cable as shown, so that they will not drift away before their task is finished.

Hood for Concealing Telephone (No. 1,221,045; issued to Lillian A. Scrajaburger.)

This invention provides a specially devised concealing hood for covering the telephone, known as "My Lady's Bonnet," etc. As shown in the illustration, the device comprises a wire framework provided with a plastic covering on the back and head. The attachment is suitably designed and the appliance is provided with a sliding curtain. To use the invention, the user simply grasps the skirt of the figure and turns the whole outfit about 180 degrees; then the rear curtain can be slid sideways and the receiver is seen from the hood.
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 duffers 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! We pay you $3.00 and grant you a Phoney Patent in the bargain, so you save $37.00! When sending in your Phoney Patent application, be sure that it is as daffy as a love-stick 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.

Phoney Patent Offizz

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 confined in solitary confinement throughout the world, that I, Salmon Taddeus Raphangr of the City of Rushour in the State of Deliriumtremens, have devised, designed, and developed an invention of the most far reaching con-

sequences to a long suffering traveling public.

It is a well known, altho deplorable fact, that the modern trolley car for economic reasons of all traction companies are equiped with rather oval as well as "flat" wheels. The tracks too, are of the scenic 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 improvements are necessary to shake up and bump the cars vigorously, this action being required to pack the passengers tightly into the car and to jingle the passenger's nickles, so the latter can be extracted easier for the conductor's rake-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. In my researches I quickly found, that if you start the car on an incline, no further power is required to propel it, this to be 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 undreamt of by the most voracious traction company shareholder. No power house nor trolley 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 I is the strap on which the strap-hunter navigates. Every time he sways he exerts a pull of about 150 lbs. on the strap, and he 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 3 to dynamo which in

years 4 and the resulting power is also conveyed to the belts 3, furnishing additional power.

What I claim is:

1° A wireless trolley, operated solely by straphangers.

2° A self propelled fat reducing trolley stimulating digestion and preventing indigestion.

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

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

S. T. RAPHANGR.

Witmesses: By his Attorney,
A. W. Gowan, Thomas W. Benten,
C. U. Titou
RECORDING VOMTETE. (785.) J. Hassel, Baltimore, Md., asks:
Q. 1. What is a recording voltmeter?
A. 1. 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.
Q. 2. For what purpose are these instruments most adapted?
A. 2. They are generally employed in power-house, 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? How are they calibrated?
A. 3. No. Most of them require a large correction factor. 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 in constant motion.

The wiring diagram herewith gives connections of a recording voltmeter for calibrating the same with a standard voltmeter.

IMPULSE EXCITATION. (786.) Paul Magdalen, Hackensack, 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 be preceded.
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 cyclical and not impulsive or semi-periodic 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 250 to 500 letters addressed to the "Question Box"? If we were to publish all the questions and answers we would require 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 lower its standard. So, if you 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 us, look over your back numbers and when 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 small fraction of queries of those received by us are actually published.

Kindly note, therefore, that in the future we cannot, in our own interest, answer queries 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 advise for special questions requiring 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.

Q. 1. Where can I buy wireless books describing in detail the complete theory of radio engineering, and also a textbook giving complete data as to the design and operation of radio apparatus?
A. 1. We would recommend the following books, which we believe will give you all the desired information: By J. A. Fleming, "The Principles of Electric Wave Telegraphy," $10.00; by J. Zenneck, "Wireless Telegraphy," $4.00; Eecle's "Wireless Telegraphy and Telephony," $3.50. We will send any of these books on receipt of price.

Q. 2. Are all the Radio Amateurs of this country to remove their aerials and apparatus in this present crisis?
A. 2. Orders have already been given to instruct all Amateurs throughout the country to remove their aerials. The instruments were not asked to be removed or confiscated by the authorities up to the present time.

WIRING DIAGRAM. (789.) Peter Hancock, Toledo, O., asks:
Q. 1. A wiring diagram of a short wave regenerative Audion receiving outfit.
A. 1. The appended diagram gives the proper connections.
Q. 2. How can I decrease the noises produced in the receiver when the Audion is in operation? This effect is even obtained when the receiving instruments are disconnected from both the aerial and ground wire.
A. 2. The noise which you are experiencing is due to a constant electrical charge on the grid of the Audion, which causes the grid condenser to charge and discharge unperiodically; consequently affecting the receivers. This trouble might be eliminated to a certain degree by shortening a high resistance "leak" path across the grid condenser. It must be a non-inductive leak and can be made very readily by marking upon a sheet of paper a pencil mark and connecting the ends of this line across the condenser. A little patience in making the proper thickness of line will be required before proper results can be obtained.

Hook-up for a Short Wave Regenerative Audion Radio Receiver.
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. A unique co-operative plan 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 manufacturer? 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 a breadth of vision and economic principles, has seen this tremendous 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 more 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 takes 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
a station such as he proposes to establish elsewhere.

This is what his Philadelphia service station and store does:

It sells tires below the average price of high-class tires of equal size and quality.

It delivers tires PUT ON YOUR CAR.

You phone in that you need a 3x4 tire and give your address. A mechanic picks up the required tire, puts it in the carrier of a motorcycle and speeds off to your address. On arrival he takes off your old tire and puts on the new one. No trouble, no mess.

If you want your old tire repaired he takes it back with him and it is delivered as soon as repairs are made.

You have saved time, labor, worry and money.

The success of this first service station PROVES what REASONABLE PRICES, HIGH QUALITY GOODS, EFFICIENT SERVICE will accomplish. Profits are large because of volume.

The Philadelphia service station already has 11,000 CUSTOMERS. (Net tire sales, but CUSTOMERS.)

With this established PROOF of the value of this new departure service, Mr. Feist has organized a company to establish National Rubber Company SERVICE STATIONS and stores all over the country. His plan provides for opening 500 stores the first year, if possible, and more stores year by year as the company grows.

OFFERS GREAT OPPORTUNITIES

The OPPORTUNITIES offered by this chain of tire service stores are self-evident.

CHAIN STORES of all kinds have been enormously successful in the past and there is good reason to hope that some of the greatest fortunes in the country. They have made original investors enormously rich. And this in spite of the fact that most chain stores have dealt only in articles selling for a very small sum. HOW MUCH GREATER should be the profits of a chain of stores selling a product whose every SINGLE SALE equals the sale of HUNDREDS of the articles sold in most chain stores?

The UNITED CIGAR STORES, selling cigars, cigarettes and tobacco, average LESS THAN 20 CENTS PER SALE. The National Rubber Company averages MORE THAN $20 PER SALE, with proportionate profits.

THE WOOLWORTH STORES sell 5 and 10 cent articles. Yet they have made many millions and the highest office building in the world was built out of these nickels and dimes.

The REGAL SHOE COMPANY, with its chain of hundreds of shoe stores, has made its owners rich. So have the Walk-Over Shoe Stores, the W. L. Douglas Shoe Stores. All chain stores.

The TRULY WARNER Hat Store chain has accumulated wealth for its owners.

The Great Atlantic and Pacific Tea Stores, the Jewel Tea Stores, the Venus Tea Stores, all chain stores, have made millions.

The several chains of drug stores, of grocery stores, of cheap restaurants, have all made fortunes.

The reasons for this uniform success are numerous.

In the first place, operating a "chain of stores" of any kind reduces the cost operation—what is known as OVERHEAD EXPENSE—to the minimum.

