RADIO AMATEUR NEWS

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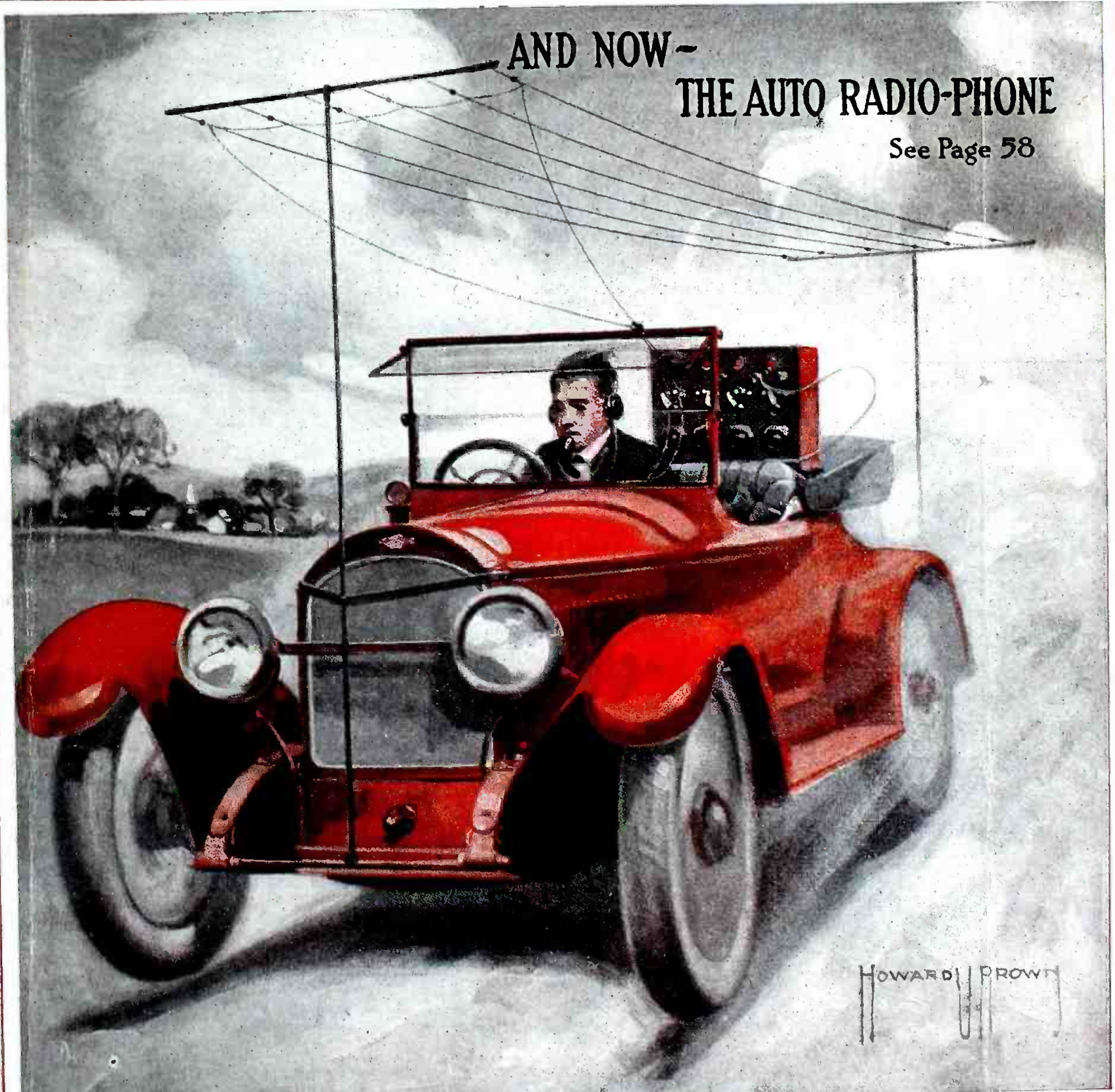
AUGUST
1919

OVER 100 ILLUSTRATIONS

Edited by
H. Gernsback

"The 100% Wireless Magazine"



In This Issue:

PUBLISHED BY EXPERIMENTER PUBLISHING CO., 233 FULTON ST., N. Y. C.

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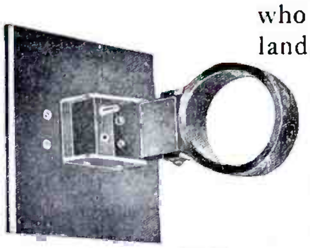

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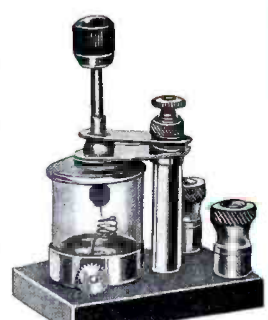

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AMPLIFY YOUR RADIO SIGNALS

ONE of the greatest drawbacks since the invention of wireless telegraphy is the receiving of weak signals at the receiving station. Many devices were proposed to improve this condition, but without success, on account of the mechanical difficulties encountered in these amplifying devices.

However, this was recently solved by the introduction of an exceedingly sensitive microphone transmitter, which is known to detect sound waves with great accuracy and magnify them through an intermediate telephone circuit.

By the employment of the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify the radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument. He is also able to demonstrate the operation of his wireless apparatus to his friends.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver as indicated in the diagram.

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Practical Instruments for Commercial and Scientific Purposes.

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Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter.

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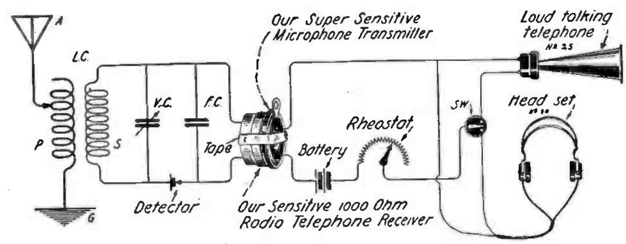

Model "C" Horn, with Loud Talking Wall Receiver. Price, $10.00 Complete

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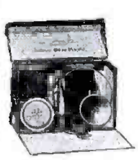

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RADIO AMATEUR NEWS

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RADIO AMATEUR NEWS

H. GERNSBACK — EDITOR

Vol. 1. AUGUST, 1919 No. 2

THANK YOU!

IT IS customary—and wise from a business standpoint —for a magazine editor to sing his own sweet praise, to blow lustily and loudly his own horn, as to the wonderful sensation the first issue his Vol. I., No. 1, created.

If he did not do so—and back up his contention by documentary proof in publishing a stack of admiring letters—his readers would think that perhaps, after all, the first issue *was* rather poor.

Now if the writer dislikes anything, it is self-praise and patting one's self on the back. So while it is a custom to publish letters from admiring friends in Vol. I., No. 2—see page 82—the writer will with your kind indulgence, now turn himself into an independent critic, and write a different sort of letter to your editor:

"Listen H.:

"I just finished reading the first issue of your new venture, RADIO AMATEUR NEWS, and I am much disappointed. I certainly hoped you would do much better, very much better, especially with the first number.

"Just because everyone tells you that you have turned out a masterpiece in that first issue, just because every mail brings you dozens of complimentary letters; just because you had to print a second edition of 10,000 copies, after all the news stands were sold out from Maine to Oregon, all this should not turn your head and make you swell with pride. As an editor of long experience you—from a professional standpoint—must know that even the poorest new magazine will, as a rule, receive a rousing welcome. Besides, the first issue *always* sells big—people buy it for curiosity's sake to see what it is like. But how will the second—the sixth—the twelfth number sell? No, my friend, you must do much better. Granted that the first issue did contain more pages, more illustrations, more articles than any other Radio publication. Granted that it did have by far the largest circulation and the largest sale of any other Radio publication. That means nothing at all, because there are only one or two other publications—*none of which* have the opportunities, the organization, the enterprise which you possess. Also, don't forget that you started RADIO AMATEUR NEWS at the psychological moment—when every amateur was thirsting for such a journal: would you take pride in handing a glass of water to a man dying of thirst?

"Confound it, man: you are doing only your duty—but why give the thirsting only *half* a glass of water, when it is in your power to give a full glass?

"To get down to brass tacks: Your new magazine must be first of all bigger; 48 pages is insufficient. Those really good articles sleeping in your desk drawers don't do your amateurs much good.

"Enlist the best radio talent in the world to contribute articles—every big radio man likes to be in good company. Call on them personally, if need be, and you will have the greatest and best radio magazine in the world.

Don't make your magazine a picture book—beautiful photos of commercial sets make nice reading, but your amateur *wants to know what's inside*. YOU know what's inside, so why don't you tell them? Just plain laziness on your part, I guess.

"Don't fill up your pages with two or three-column diagrams, when they can just as well go into one column. Your readers are wise to the fact that in so doing you cheat them out of other good articles, which are crowded out of the issue.

"Tush, tush, my friend, suppose this does cost you $100 more per issue on account of the additional money you must pay out for the contributed articles—what of it? You fully made up your mind before you launched RADIO AMATEUR NEWS that you would lose at least $5,000 the first year. Eventually you will get it all back with interest, so why be a piker?

"Don't under any circumstances neglect the young amateur—the boy who just gets into the game. Give him lots of elementary, plenty of 'how-to-make-it-yourself' material. He needs it badly, and his thirst is much greater than that of all the others.

"Stick to wireless—100 per cent. of it. Don't ever dare to 'branch out.' The Radio field is big enough for a monthly journal of 120 pages. Make an iron-clad vow that you never, never shall leave that path, and your success will be assured.

"Most disappointed was I with your Radio Phone Department. No, the quality was there, I admit, but, ah, the quantity was lacking. Amateurs want Radio Phone articles by the bushel—nay, by the carload—and you *must* leave no stone unturned to secure these for them.

"Bear the above in mind and by and by you will turn out a *fair magazine*, . . . perhaps.

"H. G."

Well, we can only hope that the present issue shows a little improvement over the first one. We tried to meet nearly all of the above criticism, but we guess we made a mess of it. At any rate, we feel pretty blue about it, but we do promise to do better, if you only be patient a while.

H. GERNSBACK,
Your Editor.

Of this issue 20,000 Copies have been printed and circulated.

The R-34 Radio Equipment

By Lt. R. F. DURRANT, R. A. F.

CHIEF RADIO OPERATOR OF THE R-34

Special Interview to Radio Amateur News

Lieut. R. F. Durrant, R. A. F. Radio Officer on R-34.

THE success of the British Dirigible R-34 in landing at Mineola, L. I., July 7th, after a voyage of 108 hours from East Fortune, Scotland, a distance of 3,200 miles, not only established a new mark in lighter-than-air craft flights, but from the distances covered by its radio equipment a great stride has been also made in aircraft communication.

Since the safe piloting of the machine depended on wireless communication for weather reports, time, etc., a very elaborate system of transmitters and receivers was installed and a pioneer in aircraft radio was selected as Officer in Charge.

Lieutenant R. F. Durrant, Royal Air Force, one of the men directly responsible for the perfection of British Aircraft Radio Apparatus, was the one England selected to bestow the honor of the first Trans-Atlantic Dirigible flight, and our readers are introduced to Lieutenant Durrant whose photo follows. Under his supervision were two radio operators, Corporal Powell and A. C. Edwards, who also shared in the honors of the gigantic R-34's success.

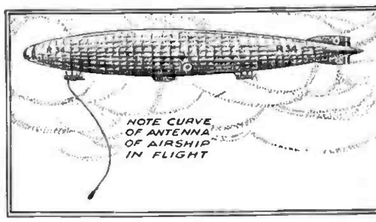
The R-34 is equipped with four transmitting sets: A high power sustained wave set for long distance work, a medium power sustained wave set for distances up to 500 miles, a damped spark transmitter for damped receptor stations, and a wireless telephone set, which is the medium power set so arranged as to permit radio-telegraphic or telephone communication to be carried on. The antenna consists of a phosphor bronze stranded cable 500 feet in length which is lowered from the forward gondola, in the middle of which the radio room is situated. This cable is provided with a weight on its farmost end from the gondola and tends to mantain the wire at right angles to the line of the big ship. However, as Lieut. Durrant explained and as shown in figure 1, the force of the wind and the ship's speed cause the antenna to take the shape shown while the ship is in flight. It is also possible to lower another cable of the same length and thereby increase the fundamental of the antenna, but in practice the one wire was found well suited for the work carried on by a ship of this type.

With the large transmitter, which employs oscillion tubes of British Design drawing 3.6 amperes on the filament circuit and the application of 3,000 volts to the plate circuits, a radiation of 4 amperes was possible. While over the Firth-of-Forth and communicating with the *Queen Elizabeth* which was some 9,000 feet directly under the airship; the station situated at the Azores reported picking up the R-34's signals; a distance of 1,400 miles.