Secondly, the purchasing power of the buyer who buys for hundreds of stores is so enormous that he can pretty nearly make his own price. He gets ROCK BOTTOM costs on everything. Woolworth can sell for 5 or 10 cents articles that often retail at from 25 to 50 cents because he buys outright entire factory productions. The manufacturer who sells his whole output to one man for cash, eliminates all selling expense, salesmen, advertising, collections, etc., and can sell for a quick turnover, and will yet make more profit in the end. That's how the chain buyer can buy at such a low figure that he can sell goods that retail generally for 25 cents for 5 and 10 cents.

Then, the chain store man nearly always BUYS FOR CASH. That means he takes advantage of every cash discount and by paying cash he enables his manufacturer to buy for cash and get a similar benefit. So it becomes an endless chain of savings which benefit the ultimate product.

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. These chain stores are 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 now. 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 55,000 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 sixty stores, and over 250,000 retail stores; the National Cigar Stores, 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 automobiles in the United States. It was estimated that there were over 4,000,000 automobiles in the United States in 1917, and the number is expected to reach FIVE MILLION in 1918. This means that there is a tremendous Possibility for More Machines.

According to the best informed automobile authorities, it is estimated that there will be added at least 1,000,000 new autos during the year 1918, and that the total will reach at least FIVE MILLION AUTOS in actual use in the U. S. With such an enormous distribution of cars, and all the automobile factories of any kind whatever in the service business, an enormous supply of tires will be required to keep these autos running.

The national average of tire consumption per car is 2.5 tires per annum, or 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 places 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 forty 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 for purposes of pleasure, it is more than likely that the distribution will be much more even.

It has been estimated by statisticians that there are OVER TEN MILLION men in the U. S. who should be, and probably
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are who, because of their businesses, 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 RICH MAN of the U. S. He has been getting the biggest prices ever paid for crops, has he 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.

PROFITS PILE 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 expensive 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, 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 thus is divided pro rata so that each individual store pays only a small sum as its share of the advertising expense.

With all the actual contract price from the manufacturer and so charged against the store, much cheaper than the average tire store man can buy them.

WHAT PROFIT IS REMAINED-UPON THIS CHAIN STORE'S WHEELS—ARTIFICIAL FACTORY SELLING EXPENSE IS ELIMINATED—the entire output of the factory being sold to one customer—the chain store.

The saving of the traveling expense and salesman’s salaries and commissions. The saving of advertising and promotion expense. The added office accounting and advertising expense is SAVED by the chain stores. In these items alone is found a selling cost of at least 20 per cent.

On top of that, the FUTURE DISCOUNT OF 40 PER CENT IS WIPED OUT.

No thinking man or woman has to be told that the NET SUM the manufacturer receives ALONE CONTROLS 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, the manufacturing cost would be HIGH or even over his competitors, then added charges, as described here, increase out of proportion to the customers’ profits 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, we find that there is a minimum 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 $5 per tire sold.

This is evidently a CONSERVATIVE ESTIMATE.

If each chain store sells ONLY 10 TIRES PER DAY, we have here each store earning a profit of $50 a day or $5,000 a day profit for 1,000 stores.

$50,000 profit per day for 365 days in the year-tire service stations are busier Sundays and holidays than other days FIGURES OUT THE ENORMOUS TOTAL OF $18,250,000 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 away the ivory tires for replacement, the logical conclusion is that these 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 of $18,250,000 and let us suppose 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 $50,000. The ENTIRE ENTERPRISE OF TIRE BUSINESS WOULD BE $9,126,000, 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, this 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.

The Stock is Full Paid and Non-Assessable.

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 $200 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 be $25 per Stock. SHE WILL HAVE REPRESENTED 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. If it pays 50 per cent, it should have an Investment Value of $1,000.

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.

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 earn-

ing 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 $200 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 $400 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 $250,000 that started Ford on the highroad to his present millions? Did you get a chance to invest in the $300,000 that John N. Willys has built up into tens of millions of the Overland Company? Did YOU get a chance to get in on Westinghouse, or Bell Telephone, or Western Union, or Websch Mantles 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 Tires—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 INDUCEMENT to buy this stock. AND IT IS CERTAINLY WORTH WHILE TO YOU TO BUY IT. Remember you
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

<table>
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The Magnificent Pottstown, Pa., Plant of the National Rubber Company, Where National Speedway Redwall Tires and National Red Tubes Are Made. Two Floors of This Big Building Are Completed and Occupied. This Is a Strictly Modern Steel, Concrete and Glass Construction Factory Building of the Highest Type. The Big Tire Coming Out of the Building is the National Speedway Redwall Tire, Best on the Market.

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, 100 of 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 Net Cash 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.

Issue shares in the name of, and forward to address below:

(Subscriber's Signature) .................................................. (Town and State)
MEDICINE HAILS ELECTRICITY.

"The day of the bowling-derish in elec-

tro-therapeutics, is past," declared Dr. S.

Solis Cohen in the meeting recently of

the Philadelphia County Medical Society,

"and the science now has a definite, dis-
member place in the evolution of the medical

profession and of the public."

"We must confess with shame," said Dr.

S. Lewis Zievel, "that the greatest ad-
vances in the application of electricity to

medicine have come thru laymen and not

doctors."

Dr. A.B. Hirsch traced the history of

electro-therapeutics, and declared that an

astonishingly large number of diseases re-
sponded to electric treatment.

Q. 1. What does a "tone" circuit con- 
sist of and how is it connected to a radio

transmitter?

A. 1. A tone circuit consists of nothing

more than an oscillatory circuit shunted

generally across the gap. This circuit is

shown here and it is only used in an impulse

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 oscillating circuit condenser

capacity. It should be kept in mind, that a tone

circuit does not wipe out the tone

emitted by the transmitter in every type

of gap, as it was found by actual experi-

ence 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.

Arrangement of Tone Circuit in the Von 

Lepel and Chaffee Arc Radio Transmitter.

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 talk-

ing to the diaphragm of either of the two

receivers?

A. 1. The principle of operation of

such a telephone is identical to the pro-

duction of electric current by a dynamo-

electric machine, in that when a magnet-

ic field is permitted to be interrupted by

a wire near its field, a current of elec-

tricity is produced in that wire and the inten-

sity 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 mag-

netic 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; generation of current in the coil

which operated the distant receiver.
HIGH FREQUENCY PHENOMENA.

(702.) S. Kolin, Brooklyn, N. Y., asks: (Q. 1. Can you explain the following phenomena which I recently observed during certain experiments which I have carried on with a Tesla high frequency coil? A large primary of a loose coupled 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 Tesla Tesla, and he was able to obtain sparks which reached in magnitude from five to six feet in length.

TRANSFORMER FORMULA.

(704.) 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 when designing a transformer, namely: the voltage transformation between the primary and secondary, the latter should be made to correspond with the propersend condenser capacity, and this must be obtained beforehand; the proper arrangement of secondary coils, separated with proper insulation, and finally, the magnetic circuit in which great care must be exercised in designing the same, as 75 per cent of the electricity will be in this part of the 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.

Q. 2. What is the relation existing between the primary winding and voltage of a transformer?

A. 2. The relation of the two factors is express by the following formula:

\[ N_s = \frac{10^7 \times E_p}{2B f A_s} \]

Where

- \( N_s \): 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)
- \( A_s \): 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 cloth is very excellent for this work and it is universally employed for this purpose.

THE "BROWN" TELEPHONE RELAY.

(705.) Frank A. Vantart, Philadelphia, Pa., desires to know:

Q. 1. Is the "Brown" relay, which is used in England, a microphonic device?

A. 1. This type of instrument is a
purely microphonic device and the microphone is controlled by a super-sensitive telephone. A more complete description of this device was published in the August, 1915, issue of this journal.

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

Q. 2. What is the hindering post connections 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. These are not, but I think, largely, used abroad, especially in England.

MERCURY RECTIFIER.

(969.) Thomas Pierson, Richmond, Va., asks 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 volt. There is a certain drop for lost 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. If the set is delivering at a potential of 15 to 25 volts, its efficiency under these conditions would be roughly speaking, 100 per cent. But this may be true, and in most commercial installations of constant potential sets, the full-load efficiency is over 80 per cent and the efficiency of most constant current sets will be 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 life is much longer.

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

A. 3. On a 100 light set the power-factor on the primary of the constant current transformer is about 65 per cent. On constant potential sets it may reach as high as 90 per cent.

MEASUREMENT OF IRREGULAR AREA.

(979.) Paul Andel, New Orleans, La., asks to know:

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

A. 1. There are three general methods for obtaining the area of irregular plane surfaces and the simplest of the three is by employing a "planimeter" 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 traverse the perimeter of the irregular surface.

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

(Continued on page 149)

BOOK REVIEW


One of the most valuable and popular treatments of this all-important subject which is at the present time of interest to readers of all classes. Unlike a great many books of this nature dealing with such a subject as the submarine torpedo boat, Mr. Hoar has given us a well-written and lucid description of this magnificent twentieth century war machine. The engineer and layman will both find it particularly the interesting chapters of this authoritative work who is a junior member of the American Society of Naval Engineers.


The American boy is always interested in a good book dealing with experiments of a practical and interesting nature. There have been many good books published 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 this presented by Mr. Seaver. The volume is profusely illustrated with clear-cut drawings, which can be readily understood by young boys from ten to fourteen years of age. The electrical experimenter has been cleverly and interestingly woven thru the experiments and discoveries.

A number of excellent half-tone illustrations are inserted, showing modern electrical appliances, so that instead of the usual "dry," experimental, and simply explained laws, he will be also given a clear understanding of the practical connection between such experimental apparatus and the commercial instruments and appliances. Mr. Seaver is to be congratulated upon the adaptions with which he has combined these two important fields of electrical engineering: the developer and experimenter not become confused or discouraged by his inability 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 double type; how to build small transformers and the principles upon which they operate; how to build primary and storage batteries; how to charge discharges and how to protect buildings from and also a considerable number of experiments in static electricity. We strongly recommend this book to the American boy.

EXAMPLES IN ALTERNATING CURRENTS. Vol. 1, Second Edition, By Prof. F. H. Austin, B.S., E.E. Flexible green leather covers, pocket style; size 7x5 1/2 inches; 224 pages, 75 illustrations with numerous tables. Price, $2.40. Published by the Author at Hanover, N.H.

The second edition of this valuable treatise, containing a number of valuable suggestions and hints, is now available. It is a book for the student who wishes to improve his knowledge of alternating currents. It is a book that is a must for the student who wishes to become proficient in this field. It is a book that is a must for the student who wishes to become proficient in this field.
It is not possible to measure the entire cost of interior telephones by the cost of the service alone. Rather, your telephone expense must also be measured in terms of the per-minute time cost of employees using the system. In other words, your interior telephone system is a business expense only when it directly affects the gap between the two vitally interested parties—your employees—by the message process—competing employees in perhaps every department to use up the precious minutes you are paying for, all for the purpose of responding to a useless telephone call.

The money saving answer to this problem is "Don't use the telephone at all but hunt men!" Allow it to be used only after the man has been found by the aid of the National Calling System, which summons him instantly, no matter where he may be about your establishment or grounds. The man called then goes to the nearest telephone and talks directly, with the man who sought him.

The National Calling System is efficient, moderate in price and a positive money saver, as small as well as large establishments.

SEED for Complete Information

(Continued from page 139)

boundary of the plane surface, and determining the area of the squares, then multiplying the areas 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 the aid of higher mathematics; where a limiting value of the maximum and minimum peaks of the perimeter of the surface is obtained by an integral expression, and substituting this value in an integral equation as used in the Calculus. Some engineers weight these small differences too much in the chart of their plans, and by a simple calculation, compute the area of the irregular surface.

WHEATSTONE BRIDGE CIRCUIT.

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

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 interference acted upon the galvanometer.
A. 1. The diagram hereafter 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.
(799.) Joseph Hassel, Boston, Mass., asks:
Q. 1. What are the ores used in the production of commercial aluminum? A. 1. Aluminum oxid is the main source of which aluminum is extracted. Bauxite, a hydrated oxid 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 electrolytic one. The electrolyte consists of a solution of aluminum oxid in melted cryolite. The cryolite is not decomposed, but serves as a solvent only. The mineral Bauxite is used to furnish the oxides. The cryolite is fused and kept liquid by the heat generated during the passage of the current; the dissolved oxid is separated into aluminum and oxygen by the current. The aluminum collects as a molten mass in the bottom of the melting pot. The oxygen is liberated at the anodes, which are oxidized by it. The weight of the anodes consumed about equals the weight of the aluminum liberated.

TELEVISION.
(800.) 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 diaphragms. These diaphragms 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.

TRAN-PACIFIC RADIO COMMUNICATION SUSPENDED.
Wireless communication to Hawaiian territory beyond Honolulu has been suspended. Messages to other islands will be mailed from Honolulu.

SEND NO MONEY
USE THESE ELECTRICAL BOOKS SEVEN DAYS AT OUR EXPENSE

By merely filling in and mailing the coupon below you can get this complete set of the Cyclopedia of Applied Electricity on trial. Use these books for seven full days before you make up your mind whether or not you want them. If you keep them, you may send them back at our expense and you won't be out a penny. Remember, we pay the shipping charges both ways.

A MASSIVE ELECTRICAL LIBRARY—NOT HANDBOOKS
These seven splendid volumes contain all the knowledge you need in order to earn big money in the electrical field. They are not thin handbooks, but thick, encyclopedia-size volumes, bound handsomely in half red morocco leather, gold stamped. Each one measures 7 by 10 inches, and is 2 inches thick.

This big size permits the use of large and comprehensive illustrations, plates, diagrams, etc. Over 8,000 cuts are contained in the Cyclopedia's 3,900 pages.

The completeness of the Cyclopedia will be a revelation to you. Everything electrical is explained in plain, simple English—every technical point is made clear. Each volume is carefully cross-indexed for instant reference.

50c a Week—This sum—an insignificant wealth of electrical information is yours. But you don't have to send us a penny until you have used the books for seven days. Then, if you decide to keep them, send only $2.00 a month—50c a week—until the special advertising price of $19.90 has been paid.

The regular price of these pay-raising books is $35.00.

Consulting Service Free
A year's Consulting Membership in the American Technical Society—regular price $12.00—will be included with all orders for a limited time. The advice of an entire corps of electrical experts is yours to help you in your progress for a whole year FREE!

Send No Money—Just the Coupon
See these books for yourself before you buy. Remember, you don't risk a penny or assume a single obligation. The books will be sent by prepaid express to any one within the boundaries of the United States or Canada. and may be returned at our expense if they fail to please. But you must act now! This generous offer cannot be continued indefinitely. Send the coupon now.