> *On its return trip to Europe the R-34 carried a number of July* RADIO AMATEUR NEWS. *Chief Radio Officer Durrant as well as his two radio aides expressed themselves very highly over the new magazine.*—EDITOR.

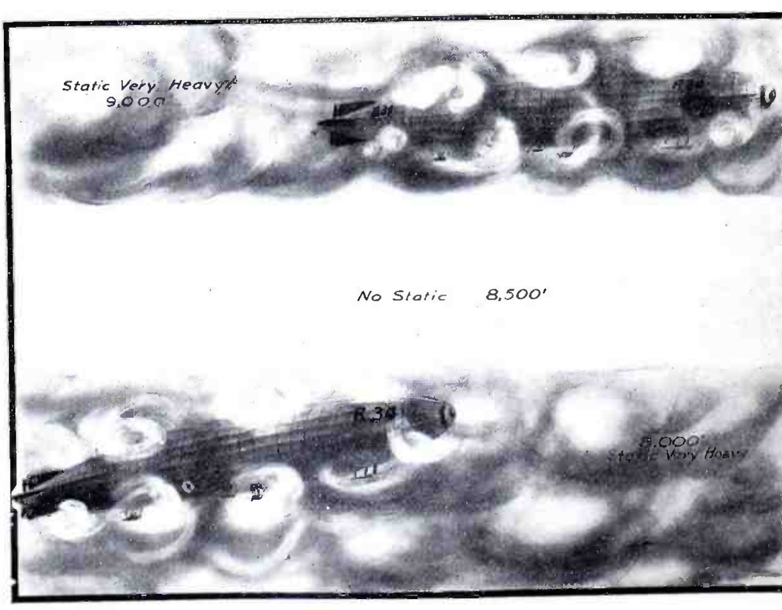
This is a remarkable distance for aircraft apparatus and, in our estimation, marks a new record for such medium powered sustained wave apparatus. This set is installed in such a manner that it is possible to connect both oscillions in parallel if desired. Communication was held with the British Air Ministry 800 miles, and St. Johns was communicated with while the ship was 1,150 miles from that station.

After the ship reached within 500 miles of the coast the operators shifted to the auxiliary medium powered set, which is applicable to telegraphic or telephone communication, whichever is desired.



Note Peculiar Shape Maintained by Antenna While Ship is In Flight.

For the purpose of communicating with ships which are not supplied with undamped wave receptors a small damped spark transmitter is furnished. The coil is rated at about 2½" spark and remarkable work was performed with this type of apparatus. It is rated at 100 watts input; with it communication was established with Cape Race on 600 meters—three hundred miles, which to say the least, is exceptionally surprising for it has been considered impossible to communicate one third that distance with the same transmitter on land.



Peculiar Phenomena Experienced by Lieut. Durrant on His Trip to America.

In respect to the extreme ranges covered with these types of instruments it may be well to suggest some reason for the increase noted on the R-34's trip. It is highly probable that the extreme value of capacity embodied in the metallic covering of the huge gas bag furnished a much better ground or counterpoise effect as compared to the very inefficient and impractical means applicable hitherto; and that this alone has considerable bearing on the distances covered by these medium powered sets. It is one more step towards (*Cont. on page* 86)

Tree Radio Telephony and Telegraphy

By MAJOR GENERAL GEORGE O. SQUIER

CHIEF SIGNAL OFFICER, UNITED STATES ARMY

IN 1904 the author conducted some experiments with a view to utilizing growing trees as antenna for radio telegraphy and discovering the efficacy, in a general way, of using a direct metallic contact to certain trees (principally eucalyptus) to increase the audibility of radio signals.

It was found that the regular Army buzzer telephone and telegraph sets were inoperative with any ordinary ground or earth, but became operative when connected to a metallic nail driven in the trunk or roots of a tree. This incident led the author to pursue the subject experimentally in the autumn of 1904.

Living vegetation plays a more important part in electrical phenomena than has been generally supposed. We have seen that living vegetable organisms absorb and conduct electromagnetic oscillations over a wide range of the electromagnetic spectrum, beginning with sunlight, whose electrical action in the plant cell is at present little understood, and extending to waves of identical character, but of immensely greater lengths, such as Hertzian radiation, telephonic waves, and oscillations of the ordinary low frequencies used in commercial electric transmission lines. Disruptive discharges between vegetable electrodes and electrostatic effects between vegetable surfaces are easily produced.

If, as indicated above in these experiments, the earth's surface is already generously provided with efficient antennae, which we have but to utilize for such communication, even over short distances, it is a fascinating thought to dwell upon in connection with the future development of the transmission of intelligence.

A growing tree, covered with foliage, is influenced inductively by electrical disturbances outside of itself, and in fact becomes generally responsive to induced electrical oscillations.

It is believed that vegetation should be studied more systematically, from a distinctly physical standpoint, than has been done in the past. Physics has been said to be the mother of all sciences, and more the physical method of studying all science is proving to be the true one, as is evidenced by the great advance in recent years, in comparatively new branches of scientific work, such as Astrophysics and Physical Chemistry. Has not the time arrived for a more systematic study of Physical Botany, in the light of the new electrical theory of matter?"

Tree Antenna

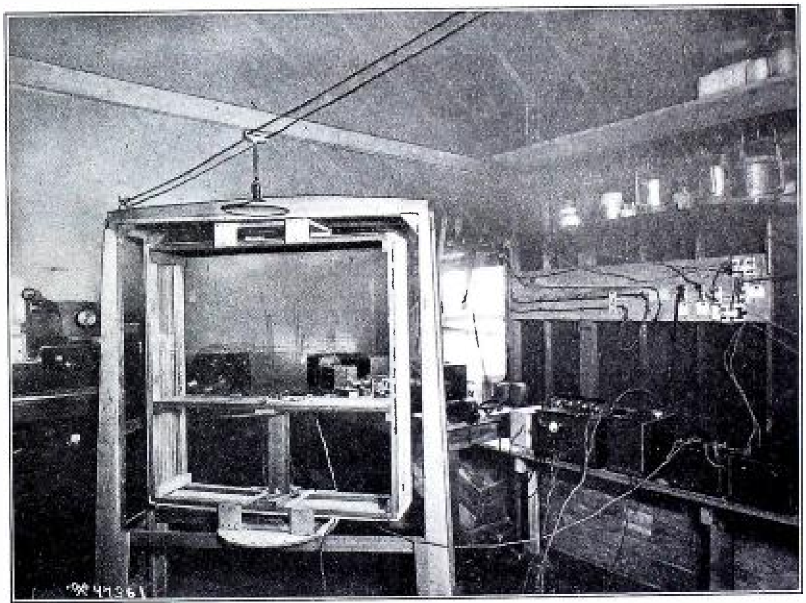
In connection with the organization and development of Transatlantic radio reception, which was carried out during the period of the war to provide against the possibility of the interruption of the submarine cable system, the Signal Corps established a chain of special receiving stations in different parts of the United States to copy and record enemy and allied radio messages from European stations for the information of our Army General Staff.

It was immediately discovered that with the sensitive amplifiers now in use it was possible to receive signals from the principal European stations by simply laying a small wire netting on the ground beneath the tree and connecting an insulated wire to a nail driven in the tree well within the outline of the tree top.

One of the best receiving arrangements was found to be an elevated tree earth-terminal in the upper part of the tree top as described later, and an earth consisting practically of several short pieces of insulated wire sealed at the outer ends radiating out from a common centre, and buried a few inches beneath the surface of the ground in the neighborhood of the tree.

It was soon found that a tree-antenna could be used efficiently as a multiple receiving set over widely different wave lengths, receiving either from separate terminals at the same or different heights of the tree or in series from the same terminal.

This same type of circuit was employed in an inverse manner for telephonic transmitting purposes, and although the experiments thus far have been limited to short distances, it was found that 2-way telephonic communication was easily established with remarkably low values of transmitting antenna current.



Floraphone Long Wave Receiving Apparatus, with Direction Finder and "Barrage" Receiver.

The flexibility of this arrangement is very striking. The linking up of wire and wireless methods was found to be convenient and efficient. Radio telephonic messages from airplanes were readily received by the tree-antenna arrangement and transferred thence to the wire system of the City of Washington and finally received at any point desired.

Furthermore, telephonic transmission thru the tree-antenna was received by another tree-antenna, and automatically returned to the sender on a wire system, thus making the complete circuit. Long distance reception on any wave length from all the larger European stations and from our ships at sea was easily accomplished and traffic copied on a twenty-four hour schedule by the regular enlisted operators of the Signal Corps.

Tree contact was made through copper nails driven three inches into the tree. Ground contact was made thru a bundle of copper wire buried three feet deep in moist soil. Three grounds were installed so that the individual resistances could be determined. An average value for this resistance with direct current was 150 ohms.

At radio frequencies, on account of capacity effects, this resistance was much smaller.

Using the substitution method, measurements of the apparent series capacity and resistance of the lead alone and of the lead attached to nails driven into the tree at various heights were made at different frequencies. In all cases the lead was of just sufficient length to reach to the point of contact, whether connected electrically to the nail or tree.

The original data are given in Tables I and II.

The small change in the electrostatic capacity occasioned by making electrical contact with the tree, while all other conditions remain unaltered, is to be remarked and also the large increase in resistance under the same conditions. The increase in resistance is particularly pronounced for small heights and long wave length.

It is interesting to note that no correspondence is to be observed between the resistance curves when plotted from curves I and II, as determined by these measurements, and the curves representing the radiation resistance of a simple vertical wire.

The explanation of such large resistance values in case of tree antennæ is probably to be found in the effect of the immediate proximity of partially conducting media to the conducting lead.

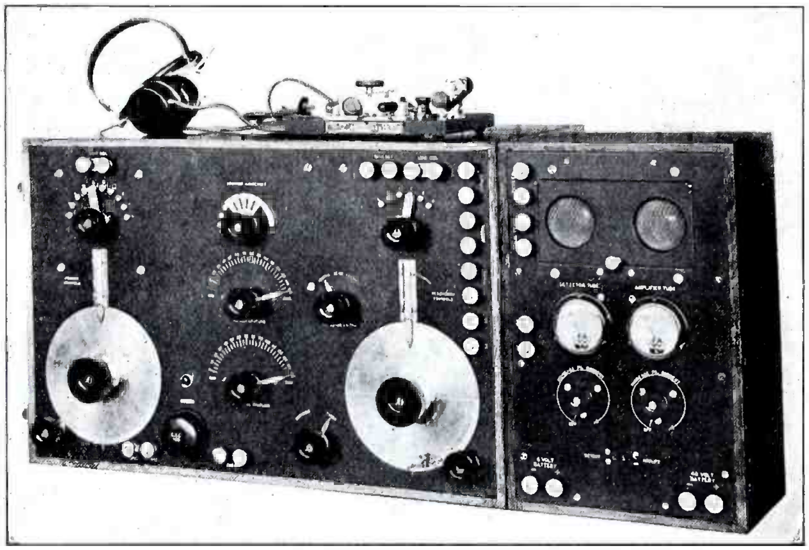
Referring to the general theory of alternating current systems, it can be shown that the receiver constants for which a maximum energy extraction from the antenna is obtained are: (1) The receiver inductance should be such as to resonate with the apparent antenna capacity at the frequency in question. (2) An effective receiver resistance equal to the apparent resistance of the antenna at the frequency in question.

An inspection of the foregoing shows that, in general, the effective antenna resistance is many times the apparent resistance of antenna as ordinarily used, and that,

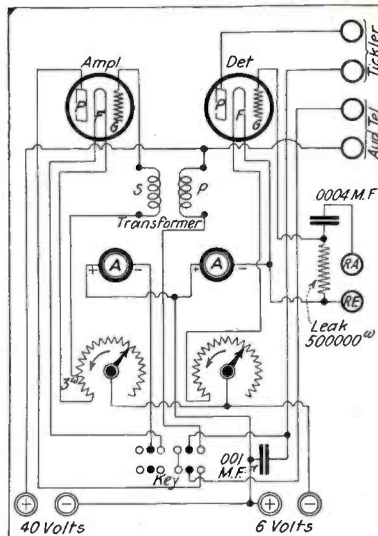
(*Continued on page* 91)

Battleship Type Receiver

THE Battleship Type Receiver is the most efficient receiving design manufactured, as is attested by the large number of United States Navy ship and shore stations equipped with this type of receiver. The receiver is manufactured for the Bureau of Steam Engineering by a well-known Boston concern, designers and manufacturers of high-grade radio apparatus. It combines all the latest radio receiving developments compatible with practical operating efficiency.



The Battleship Receiver and Two Step Amplifier.