AMERICAN TECHNICAL SOCIETY
Dept. E-744-A CHICAGO, U.S.A.

Read These Subjects
MIGNON UNDAMPED WAVE WIRELESS APPARATUS

Amateur and Commercial Use

This latest Mignon invention is entering a new field in Radio Engineering, eliminating the so familiar LOOSE COUPLERS and LOADING COILS, and introduces adjustable DISC-CORES, heretofore considered impossible. DISTANCE RANGE UNLIMITED.

Mignon Wireless Corporation
ELMIRA, N. Y., U. S. A

Write for Catalogue and mention Electrical experimenter

MULTI-AUDI-FONE

SPECIAL NOTICE

We have just placed on the market a new loose coupler built of mahogany with all metal parts highly polished nickel plate.

New in design and wonderful in efficiency.

Made in two sizes.

Type “AD” 150 to 3000 Meters $6.50
Type “AU” 4000 to 15000 Meters $12.00

Multi-Audi-Fone.......$18.00
Two Step M. A. F......75.00
Short Wave Regenera-
tive Attachment.......22.50
Multi-Form Receiver...100.00
Detectorphone..........35.00
Fixed Condenser.......1.00
M. A. F. Detector.....3.00
M. A. F. Loading Coil..2.00

MULTI-AUDI-FONE

275 Morris Ave. Elizabeth, N. J.

Send 2c for Circular

NEW METHOD OF MEASURING PRESSURE OF LIGHT.

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 wires. Inasmuch as it is required that the radiation should be normally incident, the lamp was not brought too close to the tube, a calculation of the limiting angle having been previously made. 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

\[ E = \frac{1}{1 + 0.07x^{0.9}} \quad \text{or} \quad 2.04E, \]

where \( E \) 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 all that is incident on the strip. It is, therefore, necessary to substitute 2.02 for 2.04E.

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 calculate the deflection of a strip such as that represented in Fig. 1 by taking moments about the axis of rotation. The details of apparatus used are given in the original paper, as well as the thermo-kinesic reaction and a table of results observed in success.

ELECTROLYSIS SURVEY PROPOSED IN MONTGOMERY, ALA.

The Bureau of Standards has been asked to make an electrolysis survey in Montgomery, Ala.
DO YOU

own a wireless station, either for sending or receiving? If you do, then you can join the Wireless Association in the country (The Wireless League of America). If you believe in the preparedness of your country, you wish to help Uncle Sam, or if you wish to have your station formally recognized, join the LEAGUE, a national non-commercial organization. Beautiful engraved and sealed certificate, FREE to all members. No dues or fees WHATSOEVER.

Honorary Members: W. H. G. Bul-
lard, U. S. N.; Prof. Reginald A. Fessenden; Dr. Lee De Forest; Dr. Nicola Tesla.

Send stamp for large 8-page information booklet. DO IT NOW. 233 FULTON STREET, NEW YORK

Continuation of List of "Perfect Score" Stations in Trans-continental Amateur Relay as published in the May number.

OHIO
D. Schellenbach, 8 IF, Wyoming
K. A. Aue, 8 AH, Defiance
C. Lingweiler, 8 EJ, Dayton
No Name, 8 ATG, Tiffin
C. Caudler, 8 NL, St. Marys
J. Fermer, 8 ML, Cincinnati
Scott High School, 8 LL, Toledo
M. L. Sager, 8 LW, Tiffin
N. Thomas, 8 FX, Marietta
J. H. Grice, 8 WE, 8 EZ, Lima
J. F. Eckel, 8 PL, Cincinnati
J. O. Hibbert, 111, Ottawa
L. M. Clauung, 8 YL, Lima

OKLAHOMA
A. & M. Steddom, 5 AB, Oklahoma City

PENNSYLVANIA
W. T. Mapes, 3 AUC, Carlisle
Chris, M. Bowman, 3 PC, Lancaster High School, 8 JS, Bellefonte
L. R. Alexander, 8 AE, Grove City
R. G. Goodwin, 3 ZL, Philadelphia
M. H. Mannick, 3 MR, Pittsburgh
Peabody High School, 8 YZ, Pittsburgh
W. S. Shoop, 8 RV, Vandergrift
F. J. Anderson, 3 QQ, Reading
F. H. Brian, Smithport
C. H. Stewart, 3 ZS, David's Naval Academy, Philadelphia
Karl E. Hassel, Opel, 8 VL, Pittsburgh
R. C. Clement, 8 AJT, Washington
St. Joseph's College, 8 JF, Philadelphia

RIODE ISLAND
C. E. Davis, No call, Edgewood
M. V. Polly, Jr., 1 EMG, Bristol
H. W. Thorley, 1 Al, Pawtucket

 TENNESSEE
S. H. Shoji, 5 CY, Nashville
C. B. Delahunt, 5 ZD, Memphis

TEXAS
B. Emerson, 5 DC, Dallas
K. Corbett, 5 ZC, Dallas
J. L. Antrim, 8 EJ, Houston
C. W. Gillingham, FM, Austin

VIRGINIA
R. R. Chappell, 3 St, Richmond
G. C. Robinson, 3 St, Richmond
J. F. Wolford, 3 WY, Roanoke
W. T. Graves, 3 EQ, Danville
J. E. Kron, 3 TY, Newport News
S. A. Johnson, 3 TY, Newport News

WEST VIRGINIA
J. F. Law, No call, Clarksburg
H. E. Burns, 8 AGH, Martinsburg

WISCONSIN
H. J. Crawford, 9 WT, Wausau
C. Quinn, 9 RD, Menasha
M. P. Hanson, 9 XM, Madison
E. H. Hartwell, 9 BV, Salem
A. Rufsvold, 9 ADI, Marinette
O. H. Terry, 9 HQ, Stoughton

TO RECHARGE THIS CELL—FILL WITH WATER.

The "H2O" Cell, as it is termed by its English sponsors, was introduced to meet the demand for a wet smaller and more compact than the "Leclanche", and in this respect it appears to have gained its advantage. This cell may be stored for any length of time and in any climate without any deterioration. It is not liable to creeping or evaporation while in use. Its internal resistance is low, and it does not polarize in use so quickly as wet batteries of the "Leclanche" type, it is claimed.

The addition of water only is needed for charging, and its active life is equal to any Leclanche cell of similar size. If the cell is required for instant use, it is recommended that the cell be filled with warm water: distilled water being used, if possible, as this tends to prolong the life of the cell by reason of the absence of iron or lime impurities, which are frequently found in hydrant water.

In order that the condition of the zinc electrode and the interior parts of the cell may be examined, the container consists of

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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. The 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 it 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 very much less than Lechacité batteries. The top of the sack has a rubber ring, E, round it in order to further safeguard the apertures of the metal touching the sack. Above the sack a specially shaped porcelain ring, F, is slip over the carbon rod, G, and this serves as a support for a waxed cardboard disc, 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, J, is soldered to the zinc cylinder, and this is brought up at the side of the cardboard washer 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 embedded in the sand. When arriving at the scene with one of the Linquist hydrostatic lifting units of the type already described, this is set up out in the deep water at a considerable distance, say one thousand to 1,300 feet from the vessel in distress, and a heavy cable is attached to the ocean cylinder 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-4 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
occurred. One of the divers who worked on the Submarine F-4 and who had negotiated depths of 306 feet (corresponding to a pressure of 125 pounds to the square inch) has seen the development believes that Mr. Lingust's calculations as just cited are not only practical but feasible.

ELECTRICITY AND WATER TO RUN OUR AUTOS.
(Continued from page 88)

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 obtain our gas from water, which nature has provided abundantly, and so easy to secure that the cost is practically nothing.

These inventors in this electrolytic gas cell generator intended for a substitute for gasoline in driving automobiles will undoubtedly find interesting in U. S. patent on a similar cell, bearing the number 1,239,060 which is disent in 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. Kintbert and Halsey M. Barrett, receivers of the National Electric Signaling Company, plaintiffs, vs. the Atlantic Communication Company, August Merckens, P. C. Schmizter and K. G. Frank, defendants, in which he found for the plaintiffs. This suit was based on a claimed infringement of United States letters 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 generally as the "heterodyne" method of receiving radio telegraph signals.

The court found that Reginald A. Fessenden, the inventor of this system, had produced an invention of great merit and entitled to a broad interpretation. He found that the prior art cited by the defendant as anticipating the Fessenden invention had failed to teach the art anything in respect to the use of beams 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 patents, and was based on the theory that the Fessenden patents were not entitled to a broad interpretation but should be restricted to the use of the particular form of apparatus claimed 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 of 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 watts and operates at 30 volts. In most cases a 2, 2½ or at most a 4-h.p. engine is required to run this system. The generator has a heavy flywheel pulley with cored 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 and off. An automatic electric 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 any time either direct 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 start-

Mesco Wireless Practice Set
For Learning the Wireless Code

The Practice Set comprises a regular telegraph key, without escutcheon, 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 for 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 to adjustment, and 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.

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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 while en route from Philadelphia to Cartagena, Colombia. SOS calls were answered by the Miami land station and the steamship's V an Heugendorp and Illinois, all 14 persons on board being saved.

July 22.—Steamship Matatana, stranded on rocks seven miles south of St. Mary's Light, Cape Race, N.fld., lost line to shore and passengers and crew were removed. The distress call was answered by the steamship Steyhan, Red Cross Line, which stood by until passengers were safely removed.

September 15.—Steamship Congress, with 44 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 land station at Marshfield, Ore., Cape Blanco, Ore., and Eureka, Cal., and the steamship F. A. Kilbourn, 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 calls were answered by the Coast Guard cutter Ossipee 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 Astilla, with fifty-six persons aboard, caught fire off the Virginia Capes while en route from Guanatamo, Cuba, to New York. Approximately twenty-five vessels responded to the distress calls, and all persons were saved.

October 19.—Steamship Arapaho lost her rudder twenty-five miles north of Cape Lookout. SOS calls were answered by the steamship Henry R. Marston, 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 at the Azores Islands. Communication was established with vessels, but assistance was not needed.

October 29.—Tug Yquitol disabled 150 miles off Irish coast. SOS call answered by the steamship Rydalm, which towed the tug to Queenstown.

November 25.—Steamship Porchaton, on route from Europe to Bar Harbor, 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 them in working their way.

November 28.—Steamship Coronado lost propeller off Tillamook Head. Distress calls answered by Astoria, Ore., station, which dispatched tug to assistance of disabled vessel.

December 3.—Steamship Carolina, Goodrich Transit Co., struck rocks off entrance to Sturgeon Bay Rapids Canal. Distress calls were received by the Manitowoc, Wis., station, which dispatched a tug to the assistance of the disabled vessel.

December 11.—Steamship Sunner grounded in fog off Barnegat, N. J. Six vessels responded to SOS calls, and all persons on board were saved.

December 14.—Steamship Porchaton, in collision with unknown vessel on way to open sea, caught fire on Cape Cod and sank. Coast Guard cutters, and steamship Jameson answering SOS calls. Crew transferred to Coast Guard vessels and passengers were taken to New York on the steamship Jersey City.

THE PENALTY for failure to do so is a fine of 15 or 20 cents, which is paid for each omitted article, as well as the loss of articles which cannot be found or obtained elsewhere.

-Apologies to "Casey Bee."

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 Woolsey, in his annual report submitted to the State Legislature, estimates the 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 such stupendous resources, the value of which has been estimated by conservation experts at $250,000,000. Attorney General Woolsey 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 be harnessed to yield 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.
SPRAGUE DEFENDS ELECTRIC DRIVE FOR CRUISERS.

After consultation with Secretary of the Navy-Wheeler, Mr. Sprague, Chairman of the Naval Consulting Board Committee on Electricity and Ship Construction, has come out strongly against the critics 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 vessel on the collier Jupiter and the adoption of similar power for three battleships," 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 total of 180,000 horsepower.

"The wisdom of this decision," Mr. Sprague continues, "was challenged by Charles Curtis of the International Curtis Marine Turbine Company, which company, 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 one engaged in a commercial enterprise which may be seriously affected to be, even if unconsciously so affected 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. Weller, President of the Crocker-Wheeler Company, manufacturers of electrical machinery, who has been voluminous in his attacks; Dr. Frank C. Crocker, an associate of Dr. Wheeler; George Gibbs, Consulting Engineer of the Pennsylvania Railroad; his associate, Mr. Michael Finkin, a distinguished scientist and inventor of a system for increasing the efficiency of the long-distance telephone; Isham Randolph, a well-known civil and railroad engineer; Prof. William H. Furr, a widely-known consulting engineer; President Falk of the Allis-Chalmers Company; and many others, of whom few, it is to be feared, are within the professional standing of Mr. Curtis, whom I feel regret that he should have been permitted to cast in this role of advocate.

But it is manifest that this is a matter of very great importance to the public, and which affects their interest, as well as those of the departments, and which involves that of the greatest magnitude, and that it is important that nothing should be said or done to produce any misunderstanding in the public mind, or that may influence the result of the adoption of this system, or to produce any dissatisfaction in the mind of the naval authorities in the adoption of this system, or to produce any dissatisfaction in the mind of the naval authorities in the adoption of this system, or to produce any dissatisfaction in the mind of the naval authorities in the adoption of this system."

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manufacturers of electrical machinery; Luther Lovekin, Chief Engineer of the New York Shipbuilding Company, and Calvin Tomkins, 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."

"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 of the ships and accepted methods of drive, with their varying influence upon the distribution of weight, location of weights 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 torpedo damage, 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 even 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. Carty, Telephone Engineer, Now Major Carty

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 in the National 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's service was turned over to the government for a test under hypothetical war conditions. In 45 seconds Secretary Daniels was in communication with the Pensacola, Fla., Navy Yard, and in 1 second 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 Whitney, in New York State, in less than 24 hours after the troops were called out, connecting Washington, D. C., New York, 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 having this important branch of the country's defensive system ready, not only in material, but in personnel.

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Edited by H. Gernsback.

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

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

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 telephone-attachment, printed same in your Patent Advice department, in the following issues this year, as soon as possible.

"After reading your article on patents wanted, I devised a scheme by which any tone desired can be had instead of using bells. I have drilled and tapped the armature knob of the ringer and screwed thereon a certain pin projecting on a protruding stand. I have a mandolin string, which is adjustable (any note can be had): when the phone (rings) the device passes over the etrium and I have attained a dull, soft-pitch tone which is audible three rooms away.

"I should 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 Al. Moreira, Lowell, Mass., submits a design of a glass periscope, his idea lying 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 strain 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 bubble 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, it is useless to make the periscope itself invisible.

AUTOMATIC TUBE CLOSER.

(154) James D. Miller, Montreal, Quebe.