Connections for Audion Amplifier

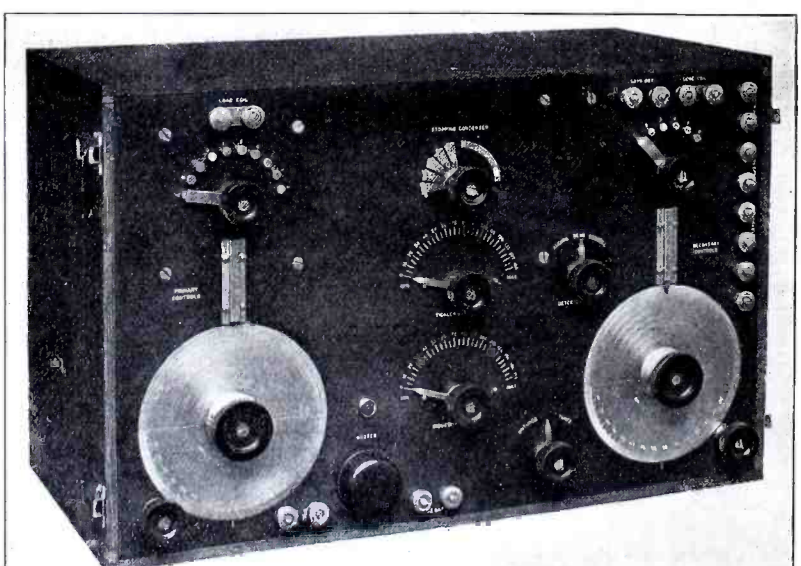
The receiver is built in two units, namely, the radio frequency unit and the vacuum tube control amplifier unit. The circuits are designed to give a high efficiency with crystal detector operation, as well as with vacuum tube operation. The wavelength range of the receiver is 250 to 6800 meters. Longer wavelengths may be obtained by the insertion of load coils in the circuit. This receiver possesses a great degree of selectivity and it is highly sensitive. An untuned or "stand-by" circuit is provided. The receiver is especially adapted for use on commercial ship and shore stations carrying a large volume of traffic. It offers reliable daylight reception from transoceanic stations.

A switching mechanism permits the use of either of two tuned circuits or an untuned secondary. The coupling between antenna and secondary is purely electro-magnetic and continuously variable, passing from the maximum coupling value through zero to a small reverse coupling. By *providing absolute zero coupling between the circuits, desirable low couplings up to zero value are assured. Interference is greatly reduced by this means.* The maximum coupling for any wavelength is such that appreciable retuning of the circuits does not occur in going from the zero to the maximum value. The coupling maximum gives a rapid change of coupling per degree on close coupling, and a very small change per degree on loose coupling.

A coil is arranged in controllable inductive relation to the secondary coil, for connection to the vacuum tube control box, this permits control of the coupling between grid and plate circuits of the vacuum tube, and by its variation permits reception of regenerative spark or undamped signals.

The coils used in the receiver are *banked-wound inductances* of high frequency cable, wound on threaded bakelite tubes. The assembled coils are impregnated in vacuum and baked. The coils are sectionalized with spaces between the sections. The individual sections are automatically connected, entirely disconnected and opened, or entirely disconnected and individually short-circuited by a mechanism operated by the inductance switch. By this means every coil in the receiver has a natural period when connected with its leads and switch points less the shortest wavelength in the range of the receiver. This eliminates the reception of parasitic signals, reduces the absorption of the desired signal by the coils, forces the energy into the detector, and minimizes interference on all wavelengths within the wavelength range of the receiver.

The condensers are of the self-balanced plate type. Insulating bushings are entirely absent in their construction. Their calibration is constant and their losses extremely low. A gearing mechanism connects the condenser shaft to a control which gives a vernier motion of the condenser for adjusting the heterodyne note.



The Last Word In Receiver Design. Note the Calibrated Condenser Scales.

The condenser dial is engraved with marking from 0 to 180° and with rows of concentric circles. A mechanism operated by the inductance switch moves a pointer to successive engraved bands. On these bands may be engraved the wavelength calibration of the receiver. This will assist in identifying stations and operating a network on wavelength schedules.

The untuned or "pick-up" position can be made as broad or selective as desired by coupling control. In switching from untuned to tuned secondary, no readjustment of the primary is necessary.

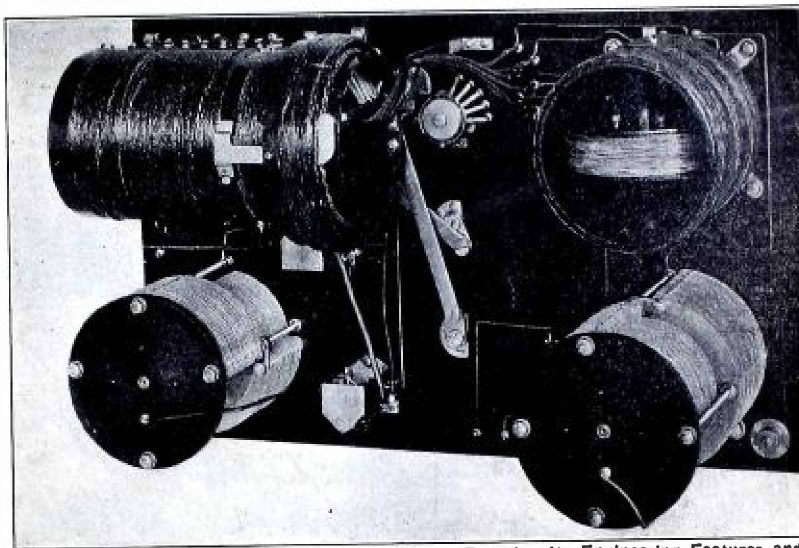
Static or capacity coupling between antenna and secondary circuit causes the receiver to pick up atmospheric disturbances and interfering signals. All capacity couplings have been carefully studied and eliminated by wide separation of the points in the two circuits of relatively high potential difference, and the disposition of ground and low potential leads of the two circuits in adjacent locations, to act as barriers and screens for residual couplings.

All wiring is of rigid copper, encased in varnished cambric tubing. A variable stopping condenser for crystal operation is mounted on the panel.

The receiver is mounted under a ½" bakelite dilecto panel. The containing box is of ⅝" oak. The front of the panel contains the control handles and binding posts. A switch transfers the receiver connections for vacuum tube reception or crystal reception, or protects them during transmission.

Binding posts and short circuiting links are included in both the primary and secondary circuits for loading the receiver to any desired wavelength longer than the natural range of the design. This feature renders the receiver a universal solution for all wavelengths above 250 meters.

Hundreds of these receivers manufactured by this concern are now in use by Navy ship and short stations.


Rear View of the Battleship Type Receiver Clearly Exposing Its Engineering Features and High Standard of Design.

The vacuum control box shown in the illustration contains two vacuum tubes. A switch permits the use of either one or two. The first tube may be used as a simple detector, or as a self heterodyne detector oscillating on the intermediate point of a regenerative detector. The three states are controlled by the regenerative adjustment in the receiver. The input of the first tube may be amplified by a transformer interlinking the first and second tubes. Separate filament rheostats and ammeters are provided for each tube. The sensitivity of the second tube is controllable and linked with the variation of filament current in this tube.

The vacuum tubes are mounted on shockproof mountings that entirely eliminate "noise" due to mechanical vibration. The amplifier is of the regenerative low frequency type that was jointly developed by one of the company's engineers in 1917 and standardized upon by the Navy. This method provides a maximum of amplification and is immensely superior for radio reception to the flat amplifying transformers developed by the telephone companies.

The apparatus is mounted on the rear of a bakelite dilecto panel. The controls and binding posts are placed on the front of the panel vacuum tube control box. The binding posts interlocking it with the battleship receiver are directly opposite the receiver binding posts and are correspondingly engraved.

In the construction of both the receiver and control units, the best of materials and workmanship enter. The apparatus is rugged, and has an indefinitely long life in service. It presents the best solution that modern radio practice can produce, and represents an investment that should be highly productive in establishing reliable communication free from interference and consequently increasing the volume of traffic that may be handled by a station.

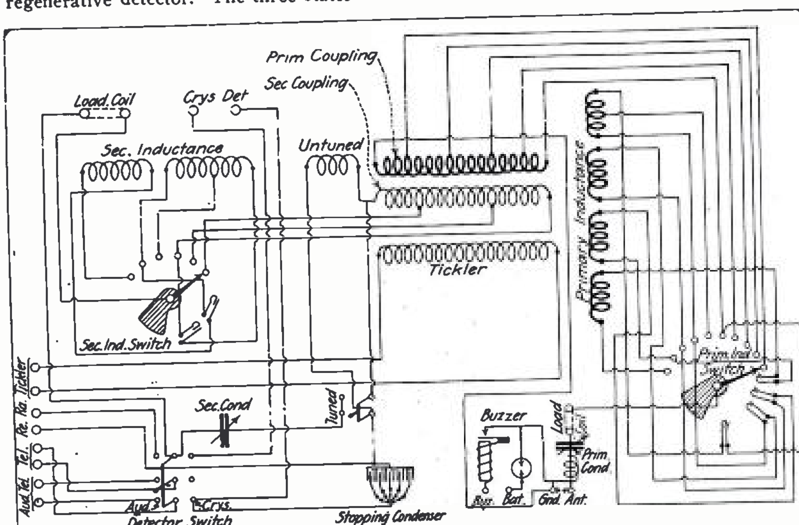


Diagram of Connections for Battleship Type Receiver

Photos courtesy Wireless Specialty Apparatus Co.

Curious Cases of Audibility

A ship approaching Tampico—position at commencement of test: 80 miles east of Tampico Bar—was unable to hear the Mexican government station at Tampico (*X A J*). However, another ship on the Pacific coast, and beyond the high Mexican mountains, was clearly heard and communication established. This ship on the west coast notified the ship in the Gulf when *X A J* began sending, but for twenty-five miles beyond position indicated at commencement of tests *X A J* could not be heard.

Furthermore, an imaginary line, drawn from the ship in the Gulf to the one in the Pacific, would have grazed *X A J*.

The "deadest spot" on the Atlantic coast is close to the shore between Hatteras and Jacksonville. Many operators assume that the quietness of the ether in the district indicated is simply explained by the absence of a great number of stations in the vicinity. It has been demonstrated by comparative tests when passing thru this area that the same lack of signals has been found on the stations which work on schedules.

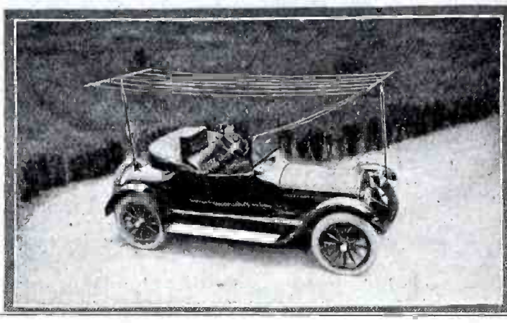
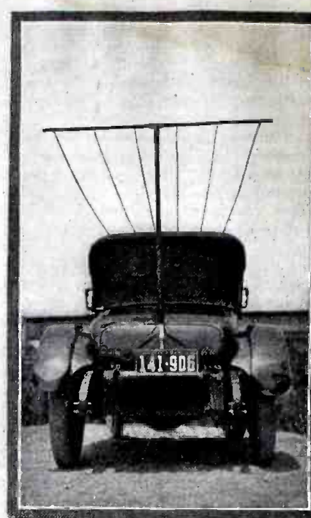
Signal strength from *N A A* was found to increase somewhat when the latitude of Jacksonville was passed south-bound. Signals from the south, i.e.: *N A R, N A W, N A X*, were very erratic. Only *N A R* could be depended upon for consistent action from among the three in this direction.

Signals from *N A U* were louder in this district than almost anywhere else on the coast. *W B F, W C C, W C G* and *W C Y*, which were well audible below the Jacksonville latitude, were hardly within the limits of audibility in the "dead" area.

Static in this section was horrible at all times, but often there were quieter moments. No difference in signal strength was manifest during these periods.

Another "dead" area is Long Island Sound. One of the *K X* ships, which was barely audible at New York when leaving New Bedford, was compared for signal strength continuously for several months and only slight changes in audibility were had. The same ship came in quite loudly in the Gulf of Mexico upon several different occasions.



Left—Mr. Grebe Tuning up His Auto Radio Phone Set. Top Center—Mr. Grebe Radiophoning En Route. Bottom Center—Complete View of Auto, Showing Antenna Construction. Right—Rear View of Auto Showing Method Employed to Support Masts.

THE AUTO RADIOPHONE

By A. H. GREBE

Expert Radio Constructor

THE present stage of radio telephone development has placed this form of communication on such a highly practicable plane that its rapid adoption for many useful purposes is only a matter of a very little time.

On aircraft it is now considered indispensable and because of the extreme simplicity of operation it will be used in many places on land over spaces which cannot be economically spanned by wires.