Canada, submits to us several drawings of collapsible tubes such as are used with tooth-paste and shaving creams, the idea having 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 at present it seems too complicated, having too many parts. We would also advise our correspondent to submit to the idea, to the 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 sufficient 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 compressed 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 compressed air you use a vacuum, enormously better results are obtained, as, for instance, in the Moore Vacuum Interrupter. Personally, we have no faith in compressed air interrupters, as we have never seen one work satisfactorily.

ELECTRIC CIGAR MOISTENER.

(156) Charles Bicker, Salina, Kans., 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.

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the market to-day and we have one in mind which seems to have the greatest sale, whereby an electric incandescent lamp is plunged in a vessel filled with water, which owing to the heat of the lamp, is made to evaporate.

AMPLIFICATION TRANSFORMER. (157) A. J. Camile, New York, N.Y., sends in a sketch and description of a transformer which is supposed to amplify alternating currents, or more, 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 1 ampere.

Ans. No matter what a scheme of this kind may consist of, it is absolutely impossible, by an not-existing energy 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 Szepnagy, Paterson, N.J., writes as follows:

"Wishing that the same whose services Edison, Maxim, or Lewis obtained their patents, I sent for the literature of a good many patent attorneys.

"Many lawyers have a considerable number of names and addresses of their clients who, however, are almost all unknown to the world at large. The matter 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? Any answer is appreciated.

"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 attorneys from using their names for obvious reasons, as it is naturally to their interest not to disclose who does their work for them. Personally, we think you will get cheaper, better and quicker service from advertising patent attorneys than from those who do not advertise, for the simple reason, that the former do a larger business and consequently cost less. 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 Dunfield, Van Wert, Ohio, has submitted a model design of a toy electric hammer and wants to know if such an article is on the market already and if it is a worthwhile patenting.

"This indeed is a very excellent idea and one of the best schemes for a cheap electric toy that we have seen lately. While the idea is not entirely new in the principle, we are certain that a patent may be obtained on the construction of this article.

"Our correspondent also submits to us a sketch of an electrically-driven interrupter on which he desires our advice.

"Ans. There are several known in this design, and similar interrupters are in use all over the world and a patent can certainly not be obtained on this device.
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The School is located in the Heart of the National Capital where one may feel in close touch with the needs of Our Country at this Crisis. Several of our students have just passed the Tests for the Navy and are now in service at the large Arlington Wireless Station. Our Correspondence Courses have helped many, who could not attend our school, to get a Commercial License. Enroll now in one of our Courses so you may be prepared to serve when the call comes. Send stamp for catalog which gives full information.

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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 106)

colusis and other pulmonary troubles often yield to the "effeive" treatment.

3. Perhaps the most remarkable therapeutically useful method of heavy high-frequency currents is their power to stimulate the nerves and to increase the heat in the body. This is in the case of the "D’Arsonval current" used. It is a secondary current of high amperage derived from the heavy coil of copper strip shown in Fig. 6. The lower terminals of this coil is connected with the condenser plate and the patient’s body is placed in the field of this coil. Then it is found that the patient will become far more sensitive to the sensations of temperature and to the effects of the current than he is when it is applied by means of a small, low-amperage transformer.

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 the principle of the transformer is shown. In Fig. 24-A, A is a jar or cylinder containing a high-voltage transformer. The transformer is connected to the main power source and a piece of sheet rubber stretched over the top of the jar. Before placing 1 in the jar and raising the tube it is important to invert it and invert it so that it just floats upright. On pushing down on the sheet rubber the vial will float to the top of the jar. On releasing the sheet rubber the vial will sink to the bottom of the jar.

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EXPERIMENT 29.—We are all familiar with the fact that objects weigh less in water than in air. The absence of air is the cause of this. 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 separately, and it is found that different weights. If they are 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 the cork) in it, the overflow 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 is equal to the weight of the bodies were immersed in the first part of the experiment. In Fig. 25-B, abed, represents the cross-section of the object used. The pressure at ab, equal to the weight of the column, ead. The pressure at ch, is equal to the weight of the column, ead, which is the result of the buoyant force at ch, and is equal to the weight of a column of water alike, which is the same. Water is lighter than air, 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 float. The ordinary ship floats because it is constructed so that if it were immersed, the buoyant force would be greater than its weight.

(The to be continued)

THE NAVAL RADIO OPERATOR.

(Continued from page 109)

Members of the Electrical Class are quartered at Mare Island, New York. The school buildings are situated in the Navy Yard. Out of the school house the course of instruction is contemplated whereby they will be instructed in the regular duties of a man-of-war man; this is necessary, as every man aboard ship, irrespective of rating, is a member of a military organization. Short leave is granted in accordance with the regular Navy custom, usually from 4:30 p.m. to 7:30 a.m. every other day. Leave of absence is granted after completion of course.

All the Naval Training School comprises twenty-two weeks of advance work and three weeks of examination. The schedule is based upon an eight days per week and weekly written examinations. The final examination is in writing. In the radio courses there is emphasis 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 radio course is as follows:

- Machine Shop (bench work),
- Magneto Practice,
- Alternating Currents,
- A.C. and D.C. Instruments,
- Batteries,
- Motors and Motor Control,
- Radio Power Circuits,
- Primary Circuits,
- Service Circuits,
- Condensers and Oscillating Currents,
- Radiating Currents,
- Transmission Line,
- Receiving Circuits,
- Receiving Sets,
- Service Radio Sets and Routine Work,
- Surface Circuits,
- Radio Regulations and Fleet Work,
- License Examination.

Review and Examination.

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 school and the students are studying, and the lapse of time since entrance to the school.

The first eight weeks of the radio course are devoted to the practical application of the studying, and the radio equipment. We use the books "Swoope's Lessons in Practical Electricity" and "Bullard's Naval Radio" Text Books.

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. The instructors are Chief Radio Electricians. Each instructor is assigned an operating desk having control of one operator. 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 25 words 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 School have successfully obtained an excellent general knowledge of radio and are fitted for themselves for promotion in this branch of the Naval service.

THE HOW AND WHY OF RADIO APPARATUS.

(Continued from page 113)

mechanical pressure can be exerted axially upon them, in order to make the gaps thoroughly closed. In the gaps above one-half K.W., the gap often becomes unduly heated, and it is common practice to place a small motor-driven fan in 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 rotor-polarized or triodes gaps. This particular design of gap has met with considerable favor, especially for small radio transmitters, of from one-quarter to several kilowatts output. This type is the most often used, and it is used on a low frequency or (0 cycle transformer at the transmitting station.

In the first place, this gap operates with a remarkably small chancce between its two semi-circular flat sparking electrodes and its rotary electrode, or having a gap about...
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 Telefunken 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 legs accurately milled-out, or milled-out at equal 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 back and front surfaces of the stationary and rotary elements milled with thirty-six radial slots, so that when rotated the corresponding tooth of the stationary member will cut through the air gap at a very high speed, the result being a good steady and repetitive spark. It is necessary that the width of the spark segments be so proportioned that the spark 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.

[These 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 receiver, so that the discharge of an induction coil will be of no use in the transmission of wireless messages, although who can say, if it is properly conducted to the ear, that it does not travel as far or farther, than an undamped wave.

It is very probable that high frequency current of a periodicity which is not detected 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.

[These 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.]

EXPERIMENTAL CHEMISTRY. (Continued from page 127)

be left in a cabinet, or some place else for a week, or until the water has disappeared. The reaction for this experiment is:

\[ 3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 4H_2O + 2NO \]

Copper Nitric Water Nitrogen Monoxide

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. ([HNO_3] half acid and half water). Apply 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.