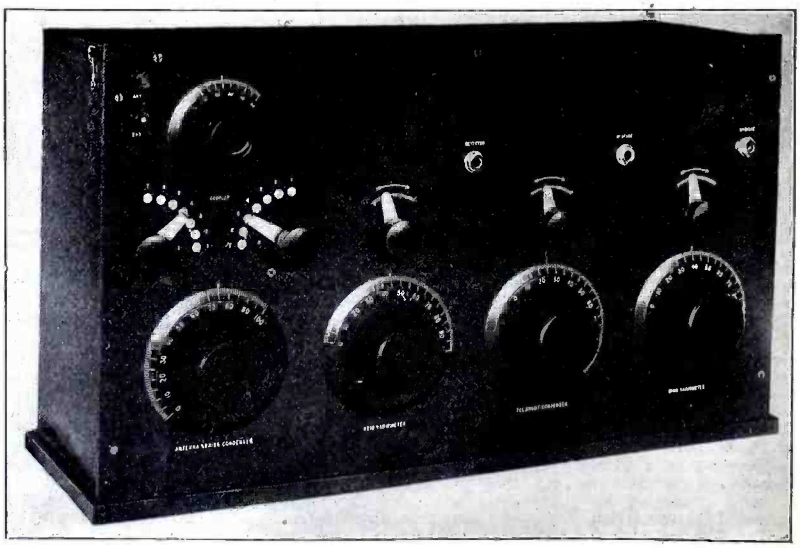
Having experimented considerably with vacuum tube radio telephones during the past few years, and being impressed by the adaptability of this type of radio communication to small antennae, the writer desired to make some tests with a radio telephone equipment installed in a motor car.

At first it was decided to use a flat loop as the radiating member, but this was abandoned in favor of a four-wire flat top antenna, used in conjunction with the frame and body of the car as a counterpiece. It was found best to depend on efficient radiation of the transmitted energy and sufficiently amplified incoming signals, than to sacrifice radiated energy in favor of the advantages of the loop for receiving.

The antenna system was constructed along portable lines, the supporting masts being fitted with socket joints for assembly and attachment to the car frame. *When not in use the entire antenna system was slung under the running board on hooks provided for this purpose.* The antenna wire was the same as used on aircraft and the non-kinking characteristics of braided wire made it more suitable than other kinds.

The transmitter consisted of a panel and cabinet assembly which included the vacuum tube mounting, choke coils, oscillating circuits and modulating system. Meters were provided for indicating the filament current, modulator and oscillator tube space currents and the radiated energy. The oscillating circuit was so arranged as to be controlled by means of a tickler coupling, and the dial for indicating the position of this coil was provided on the panel. Filament current was obtained from a storage battery located back of the seat, and this battery supplied the current for operating a small dynamotor, as well as the vacuum tubes in the receiver. The microphone transmitter was mounted on a convenient handle and arranged with a plug which was inserted thru the front of the panel. Another plug and jack was provided for connecting a hand telegraph key for buzzer modulation. A switch control on the panel

Above—Radio Telephone Generator Panel of Latest Design. To Right—Complete Receiver and Transmitter Combined.

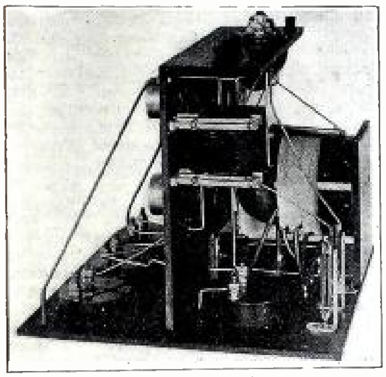


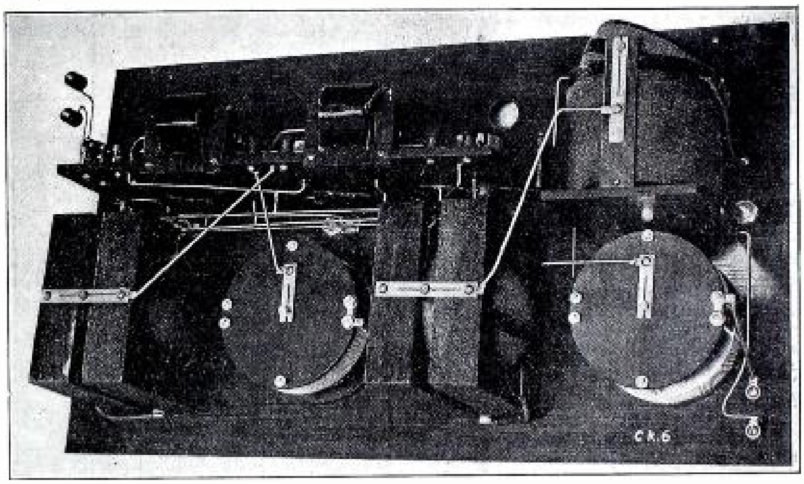
enabled the changing of wavelengths; it was found that a wavelength of 150 meters gave the best results.

The receiver consisted of a variometer type of regenerative receiver with two stages of audio frequency amplification and for this particular purpose was altered so that the antenna was directly cut in the grid circuit of the detector tube. This was necessary owing to the fact that the receiver was designed for use with the usual amateur antenna, and the wavelength obtained with the car was therefore below the requirement. The three stages of tubes were operated by a telephone plug, which controlled the filament and transformer circuits. *Signals from ship stations and land stations within one hundred and fifty miles radius were copied without any difficulty.*

An interesting feature of reception occurred when other motor cars were operating nearby. The discharges at the spark plugs were very plainly heard upon the approach of a car and continued until the latter had gone a considerable distance. This same feature caused considerable difficulty in receiving on the motor car radio station itself and was not entirely overcome by shielding the ignition wires.

Owing to the fact that all the tests were conducted on a laboratory basis, it is not possible at this time to furnish data regarding the distances covered but it is probably sufficient to say that the tests have shown that the auto-radio-phone is entirely practical and the near future should bring extensive developments along these lines and we may soon hear an "SOS": "Send an emergency service car to car No. 999-999 three miles east of "Suburbanville."





Above—Rear View of Radiophone Generator Panel. To Right—Constructional View of Receiver and Transmitter Parts.

Radio Activities "Over There"

By Corporal A. E. Chute

Formerly with A. E. F.

ONE of the sources of information concerning the enemy's intentions and dispositions during this war has been derived from the observations, from all possible angels of the enemy's communication service. This source of information, practically unthought of before this war, has developed to such an extent that, at the close of hostilities, it constituted one of the main branches of our Intelligence Department. There have been times when Radio Intelligence has obtained information of the most vital importance which could be obtained in no other way and it has constantly served as a check upon information obtained from other sources. The ability to locate accurately enemy radio stations in the St. Mihiel salient on the day before the attack of September 12, 1918, was the only proof that the enemy had not withdrawn from the salient, and this proof, even in the face of overwhelming evidence to the contrary, prevented an eleventh hour change in the plans for the attack and a possible change in the results.

The practical side of Radio Intelligence has been handled in the American Army by the Radio Section of the Signal Corps, and upon the efficiency of this section has depended to a large extent the success of Radio Intelligence.

Just before the St. Mihiel drive there were indications that the enemy had withdrawn and the advisability of advancing the infantry without artillery preparations was seriously considered. The final decision to make the attack as originally planned was based on the evidence of the goniometric service that enemy radio stations were still in their old locations.

A certain message was intercepted announcing that an attack had been postponed on account of bad weather. At 1.25 P. M. and again at 1.52 P. M. messages were received ordering batteries to be at absolute attention and announcing that the barrage signal would be "Blue." Troops were notified and took the necessary steps to meet the raid which took place that night.

The Radio Intelligence Section

There was one kind of work done by the Signal Corps at the front which for interest and daring vies with anything the records of the war hold. This was the task performed by 12 officers and 402 men of the Radio Intelligence Section, who maintained six different stations to keep tabs on the enemy and policing our own lines to see that the enemy did not keep tabs on us. They had radio receiving stations which copied messages in code from German ground-radio stations; airplane stations which intercepted messages between enemy planes and ground stations; goniometric stations which located enemy observation planes; control stations which supervised and policed the work of the American radio stations; goniometric stations which plotted bearings on enemy radio stations; and last, but not least, the listening stations which copied telephone and ground telegraph messages of the enemy. The Germans devised a new code which was supposed to have gone into effect March 11, 1918. On March 13 an American Intelligence radio station received a message from a German station which had just received a message in the new code, asking that the message be repeated in the old code. From the call letters given in the message it was possible to find both the original message in the new code and the repetition in the old. This assured the solution of the new code before the German operator knew it himself.

Changing Codes at Instant's Notice

As a contrast, and as a curious commentary on the much-talked-of German efficiency and American unpreparedness, when a code book was stolen from us by the Germans, not only was another code ready but our operators were actually prepared to use it when the order went out to put it into immediate effect.

There is no more thrilling page in the romance of the war than the little history of the American listening stations of the Signal Corps. They were always to the front and sometimes in *No Man's Land* itself, but wherever they might be located they were, as one of the men described it, "very near heaven." Their business was eavesdropping, and if they did not hear anything good about themselves they managed to do the doughboy lots of good.

Loops of wire were constructed out in No Man's Land parallel to the enemy lines and the tiny electric stray currents induced in the loops were stept up by a three-step amplifier. Copper mesh mats or metallic rods were also buried as near the enemy wires as possible and from them wires were led to the amplifier. By this means ground currents and leaks from the enemy's lines were picked up and copied. The planting of these "grounds" near the enemy's lines called out some of the most heroic instances of personal bravery and resourcefulness at the front. Time after time these men were caught by the glare of a star shell as they crawled out into the night toward the German lines and were seen no more. Often they were caught in a barrage. More often, however, they wiggled their way through barbed wire and shell holes, planted their wires and returned to reap the benefit of their daring exploit.

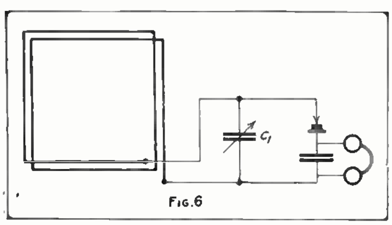
Loop Antennae and Direction Finders for Amateur Use

By David S. Brown

DURING the war the use of loops (or closed coil antennae) became more and more popular as their possibilities were uncovered. While loops were by no means new in the radio art, their applications were extremely limited until the last few years. At present they open a field for the amateur radio man which has hardly even been dreamed of. It is the purpose of this paper to illustrate and explain some of the different types, with their special applications, so that the use of loops may be made an immediate possibility for the experimenter.

First, it might be well to explain that a so-called "loop" consists simply of one or more turns of wire mounted rigidly on a suitable framework. The size and number of turns depend upon the use for which the particular loop is intended. Several years ago Dr. F. A. Kolster of the Bureau of Standards demonstrated the possibilities of loops by using them for transmission and reception over considerable distances. He also designed small loops which could be mounted on a pivot inside of a building. With the latter he was able to receive from foreign stations and to locate the direction of the transmitter from the receiver. Both the French and British Armies were using small loops in the early part of the War for receiving because of the fact that they were small enough to be easily portable and hidden from the enemy. The United States Signal Corps early started experiments and were soon in a position to use loops for almost any purposes of transmission and reception.

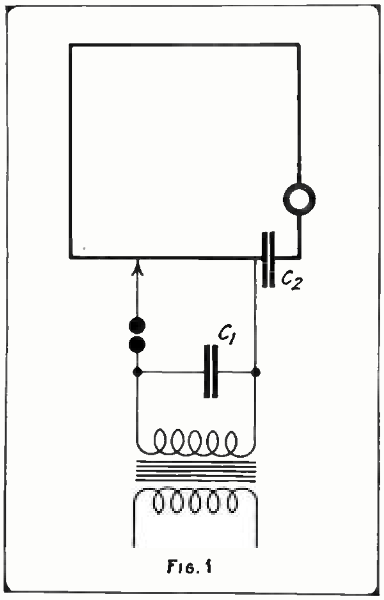
One of the most recent uses of loops, or more properly, closed-coil antennae, is the system due to R. A. Weagant* for the elimination of static.



The Loop in Conjunction with a Crystal Detector Provides a Very Efficient Indoor Antenna.

There are three general types of loops. The first, and now the most common, is the "solenoid" type. The second is a flat or "spiral" type. The third consists of two of the first type and is called the "crossed coil" type. The two latter are used almost entirely for direction finding. It has already been mentioned that the size and shape depend upon the special use. However, for almost all ordinary work, loops are made square or rectangular. The actual design and dimensions will be taken up later.

It is not the purpose of this paper to discuss thoroly the theory of loops, but in order that the reader have a fair idea of the operation, a brief summary will be given. It may be shown mathematically that the strength of signals received in a loop varies as $\frac{NAL}{\lambda^2 R}$. Here N is the number of turns, A is the area (length times height of the loop), L is the inductance, λ is the wave length, R is the high frequency resistance. This would indicate that the received signal would be increased by increasing the number of turns and the



Simple Type of Loop Antenna Devised by Dr. F. A. Kolster of "Decremeter Fame."

area of the loop. However, as N, A and L increase, λ increases by the square, thereby diminishing the factor; and if the graph of this "Reception Factor" be plotted, it will be in the form of an inverted U, indicating that at some particular wave length there is one size of loop that works best. And *vice versa*, any one loop will respond best to one certain wave length. Dr. J. H. Dellinger* of the Bureau of Standards gives the following formulæ for loop reception:

From antenna to loop

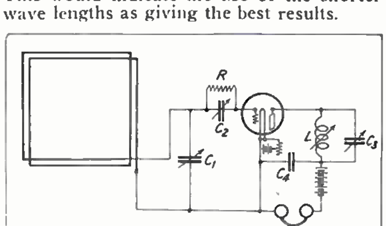
$$I_r = \frac{K H_s I_s A_r N_r}{R \lambda^2 d}$$

From loop to loop

$$I_r = \frac{K A_s N_s I_s A_r N_r}{R \lambda^2 d}$$

In these formulæ K is a constant, H is the height of the antenna, I is the current, A is the area of the loop, N is the number of turns, R is the resistance of the loop, λ is the wave length, d is the distance apart of the stations. The subscripts "s" and "r" refer to sender and receiver, respectively.

It will be especially noted that in loop to loop work the received current varies inversely as the cube of the wave length. This would indicate the use of the shorter wave lengths as giving the best results.

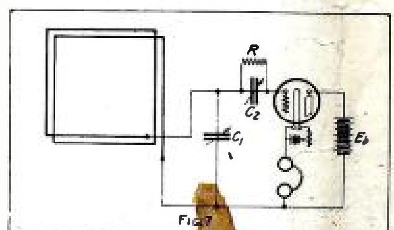


A Circuit Which Proved Most Satisfactory for All Around Reception Purposes.

From the previous discussion it may be seen that it is advantageous to use short wave lengths with low power sets. *It is perfectly possible for the amateur to have all his apparatus and his loop antenna in his room and to be able to communicate with practically no interference.* The distance depends, of course, on conditions and power. In a crowded locality it would obviously be of great advantage to have groups working on wave lengths varying from fifty to one hundred meters. Furthermore, at these high frequencies the tuning is very sharp, and hence interference will be eliminated to a great extent.

No attempt will be made to describe transmitters, as that part of it is up to the user himself. Spark coils of low power may be successfully used at low wave lengths for distances of five or ten miles or more, depending on the type of receiving apparatus and also upon local conditions. One of the chief troubles encountered is absorption of these very low wave lengths. There is no way of telling what waves will be absorbed until they are tried. *For example, in experiments conducted with a transmitter (both spark and undamped) entirely within a steel-frame building, sending to a receiver several miles away in somewhat hilly country, wave lengths of fifty, fifty-five, seventy-five and one hundred meters worked well. But sixty and sixty-five meter signals were hardly audible, altho the power and other conditions were the same.*

It is a well-known fact that transmission may be accomplished with undamped waves, using much less power than damped waves.



Another Hookup Which Gives a Wide Range of Selectivity.

Therefore, it is possible that many experimenters will be able to use low-power vacuum tubes on short wave loops for local transmission. The advantages of such a set (for local work) over a high-power spark set on two hundred meters are so numerous that they may well repay experiments in that line.

Fig. 1 shows a spark coil or transformer with the customary spark gap and condenser C_1 connected to a loop. The loop and its condenser C_2 should be designed for and tuned to the wave length intended to be transmitted. The closed "oscillating" circuit may have its wave length varied by means of C_1 or the inductance tapped on the loop. However, it is not possible to vary C_1 much, as that has a certain value best for the size and frequency of the spark coil or transformer. A little experimenting will soon determine the right sizes and values.

It is suggested that for wave lengths around fifty and seventy-five meters, the loop should be three or four feet square and of a single turn of very heavy cable, such as "Belden braid" or "pigtail." Such a loop has been used for all wave lengths from twenty-five to one hundred meters with both spark and tube sets. The same

*Reference Proc. I. R. E. Vol. 7, No. 3.

*U. S. Signal Corps Radio Pamphlet No. 40.

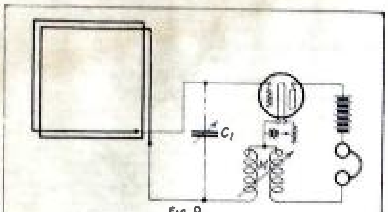


Fig. 9

The Armstrong Regenerative Hookup Applied to the Loop Antenna Increased Its Effective Range 120 Fold.

loop may also be used for receiving these short waves.

For general radio reception a square, multiturn solenoid may be used for any desired wave length. The size and number of turns depend, of course, on the wave length desired. However, from previous discussion of the "Reception Factor," it will be remembered that any loop works best over a limited range of wave lengths, beyond which signals are received quite inefficiently. *It is possible to get good signals at wave lengths greater than those for which the loop is designed, but not less.* The reason for this is that as the wave length is decreased, the natural frequency of the loop circuit is approached. At that point (fundamental wave length of the loop circuit) the high frequency resistance of the loop becomes so high that the signals are negligible. The sizes of loops best fitted for amateur work, i. e., 200 to 3,500 meters, are the six-foot and four-foot (square). On the whole, the six-foot loop makes the best size for all-around work, except, of course, the very short waves.

The table, Fig. 2, gives various sizes of four-foot loops and the best range of wave lengths at which they may be used. Fig. 3 gives the same data for six-foot loops. Fig. 4 is a table giving comparative data on different sizes. An mportant factor in loop design is the spacing between turns for the various sizes of loops. The table, Fig 5, shows the proper spacing between centers of successive turns. *All of these figures are the results of actual experimental work.*

The receiving apparatus for use in connection with loops is very simple. No loose-coupling is necessary, the loop being connected directly into the detector circuit. For long wave lengths almost any circuit may be used. Of course, the "oscillation audion" is the most sensitive system and is

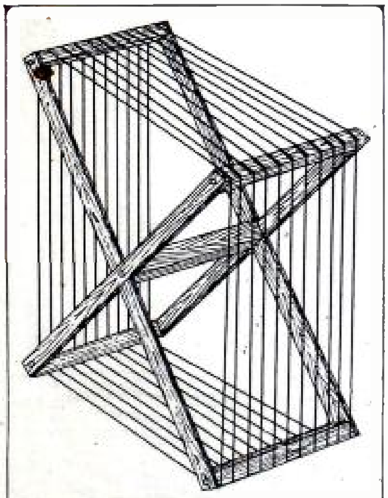


Fig. 12

The Square Solenoid Loop Antenna Which Any Experimenter Can Construct in Several Hours Can Be Placed in His Room and Signals from European Stations Copied with Ease.

WAVELENGTH RANGE FOR FOUR FOOT SQUARE SOLENOIDS.

Turns	Best Wavelength	Efficient Range
3	250	200-330
4	300	250-400
6	350	300-800
10	600	350-1000
20	1200	900-1800

FIG. 2

the only one which will be discussed. Fig. 6 shows an ordinary crystal detector circuit. In all the circuits the tuning is accomplished by means of the condenser C_1. Fig. 7 shows the circuit used for short waves. This is practically the so-called "ultra-audion" system. The same circuit will oscillate at longer wave lengths by placing a condenser across the telephones.

Figs. 8 and 9 show representative circuits of different types. However, as was mentioned, practically any circuit may be used.

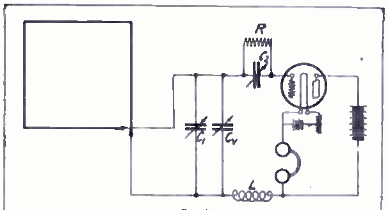


Fig. 11

When Employing Small Loops Such as One or Two Turns It Will Be Found Necessary to Employ the Inductance Indicated at L.

Fig. 10 illustrates a simple but very effective method of inductive feed-back, using the loop itself for coupling. Each turn of the

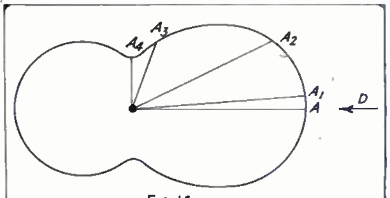


Fig. 14

Plan View of Directive Qualities of the Direction Finder Concentrated Antenna.

loop should be bared so that the point of connection "f" may be varied until the proper result is obtained.

Figs. 7 and 10 illustrate the two simplest circuits and the two which appear most satisfactory for all-around use. The "ultra-audion" circuit of Fig. 7 may be made oscillating or non-oscillating by proper manipulation of the apparatus. The grid condenser C_2 and its grid leak may vary somewhat with the different types of vacuum tubes used. In fact, it is sometimes best to eliminate both and use a "bias grid battery" connection. However, for greater flexibility of operation, the grid condenser should be inserted in this circuit. A variable condenser of 700 micromicrofarads is about the right capacity. The leak is from two to four megohms, depending on the tube. With a low vacuum "audion" no leak is necessary. When the filament of the tube is burning at normal heat, varying the grid condenser from zero towards maximum will cause the tube to pass thru the various stages from non-oscillating to oscillating. Below about 70 mmf. the tube will be non-oscillating or "straight audion." Above 100 mmf. it will oscillate. Somewhere between these two points is a critical point where the amplification is a maximum. This point is frequently obtained by very slowly decreasing the filament current when the tube is oscillating. When using a small loop (three or four feet square, single turn), it will be found necessary to add a small inductance in either circuit. Such an inductance is inserted as at L in Fig. 11. It may

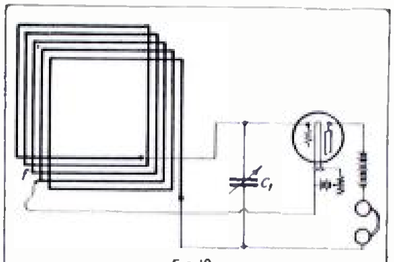


Fig. 10

With an Audion This Circuit Will Grind Out European Stations By the Yard with the Loop in Your Room or Under the Bed.

consist of as few as twenty turns on a one inch tube. By keeping it out of the loop-C_1 circuit, it will not affect the wave length.

WAVELENGTH RANGE FOR SIX FOOT SQUARE SOLENOIDS.

Turns	Best Wavelength	Efficient Range
3	220	180-400
6	500	400-900
10	700	600-1200
20	1400	1000-2000

FIG. 3

When working at very short waves, it will be found necessary to shield the set from the effects of the body (i.e., the operator's hand, etc.). This may be accomplished either by enclosing the set in a grounded metal shield or, more simply, by providing the condensers with extension handles and, hence, keeping the body away. It will also be found necessary for sharp tuning, especially undamped signals, to use a vernier condenser. This is simply a very small variable condenser (usually a single plate) in parallel with C_1. This is illustrated as at C_v in Fig. 11. The primary of an amplifying transformer may be substituted for the telephone receivers and any number of stages of audio frequency amplification used.

The circuit of Fig. 10 is operated merely by tuning in the signal with Condenser C_1 and then varying the connection "f" until the proper coupling is obtained for oscillation. *With this circuit, using a four-foot forty-turn loop, signals have been heard*

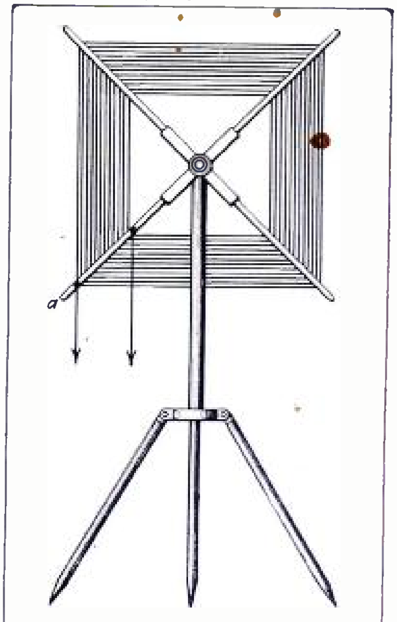


Fig. 13

Introducing the New Type of Antenna Which Permits Radio-Reckoning of Ships' Positions Due to Its Directive Qualities.

from Lyons, France. The signals were quite weak using the one tube, but were readable with one stage of amplification.