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June, 1917

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EXPERIMENT NO. 62—
Put 2 or 3 grams of Ferric as sulfid [FeS] in a test tube and cover it with water. Place this near an open window, or about one foot of a test tube, and add 3 cc. of Hydrochloric acid [HCl] to it. The reaction set off, filter and evaporate. Equation: 

FeS + 2HCl = FeCl₂ + H₂S

EXPERIMENT NO. 63—
Put 10 grams of lime salt [Sodium Hydrate - Ca(OH)₂] to a test tube, and add 10 cc. of concentrated Sulfuric acid [H₂SO₄]. Carry on this experiment near a window or where a draft can be created. Heat the solution over a Bunsen burner very cautiously, and moderately. After the action has progressed for 5 or 10 minutes [2] by the tube, cool, then pour in 15 to 20 cc. of water, to dilute or dissolve the solution. If the liquid is not clear, filter it, and observe the filtrate [the liquid which passes thru the filter paper]. If concentrated sulfuric acid is present, it will destroy the filter paper.

Equation:

2NaOH + H₂SO₄ = Na₂SO₄ + 2H₂O

Chloric acid will act. The carbonic [CaCO₃, limestone, or marble], is plentiful, and hydrochloric acid attacks it with great vigor. The reaction would be:

CaCO₃ + 2HCl = CaCl₂ + H₂O + CO₂

Inexorable substances, salts and bases, are prepared in the laboratory almost wholly by one process, Precipitation. An insoluble salt or base may be made by mixing two solutions, one of which contains a compound of the metal, the other a compound of the nonmetallic part of the insoluble salt or base which will form the mixture as a precipitate. Lead sulfate or lead nitrate is made by pouring a solution of lead nitrate [Fe(NO₃)₃] or chloride [FeCl₃] into a solution of Sulfuric [Na₂SO₄] :

Na₂SO₄ + Pb(NO₃)₂ = PbSO₄ + 2NaNO₃

Lead Nitrat Sodium Sulfate Lead Sulfate Sodium Nitrat

Acids are usually made by acting with a less volatile acid, as Sulfuric acid [H₂SO₄], on a salt of the acid required. We have seen that salts can be made by the union of an acid and a base, and we now learn how salts obtained from its representative salt. Sulfuric acid is generally used, for making acid, because it is one of the less volatile acids, and thus it can change into its hydrogen and take a metal in its place. A salt of the acid desired must be put at the other end of the reaction, if Hydrochloric acid [HCl] is wanted. Sodium Chlorid [NaCl] or some chlorid is used. If Nitric acid [HNO₃] some nitrat, as Potassium Nitrat [KNO₃], should be used.

Soluble bases, especially the alkalies, may be made by acting with calcium hydroxid. In certain cases of the base required. Other bases, for example Sodium or Potassium Hydroxid, may be used in place of Calcium hydroxid. Ammonium hydroxid [NH₃OH] is prepared from a salt of Ammonium, as, Ammonium Chlorid [NH₄Cl], Ammonium Nitrat [NH₄NO₃], Ammonium Sulfat [NH₄SO₄, etc., by heating it with a mixture of calcium hydroxid [Ca(OH)₂] [slaked lime].

2NH₄Cl + Ca(OH)₂ = CaCl₂ + 2NH₄OH

Ammonium Hydroxid Calcium Chlorid Calcium Ammonium

Sodium hydroxid is made from Sodium Carbonat [Na₂CO₃] and Calcium Hydroxid. Insoluble bases are made by mixing two solutions, one of which contains a base and the other a compound of the metal of the base required. Ferric Hydroxid [Fe(OH)₃] can be prepared by adding Sodium hydroxid solution to a solution of Ferric chlorid [FeCl₃]. Any other soluble ferric [not ferrat] salt would do as well, and any other soluble Ferric hydroxid [Fe(OH)₃] requires a soluble ferrat [not ferric] salt.

SOLUTION—
In Experiment 5 [August, 1916, issue of THE ELECTRICAL EXPERIMENTER] we illustrated the Solution. We found that by dissolving the sugar in water, we formed a Solution. Sugar is said to be soluble in water and is not soluble in the Solvent. The substance is the Solution. A substance is said to be in solution in a given liquid, when it is evenly distributed throughout the liquid in such a manner 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 homogenize when

(Continued on page 156)
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June, 1917

THE ELECTRICAL EXPERIMENTER

EXPERIMENT NO. 69—

Place a piece of Ferrons Sulphat [FeSO₄·H₂O], in some place where it may be exposed on a piece of paper for a week, and then put it away, or so, after which time examine for white powder. This experiment illustrates Eflorescence.

EXPERIMENT NO. 70—

Examine a piece of Calcium Chlorid [CaCl₂] on paper for a week or more. Note any phenomena. This illustrates Deliquescence.

The laws of precipitation state—

[1] That when two mixtures are mixed in solution, a new compound can be formed that is insoluble in the solvent employed. Such a compound will be formed and will appear as a precipitate.

[2] When, on mixing different substances, a new substance that is volatile can be produced by the rearrangement of the atoms of the partaking substances, such new substance will be produced and will appear as a gas.

EXPERIMENT NO. 71—

Suppose we wish to prepare Silver Chlorid [AgCl]. We know that this compound is insoluble. Therefore we must select a soluble salt of Silver, and also a soluble chloride. Silver Nitrat [AgNO₃] being the only soluble silver salt in common use, we make a solution of it. We may also take much more chloride, because they are mostly all soluble. Sodium Chlorid [common table salt] being one of the cheapest, we shall use it. Take a little Sodium Chlorid and dissolve it in water. Pour one of the solutions into the tube containing the other, and the precipitate of silver chloride which we wanted is thus obtained. Save the precipit for the next experiment. This experiment also illustrates a substance which is insoluble in water.

EXPERIMENT NO. 72—

Prepare some Silver Chlorid [AgCl] as in Experiment 71, taking not over 5 cc. of each solution and using for one the silver salt prepared. Let the Silver Chlorid subside and pour off the upper supernatant portion of the liquid, leaving the solid with some liquid. Add a little Ammonium Hydroxid [NH₄OH], cover the mouth of the tube with the thumb, and shake well. If the solid does not all disappear, add more Ammonium Hydroxid. Upon the addition of Ammonium Hydroxid, the precipitate should be dissolved and a clear translucent solution formed. Thus we have prepared a solid from two clear liquids, and then dissolved the solid with another liquid. This experiment shows that substances which are insoluble in water, are made soluble in various other liquids.

(To be continued.)

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$4.00 Spark Coil, $1.50; large accurate Voltmeter, $3; large Static Machine, 170 plates, operates large X-Ray tubes, worth $40, for $15; Leading Condensers, $2.50; all lead & R. goods, $1.25 Fixed Variable Condenser, 75c; $2. Rotary Potentiometer, $1.40; 2,000 ohm headset, 5c. Cash or write, all answered. Satisfaction guaranteed. K. Kramann, 1034 Third St., Brooklyn, N. Y.


FOR SALE—Receiving Set, consists: Arlington Complete, $24;受信機セット、$24; Perkin Detector, Switches and large quantity parts. All new. Only $15. J. Smith, Trout Run, Pa.

FOR SALE—One Junior Cyclojet at $65. A bargain. Write: John Pitcher, Bathgate, N. D.