The most satisfactory and simple construction of the square solenoid loop consists of two wooden X's fastened together

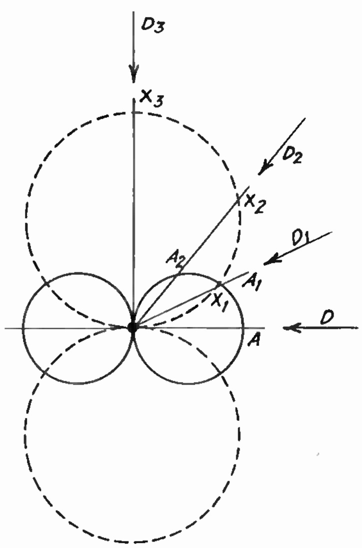


FIG. 15

Direction Finding from Airplanes Must Be Done By the Maximum Signal Method. Here is Shown a Plan View of Directive Qualities of This Method.

with four cross pieces at the extremities and one in the middle. The end cross pieces should be slotted so that the wire will not slip off and so that each turn will be properly spaced. They should be made long enough to accommodate the maximum number of turns desired. The winding may be divided into one or more parts to give the loop greater flexibility of range. The various parts must be disconnected when not in use so that there is no dead end. Such a loop is illustrated in Fig. 12. Of course for a single turn loop only one X is necessary.

CHARACTERISTICS OF SQUARE LOOP ANTENNAE.*

Size Ft.	Turns N.	Spacing In.	Inductance Micro-h.	Capacity Mmf.	Fundamental Wavelength Meters
3	8	1-8	193	49	183
4	6	1-4	154	55	174
6	4	1-4	124	66	170
8	3	1-2	96	75	160

FIG. 4

DIRECTION FINDERS

The characteristics of the spiral type loop are in general similar to the solenoid type. However, as it may be made more portable and is somewhat more directional, it is better adapted for direction finder work. This spiral loop is wound square on an X frame as shown in Fig. 13. If it be mounted in a vertical plane and rotated, the signals will vary in strength from a maximum when the plane of the loop is in the direction of the advancing signal, to a minimum when the plane is at right angles to the direction of the transmitter. However, there is considerable difference in the two maxima, that is, when the plane of the loop is in the direction of the signal and when the loop is rotated 180°. Similarly the two minima are somewhat different. In Fig. 14, suppose the signal to be coming in the direction of the arrow and the loop is mounted about its center at O perpendicular to the paper. As the loop is rotated about O, the signal strength will vary, having successive values which might be represented by the lengths of the line OA. From a sufficient number of values of OA the polar curve of received signal intensity may be plotted and would look somewhat as represented in the figure. It will be noted that the difference in length of OA and OA_1 is very small. This means that the signal strength at those two positions is practically the same. It would therefore be impossible to tell accurately in just what direction the signal is coming. However, there is much difference in length between OA_3 and OA_4. In other words, the minimum position may be found very accurately. The direction of the signal may then be considered as 90° from OA_4, that is, at right angles to the minimum.

The direction finder built by the Signal Corps (designated as SCR 83) consists of a six foot, twelve turn, square spiral mounted on a tripod. The loop itself can be folded up like an umbrella and packed with its tripod in a small bag. It is fastened at the center and so arranged that it can be rotated, or turned and held in a horizontal plane. *The loop in a horizontal plane is non-directional*, and would be used in this position for tuning in a station. Then

PROPER SPACING FOR SOLENOID LOOPS.

Size Loop Ft.	Spacing In.
4	1-4
6	7-16
8	9-16
10	3-4
12	15-16

FIG. 5.

it would be turned into the vertical plane and rotated for direction. A compass attached under the central shaft shows the direction. *It is possible with such apparatus to obtain accuracy within 1° or 2°.* It was discovered that if the outside turn of this loop be connected to the grid terminal of the receiver, the greater maximum would result when the point "a" of the loop as shown in Fig. 13, was pointed *towards* the incoming signal. *This, then, makes it possible to tell not only the direction but also the sense of the direction of the signal.*

In airplanes or other noisy places, it is not possible to use a minimum method for finding direction. With the double, or "crossed coil", type direction is found by the maximum sound. This type of loop consists of two solenoids mounted rigidly at right angles to each other. One loop is called the "main coil" and is designed for wavelength as already described. The second loop is called the "auxiliary coil" and either has twice the number of turns as the main coil or twice the area (approximately). This should give the auxiliary coil a much stronger signal than the main coil, other conditions being the same.

Referring to Fig. 15, the small solid-lined curve represents the polar curve of received signal on the main coil. At 90° to this curve is the dotted line polar curve of the auxiliary coil. The gerater value of the strength of signal in the auxiliary was mentioned in the preceding paragraph. If the signal is coming in the direction D, it will have a maximum value OA in the main coil and a zero value in the auxiliary. For convenience, instead of rotating the loop apparatus about O, let us consider the equivalent, a signal coming in the direction D_1. Then OA_1 is the current in the main coil and OX_1 that in the auxiliary. OX_1 is almost as great as OA_1, hence the value of current added by the auxiliary is readily noticeable. If, on the other hand, the auxiliary had less turns or smaller area, the addition due to it would be much less and not noticeable. This is the reason for making the auxiliary larger than the main coil. For signals in the direction D_3 the main coil receives practically no current.

The connections for operating such a system is illustrated in Fig. 16. L is an inductance of the same value as the auxiliary coil. S_1 is a double pole, double throw, switch connecting the main coil in series either with L or with the auxiliary coil. C_1 is the usual tuning condenser. The operation consists first of tuning in the signal by means of C_1 in the position "a". Suppose the signal is coming in the direction D_1. It will be heard, but it will be impossible to locate it absolutely with the main coil alone as was shown by Fig. 14 and the discussion relative thereto. Now the switch S_1 is thrown to position "b" thereby putting the auxiliary coil into the circuit. As will be seen from Fig. 15, considerable change in the intensity of the signal will be noticed. The switch S_2, a pole-changing switch in the auxiliary circuit, is now thrown backward and forward, alternately causing the auxiliary to strengthen and weaken the signal. The coil system is then rotated until no change is noticed in the signal strength when S_2 is reversed. The coils are then in a position relative to the incoming signal as shown by D. In other words, the plane of the main coil is now directly towards the incoming signal. This process may be done in a very short time and with an accuracy well within 2°.

In conclusion, the table Fig. 17 is given as a guide to the best sizes of loops to be used at various wavelengths. The different sizes are given in order relative to their respective efficiencies. The proper spacing for these loops should be obtained from Fig. 5. For wavelengths greater than those given, it is better to use a small loop and load it up than to build very large or many-turned loops because of the inconvenience. It is to be understood that Fig. 17 refers to the best sizes. As was previously mentioned, smaller loops will work nearly as well in any case. The general rule is that for short wavelengths use few turns on the largest possible area, while for long wavelengths use many turns on medium areas.

SIZE OF SQUARE SOLENOID LOOPS FOR VARIOUS WAVELENGTHS.

Wavelength Meters	Size Ft.	Turns N.
50 to 100	4	1
	3	1
200	8	1
	6	2
300	8	2
	6	4
600	8	4
	6	7
	4	10
800	8	7
	6	10
	4	15
1200	8	12
	6	14
	4	20
1600	8	16
	6	20
	4	30
2500	8	30
	6	40
	4	60
3500	8	45
	6	65

FIG. 17.

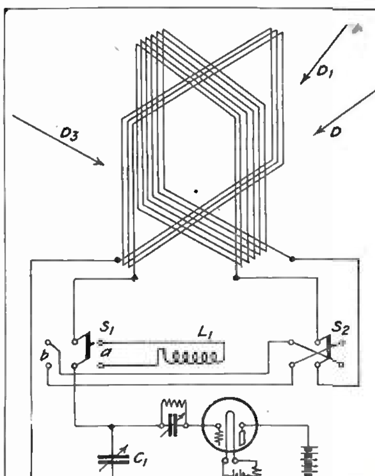


FIG. 16

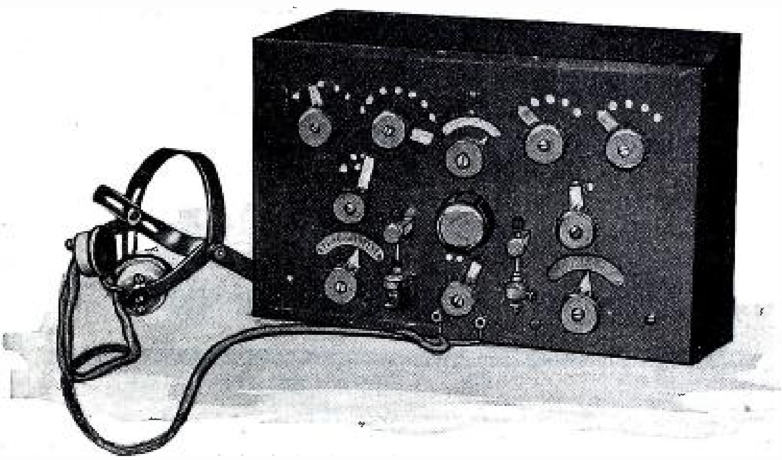
Connections of the Airplane Direction Finder Employing Maximum Method.

An Exceptional Radio Receiver

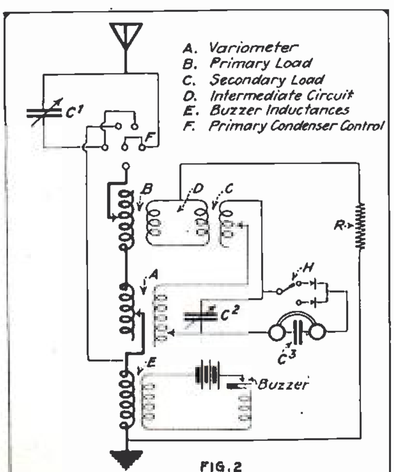
By EUGENE DYNNER

IMMEDIATELY upon the official announcement of the Government removing the restrictions imposed upon amateur reception of Radiotelegraphic signals, the construction of Radio receiving sets became of prime importance to the great body of amateur Radio men in this country. The author of the present paper therefore conceived the design of the Radio Receiver described herewith. These designs were eventually executed, and the results obtained thereby warrant the statement that it is one of the best receiving sets for amateur use with which he has come in contact for several years.

Illustration No. 1 shows the appearance of the completed Receiver. A casual survey of the illustration will make noticeable the absence of an audion, or valve, or vacuum tube, or whatever one chooses to call it. Some years ago this condition would have elicited no particular comment, but the author notes that practically every set which he has heard described in the last few months invariably included an audion in the scheme of things. The audion is unquestionably the most extremely sensitive detector of Radio signals, and the world owes a greater debt than it appreciates to Dr. de Forest's superb creation; but for steady amateur work—long usage, moderately long distance work, ease of adjustment, and *low cost of upkeep*—the crystal detector is "the thing." The statement may be made that with the increasing number of undamped wave transmitters the amateur who is not supplied with an audion will miss much pleasure, is true to some extent; but not everyone is "wild" to hear Europe. And then again, the world does not stand still. One of these beautiful mornings we will awake to read that some one or other can make a simple crystal detector arrangement sensitive to undamped wave reception; and then the fellow who remained attached to his romantic mineral detector will laugh last. Also best. . . .

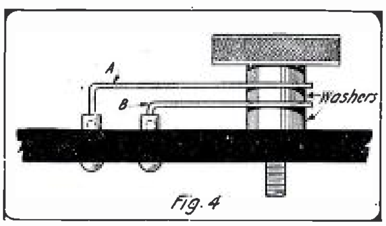


A Receiving Cabinet of Exceptional Merit. High Efficiency and Compactness are Its Prime Features.



Showing How the Set Is Hooked-up. The Grounded Intermediate Circuit Eliminates Static to a Great Extent.

In the design of the modern receiving instrument these prime factors are to be borne in mind: The highest efficiency and most precise adjustments are to be obtained at the lowest possible cost, within the most practicable compactness. The instrument described will be found to conform to these conditions.



The Double-blade Switch Shown Puts the Primary Condenser Either in Series or Parallel to the Primary System.

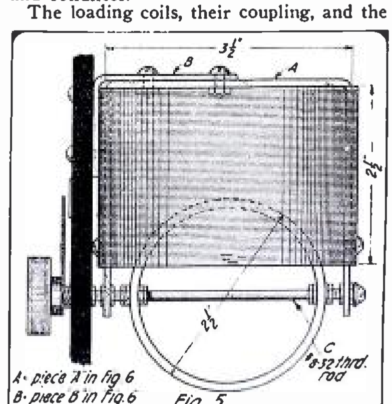
The panel should receive first consideration, as efficiency demands that nothing be lying about uselessly during the process of construction. As the various parts of the Receiver are completed, they should be fastened to the panel. It will be noted from Fig. 3—which gives dimensions of the panel and location of holes to be drilled—that all contact points are spaced one-half inch between centres. These points are one-fourth inch in diameter at the head, with a 6/32 thread shank. Closer spacing is possible, but the inductive effect of too closely separated conductors is not negligible. The switch arms are uniform in length with one exception. This is: the primary condenser control switch at the left and (F) in Fig. 2, which by a single motion places the variable condenser in shunt across the primary, in series with the antenna and the primary, or cuts it out entirely. In this case (Fig. 4 shows the complete switch) the lever (A) is a half-inch longer than lever (B), which is of the same length as all the others, one and one-quarter inches. The longer lever, when the shorter is placed in contact with the center point of the lower three, makes contact between points (A) and (B) in Fig. 3. (F) in Fig. 2 indicates the method of using this switch for its various functions. The other switches are of the usual type.