FOR SALE—An old, large, chime, chain drive, good tires, fine running order, $45. Also parts for cyclojet, twin engine with magneto, wheels, etc. $30. L. H. Murdock, 315 Steetman, Hyde Park, Cincinnati, Ohio.

WANT TO TRADE—Bicycle and wireless goods, or a motorcycle in running order. All letters answered. Roy Phillips, Hartford, Michigan.

WANTED—Trade: Foot-power tube, Post drill, 25-20 Millip pattern tube for wireless goods. Write, for particulars and state what you have to sell or trade. Lee Jones, 736 Lillian, Amarillo, Texas.

FOR SALE—Amateur receiving set, good condition. Write: Dock Stout, Troy, N. C.

WANTED—Battery, 2-inch Spark Coil, for instruments I have. Write for list. August Otar, Genoa, Ohio.

WANTED—Omnigraph and diary. Also "Smith" Flyer or motor wheel. Must be cheap. Cash or trade. Write: No. 657, Gwyned Valley, Pa.

FOR SALE—Two 36x35x film cameras. Anco, $10; Eastman, $8. Smith Premier Type writer, $10. All new. L. V. Fox, Davenport, Iowa.


AUDION and Amplifier cabinet set, including tuning equipment, $50. Anson 120 volt, opera, $12. Want fitzten coil pair undamped condenser coils, $2.50. McMurdo Silver, 261 West 57th St., New York City.


OMNIGRAPH WANTED—Will pay cash for Omnigraph in first-class condition. B. Cochran, Box 25, Palmetto, Georgia.

FOR SALE—200 watt transformer. Steps 110 to 100 and 110 to 10 volts; 110 to 110 volts; 110 to 120 volts; 120 to 110 volts; 110 to 12 volts; 110 to 1½ volts. $7. Inch spark coil; fine fat spark, 50 volt. Bassett, $1.10; Morse, $1.80; 20 volt induction. $1.50. Faraday receiver, $1.75; 75 ohm wireless receiver with headband, $1.50; 15 ohm half-wave receiver, $1.50; 15 ohm water motor, $1.50. C. M. Adams, Mifflin, Ohio.


FOR SALE—Silicon Detector without cat whisker wire, 50c; 1,000 ohm Receiver, $2; Galvanometer, 25c; Telegraph Set, 50c; Leather covered headband, 50c; Resistance must accompany wire. Write Henry Layman, Davisonville, Pa.

UKULELE—Koa wood, 10c, or trade for camera. Give size, lens, style, make, etc., by: Clyde B. Mars, Kaskela, Oregon.

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EXCHANGE—Complete set of parts for a Ford engine, with exception of crank shaft and flywheel for a panel type receiving set, typewriter or wire- less supplies. J. Yates Van Antwerp, 35 South Pennsylvania Ave., Washington, D. C.

SALE OR EXCHANGE—B-Flat corner, $12; shotgun, $1; incubator, $15; John Eno, Aztell, N. C.


FOR SALE—Motor, $10; Headset, $14; Phone Tuning Fork; Spark Set, $1; Sending Condenser, $2; Paulding, Can-


WANTED—Second-hand generator suitable for charging storage batteries. Must be in first-class condition. Archie E. Banks, Delmar, Va.

FOR SALE—5,000 mile Audion Receiving Set, cost $40. George Leonard, 11 Hanuit St., Uplands Corner, Mass.

EXCHANGE—6 volt, ½ horse-power motor; 1½ volts, 1½, horse-power motor, 110 volt ammeter. Want audion, 1 K.W. quenched gap, or other apparatus. Ira Wright, Clinton St., Mer-


HAVE—Olive Typewriter, Model J. Want cash or receiving apparatus. Make offer. All letters answered. Herbert Richter, Colgateville, Minn.


FOR SALE—Complete Audio-Ton on panel with all controls, and 4-40 storage battery. Panel has: Bass, Treble, P.D.T. filter, and various other selections wired on. Used 10 hours. $40. Also "Arlington" 4,000 M. Coupler, cost $25, for $60 and $4. Murdock Oscillation for $3. George R. Ham-

WILL EXCHANGE my Twin-Cylinder, 6 H.P., Markle motorcycle, in perfect condition, for good wireless apparatus. Francis J. O'Connell, 326 17th St., Washington, D. C.

FOR SALE—Set Cyclopedia of Applied Elec-


FOR SALE—Exchange first-class wireless set for "Smith" motor, wheel, or Motorcycle. Bernard Brown, 7th Ave., N. C.

FOR SALE—Triumph typewriter's type for sale cheap. Geo. Wissberger, Neillsville, Wis.


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THE ELECTRICAL EXPERIMENTER June, 1917 159

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**WORN OUT DRY BATTERIES CAN BE RECHARGED** for less than one cent. Send two 6’s to E. Bohrer, 1009 South Walch, Chicago.

WE WANT HUSTLERS to handle fast selling hobby goods. Big profits, beautiful premiums, free particulars. Variety Supply, 21 East 26th St., New York.

**FOR SALE**—Canaries, 400 Exposure Kodak with stereopticon enlarger; cost $55; sell for $30. True Sea Shells, folding camera, 5 plate holders, tripod, carrying case, etc., cost $2; $2.50, sell for $1. One 3 cent one, plate holders, carrying case, etc., cost $15, sell for $6. V. O. Gustafson, Toledo, Ohio.

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**BOYS!**—Penny sellers, 10c per bunch. Other samples included with order, with wholesale prices. The Novelty Distributing Agency, Box 182, Marion, Ohio.

**CASH YOUR SPARE TIME INTO MONEY**. One young man made $1,800.00 in two months. Sends to every automobile and motorcycle owner. Representatives wanted everywhere. Be first in your territory—act now to secure sample and particulars. Everhard Fabric Patch Co., Chanute, Kansas.

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**25c Diminishing card trick, apparatus included for 5c, just to introduce big free catalog. Aladdin, Neillsville, Wis.

WANTED—Second-hand drafting instruments. Highest prices paid. Send complete description and we will make offer. Deutsch, 2558 Pitkin Ave., Brooklyn, N. Y.

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**FOR SALE**—To dispose of the following instruments, I am offering some far below the original cost. Three sections, Murdock Model Condensers, $1. One K. W. Oscillator Transformer, $4. $4, Rockefeller, Spur Gap, 99. E. I. Co., Transcontinental Phones (2,000 ohms) $4. The above mentioned instruments are in first class condition. If interested, write for particulars. Charles W. Hlavina, 9318 Ave. E., Cedar Rapids, Iowa.

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so I prepared plans and specifications for a
20 kw. sub-station based on the existing plant
and then installed the equipment. The cost of the equipment was $2,000.
This plant has been in operation for several
months—without a hitch—and for its size is
the best installation in the camp.

I am now preparing plans for another station
of the same size and type for the North Thompson Mines, with which I am
connected. The equipment of this station is
based on the experience gained at the other station, and the equipment is
being built at the same price.

I hope this resume of my work has not been too lengthy. During this year I acquired a
wife and home. With best wishes to all.

"I have a friend who is preparing for a degree
in Electrical Engineering, and I have advised
him that he is making a mistake when he cons-
siders anything other than the course given
by the N.Y.E.S. Best wishes for the school."

"As this card indicates I arrived here in
Petrograd, safe and sound. Censorship forbids
mentioning the work that I am doing for the
Government, but of course you can guess what
it is. Regards to the instructors.

"Am in Central Station work, and am
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