One of the essential parts of the Receiver is the Variometer-Coupler. This very important instrument deserves much care in its construction, and the results which are possible because of its use make all efforts in its construction absolutely worthwhile. The tubes for the variometer are of any suitable insulating material which has sufficient strength to be self-supporting. Bakelite, hard-rubber or fibre will do, but cardboard tubing cannot be considered. In this case bakelite was used.

The primary is two and one-half inches long and three and one-half inches inside diameter. It is wound for two inches with a double bank of No. 24 double cotton covered wire, as good as silk and more reasonable. The secondary is two and one-half inches in outside diameter, two inches in length and wound, for three-quarters of an inch on each side of a wire-less strip one-quarter of an inch wide at the centre circumference of the tube, with a double bank of No. 32 D.C.C. wire. Seven taps are taken from the primary and five from the secondary.

The method of mounting the variometer gave same trouble in the original design, but the design finally evolved was quite satisfactory. As indicated in Fig. 5, two pieces of brass strip one-half inch in width and 3/32 inch in thickness are bent and drilled to the dimensions in Fig. 6. This makes the mounting of both the primary and the secondary on the panel a matter of simplicity and solidness.

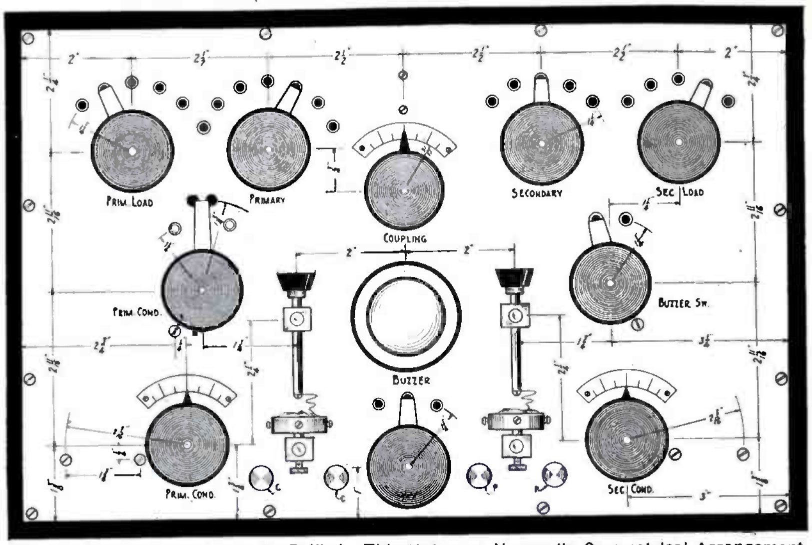
The loading coils, their coupling, and the functions of the circuits contingent to the loads, the author believes, have not been described in any journal, and are highly



A Most Interesting Feature: The Variometer-Coupler Which Makes for Extremely Sharp Tuning.

efficient in the *counteraction of atmospheric disturbances.*

The loading coils are both three and one-half inches in diameter and three inches in length, and are wound with double banks of No. 32 D.C.C. wire, from which leads are taken four times. These two coils are fastened to the panel at the places where the load switches are located, and are coupled together by two coils of No. 18 annunciator wire, consisting of eight turns wound about the loading coil to which they appertain. It is essential here that the direction of the windings be the same throughout the load circuits. A lead is taken from one side of the intermediate loading and carried thru a resistance of the order of 300,000 ohms to the ground. This resistance may be simply made by drawing pencil lines on smooth Bristol board, with which lines contact is made by tinfoil washers thru which brass screws are passed.



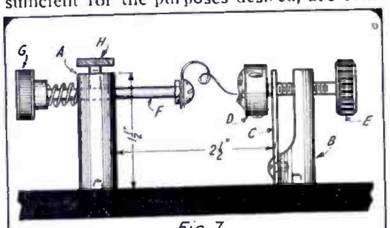
Showing How the Panel Is to Be Drilled. This Makes an Unusually Symmetrical Arrangement.

The two detectors are identical in construction and detailed dimensions are indicated in Fig. 7. Half-inch square brass rod is used in the construction of the standards. The brass cup (D), which is permanently fastened to the spring (C), is threaded at three places for set screws to hold the galena in any position desired. Screw (E) adjusts the tension between the contact and the crystal. Wound about the rod (F) between the post (A) and the knob (G) is a brass spring which serves to prevent the rod (F) from bearing heavily on the mineral when the screw (H) is loosened. Since galena is used with this set, the contact spring is of No. 32 copper wire.

Switch (H) in Fig. 2 places either mineral in circuit. (G) in Fig. 3 are the binding posts for the antenna and ground leads, and (P) are the posts for the telephones. Two binding posts at the side of the cabinet are for the buzzer battery.

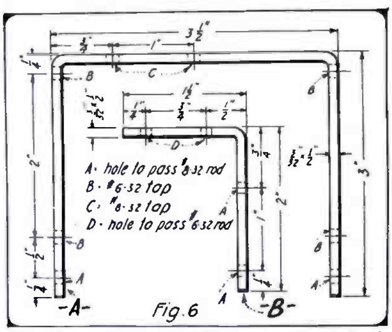
The buzzer circuit is inductively coupled to the ground lead. A coil of No. 24 D.C.C. wire in inserted in the ground lead. This coil is one inch long and one inch in diameter. Over it is wound an inch of No. 22 wire, which is in the buzzer circuit. The response in the telephones when the buzzer circuit is closed, will, under these conditions, be most natural.

In Fig. 2, variable condensers (C^1) and (C^2) are the standard ninety-degree condensers on the market. They have a capacity of .0005 Microfarads, which is quite sufficient for the purposes desired, are compact, and extremely well built. Holes indicated in Fig. 3 were drilled for these condensers. When purchasing same, care should be taken that a right and left condenser are obtained, otherwise they will not "set" symmetrically in the cabinet.

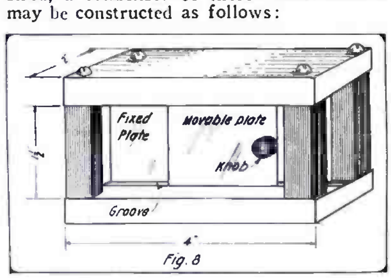


A Detector Which Is Distinctly Worth While Making. It Provides for the Most Precise Adjustments.

Capacity (C^3) shunted across the telephones will be about .00001 Mfd. For accurate adjustments, however, it may be desirable to construct a very small condenser of variable capacity. Should this be desired, a condenser of these characteristics may be constructed as follows:



The Supports for the Variometer are Made of 3/32" Brass Strip 1/2" Wide.



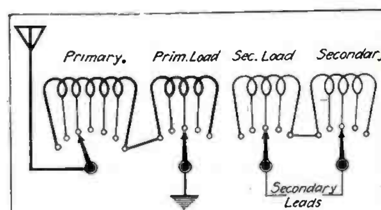
A Small Capacity Variable Condenser Which May Also Be Used In Audion Circuits.

Two pieces of hardwood, two by four inches, are slotted at identical distances by two slots 1/32 of an inch apart and an eighth of an inch in depth. The two pieces of wood, with the slots towards each other, are separated at a distance of one and one-half inches by four posts of hard rubber. Brass plates one and three-quarter inches are inserted in the slots provided for them in such a manner that a greater or lesser surface of one plate can be exposed to the surface of the other. Two leads are soldered to the two plates and the movable plate is provided with an insulating knob by which it may be slid in its slots in the base and top. By the use of this condenser very fine adjustments can be obtained. . . . . .

Really remarkable work was done with this receiver. A high-powered station at a distance of almost three thousand miles was several times heard with sufficient clarity to make entire messages easily copied. Ships at distances of over a thousand miles are easily read. Atmospherics are eliminated to quite some extent. Tuning is exceedingly sharp, therefore interference is at a minimum.

One instance of this sharpness of tuning will be cited. A vessel bound for an Atlantic port is heard calling an Atlantic coast station. After an interval the ship proceeds to send her position report. The absence of the go-ahead signal indicated that the wave of the land station was other than that of the ship. At the completion of the ship's report the shore station was tuned in and the "OK" clearly heard, but the ship's completion signal was now inaudible. The wave length of the shore station was 600, while that of the ship was about 630 meters. Such sharpness of tuning is exceptional, to say the least, yet this receiver functions permanently in this manner. The shore station is about fifteen miles from the receiver, the ship, 165 miles. The antenna was three hundred feet in length and elevated at an average of twenty feet from the ground, which is about fifty feet above sea level. . . . .

Elimination of Static was as much as forty per cent less—without impairing the audibility of the actual radio signals—than with any other circuit which was employed. It may be stated here that exhaustive experiments were made by the author to determine the character of the circuits which should be embodied in the design of the receiver. Audibility records were carefully maintained so that definite data might be arrived at. When the intermediate circuit was first employed a variable condenser was shunted across it. This, however, failed to assist materially in reception. By accident the ground lead became loosely short-circuited to one of the intermediate capacitance leads and the circuit employed herewith is a consequence.



How leads are taken from tuning system.
FIG. 9

He who builds this receiver will find himself well repaid for the efforts expended in the pleasure which he will derive from its operation.

SECOND

$100 Radio Prize Contest

The most important Radio Amateur event in years

An Ideal Sending Set

THE period of reconstruction is upon us. Now that the Government has taken off the ban for receiving radio messages, and that probably at the time when this issue appears in print the ban on sending will be off as well, it behooves us to look into the future.

In the past we grew accustomed to radio instruments which were utterly unscientific, and which were merely the outcome of a whim of the individual constructor. The whole world being under reconstruction, there is no reason why radio itself should not be reconstructed as well along modern lines.

The Publishers always having been in the lead as far as the amateur radio art is concerned, wish to go on record here with the suggestion as well as the recommendation that hereafter amateurs should operate only efficient sets. There is today no excuse for inefficient, crude, home-made apparatus that never can operate at the highest efficiency.

With this point in mind, RADIO AMATEUR NEWS will, for several months to come, conduct a series of prize contests to bring out the best that is possible for radio amateurism in the United States.

The second topic we have chosen will be entitled, *"An Ideal Sending Set."*

America's foremost radio experts have graciously volunteered to act as judges of this contest. As every one of the judges will pass upon the manuscripts submitted, there can be little doubt that all contestants will be treated fair and impartial. Furthermore, we feel certain that this contest will not only bring out the best there is in the American amateur, but that it will lift the art to a new and greatly advanced level, unknown and undreamt of before the war.

Here are the men who will act as the judges of the contest. A distinguished array of the best radio talent in America:

Dr. Lee de Forest, Inventor of the Audion

Dr. Greenleaf W. Pickard, Inventor of the Crystal Detector

Dr. Louis Cohen, Ph.D., Radio expert and inventor

Fritz Lowenstein, Radio expert

Samuel D. Cohen, Amateur Radio expert

H. W. Secor, Assoc. I. R. E., Associate Editor, Electrical Experimenter.

H. Gernsback, Editor, Electrical Experimenter & Radio Amateur News

Accordingly, we offer this month:

PRIZES OF $100 IN GOLD

First Prize . . .	**$50.00**
Second Prize . .	**25.00**
Third Prize . . .	**15.00**
Fourth Prize . . .	**10.00**

RULES OF THE PRIZE CONTEST

The sending set to be described may be of the cabinet type, or it may be of individual instruments assembled on a table or board. It may be constructed for radio telegraphy or radio telephony at the option of the designer.

It is necessary to state what instruments are used, and if certain instruments have been bought, the make must be stated. A complete diagram, neatly executed in ink, is to be furnished. A good photograph (not smaller than 5 x 7") giving at least two views of the set is necessary. A photograph of the builder is desired.

It is also necessary that the outfit embody some new feature which has not been described before, and the set must be strictly up-to-date in all respects. The sizes and the kind of wire used in the construction must be given, as well as the dimensions of the principal parts. More than one outfit may be entered by a contestant. The contest is open to every one except manufacturers of wireless apparatus. The manuscript should not be longer than 1,500 words. 1,000 words preferred. A further condition is that in addition not more than 100 words giving the utility of the outfit and its practical purpose are to be stated.

All prizes will be paid upon publication.

The contest closes in New York on October 12th, and the first prize-winning article will appear in the November issue.

Address all manuscripts, photos, etc., to "Editor Radio Prize Contest," care of this publication.

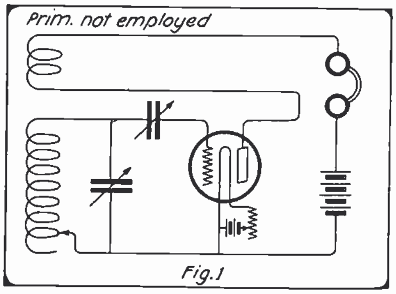
THE PUBLISHERS.

Note: This is the second $100 Radio Prize Contest. The first one, "An Ideal Receiving Set," was published in our July issue. The results will be announced in an early issue.

Is the Antenna Doomed?

By E. T. JONES, Associate Editor

RECENTLY the radio art has been flooded with new devices capable of receiving over large radii which have been substituted for the overhead antenna, each single device claiming extensive improvements over the



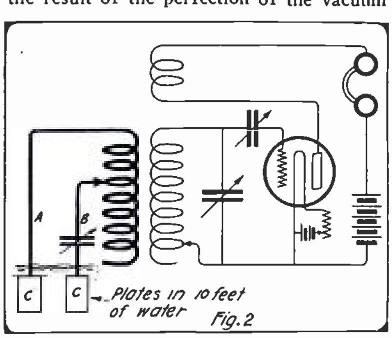
It is Possible to Receive Signals from Distances Up to 100 Miles or More With This Circuit Employing No Antenna or Ground.

preceding scheme, both economically and efficiently. The radio field at large stands aghast wondering what will turn up next without giving serious study to the problems at hand. Let me be frank in what I state in the following and facts will be disclosed which will tend to prove that investigators are all working along the same line and will ultimately arrive at one common goal: that of making use of means already furnished by Mother Nature. Eventually we will get down to the *ground,* where every efficient radio station belongs.

Today we can only conduct experiments and believe in their results as demonstrated. This does not necessarily mean that our deductions are correct in all cases, as is clearly demonstrated in every field of research, where many serious and noted scientists have arrived at different results upon which their theories have been based originally.

The result of this is to leave the minds of the students of this ever-increasing branch of scientific research in a muddled condition and cloud upon cloud piles up because experimenters are not able to come to a clear understanding on the subject in question. This condition, which of course is partly caused by individual opinions and a lack of cooperation on the part of the parties responsible for the advancement of such theories, will ultimately not exist, we hope.

In my frank and unprejudiced opinion of the present conditions, I firmly believe, and it can be easily proven, that all the late substitutions for overhead antenna were merely the result of the perfection of the vacuum



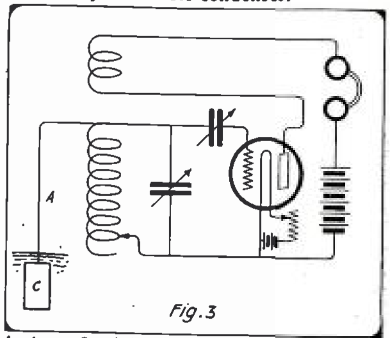
With Two Metal Plates Submerged in the River, Signals Were Copied from Ships Several Hundred Miles at Sea.

tube and circuits which make possible the amplification of weak signals. Numerous schemes were tried previous to the war, and it can be stated authoritatively that underground, concentrated loops, and tree wireless are old schemes and were tried out years ago. The double-triple and even six-step amplifier makes all these possible for commercial purposes; where, as a matter of fact, arrangements similar to those of the present-day types were employed years ago but proved very inefficient because the signals were too weak over short distances to be of any commercial value. From the foregoing, then, it should be an easy matter to form an opinion as to whether or not these devices and systems convey anything new to the radio field, with the exception of valuable measurements which have been taken to show their relative merit as a collecting means of wireless waves. It is clearly pointed out in each and every case that the possibility exists of **employing** no antenna of any kind. The writer gives some very interesting experiments which will undoubtedly prove of widespread interest to the radio field at large, and further proves the feasibility of Tesla's ground conduction theory. However, at the present time it is not possible with the apparatus of the general design to extract more energy from the passing waves than was possible before,

with the exception of amplified signals, which is purely local.

The author has on various occasions found that by placing the tip of a pair of telephone receivers in the earth (or connected thereto) that it was possible to receive signals from nearby transmitters. At first it was believed that these signals were being picked up by the body, which could act as an antenna, being insulated from the ground by the rubber soles of my shoes. In order to disprove this both tips were connected to the ground about ten feet apart so as not to form a direct short and the signals came in louder. This prompted me to believe that signals could be picked up from great distances by merely connecting suitable apparatus to the ground proper.

Any one who has employed the present design of two-step amplifier and appreciates its value, readily understands that what I say in this connection is true. It is possible to receive signals from distances up to 100 miles or more *with nothing more than an ordinary receiving circuit placed anywhere,* especially where there are no overhead antennae or wires of any kind. Figure 1 shows the apparatus as it was connected and the dimensions of the coils will be found to be extremely small when it is hinted that *the coil used was nothing more than the secondary unit of a short-wave receiver of the Naval Standard design.* The coil in question measured about five inches in diameter and had about forty turns in the circuit shunted by a variable condenser.

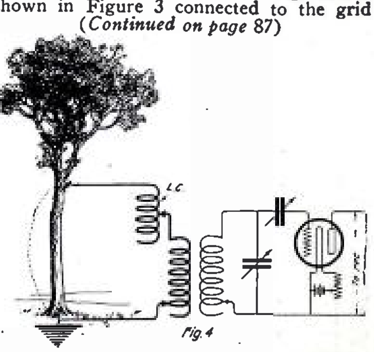


Just as Good Results Were Had with But One Plate Submerged in the River.

Luckily, in this experiment, the apparatus had been installed on a pier extending out into Lake Pontchartrain, Louisiana, for about three hundred feet. This placed the receiving apparatus this distance from any overhead wires of any kind. The experiments being conducted on underground work had been suspended and all wires taken up from the bed of the lake. Very good readable signals were received from Burrwood, Louisiana, employing a 2 K.W. transmitter at a distance of 71 miles airline. Ships in the gulf were clearly audible and this experiment prompted me to believe that it could not be the action of the coil, which was extremely small, **but rather I found a better explanation more suited for the occasion in that the capacity to earth of the coil and receiving set as a whole acted the same as a small condenser in series with the ground, and that the ground was employed as the conducting medium from such a large distance.** These experiments led me to further endeavors, and I next tried the scheme shown in Figure 2, where A was a bare wire with a copper plate at the end and B a like wire and plate *both immersed in the Mississippi River* to a depth of approximately 10 feet—the plates being separated fifty feet apart. *Signals from distances up to 100 miles and ships a little farther out were clearly audible on short wavelengths.*

After experimenting it was found that the other plate could be dispensed with, as was expected, and which was the main reason for experiment. The plate to ground is shown in Figure 3 connected to the grid

(*Continued on page* 87)



Probability of Loading and Primary Coils Providing Closed Loop Antenna; the Tree Acting as a Conducting Medium to Complete the Circuit.

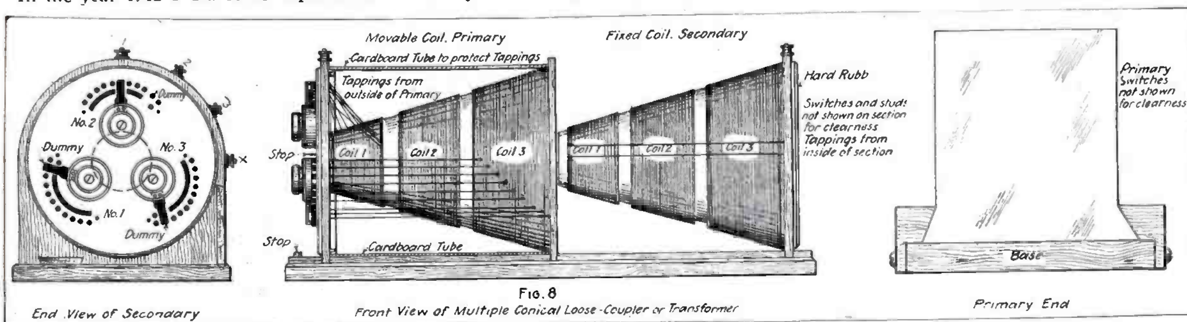
Multiple Conical Loose Coupler

By JOHN G. MERNE, I. M. T.

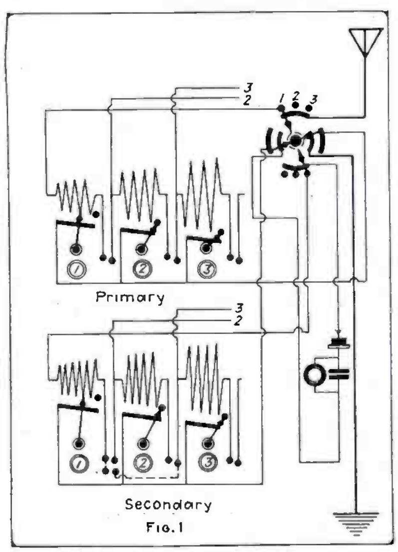
County Technical Instructor, Leitrim, Ireland

I DISCLOSE herewith for the benefit of the readers of RADIO AMATEUR NEWS drawings and sketches of a new type loose coupler which embodies new and valuable features.

In the year 1912 I did some experimenting with various types of loose couplers and developed a type which is out of the ordinary. This tuner was developed further lately and the drawings clearly show their merits as a tuning unit. The original coil was constructed of two *conical cups* made of paper impregnated with paraffin wax (used for containing cream). The primary was wound with No. 22 D.C.C. wire tapped off to 15 studs. The secondary was of the same material but wound with No. 32 D.C.C. tapped to twenty studs. The conical tube was about 5" long, 3½" at base, tapering to about 2" at narrow end. The hookup I used is shown diagramatically in Fig. 10. The instruments employed were: Copper-pyrites and zincite detector, 4,000 ohm phones, fixed condenser with an indoor antenna 10 feet long consisting of 8 strands of No. 16 copper wire, each strand spaced 8" apart, the strands connected together at both ends. This aerial was supported under a slate roof which was further plastered with a space of rafters between. This placed the antenna in the room with plaster, ceiling, and slates between it on the open air. The roof was twenty feet above the receiving room, which was ten feet from the ground, making the antenna approximately thirty feet high. With this antenna and the conical coil I received all the local stations *very loud*. Clifden, which is about ninety miles from me, came in loud, and Paris and Nordeich in Germany quite readable. *Such stations were never received by me before*, on any other coil employing the same antenna. Another strange thing was that by connecting the primary and secondary as shown in Fig. 11 the signals from local stations came in about four times as loud as when using the first connection, and could be heard plainly without putting the phones to the ears. No variable condenser was used and still the tuning was very sharp. I determined that such a coil could be improved and the enclosed drawings show clearly what has been done along these lines.



Front and Side View of the New Type Receiving Transformer Which Embodies Valuable Features.



Coil No. 1 Operating and Remainder Cut Out of Circuit Preventing Dead End Losses.

On examining the drawings in proper sequence one will clearly understand the working of the various switches and the connections of each coil as a separate unit. Terms used: M. S., main switch; C. S., coil switch.

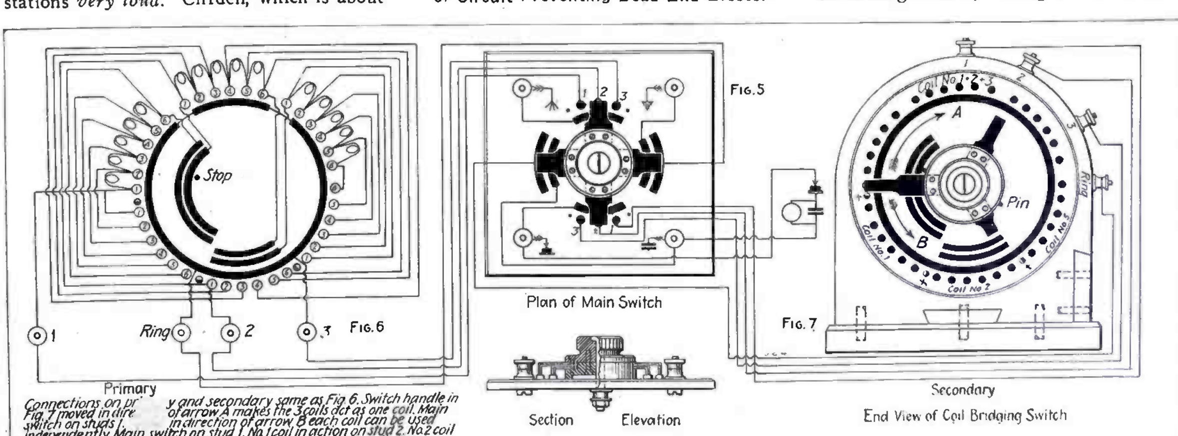
Fig. 1. M. S. on Studs 1. C. S. Nos. 2 and 3 on dummy studs enables No. 1 coil to operate and cuts out the other coils completely, preventing dead end losses.

Fig. 2. M. S. on Studs 2. C. S. Nos. 1 and 3 on dummy studs enables No. 2 coil to operate and cuts out the other coils, Nos. 1 and 3, preventing dead end losses.

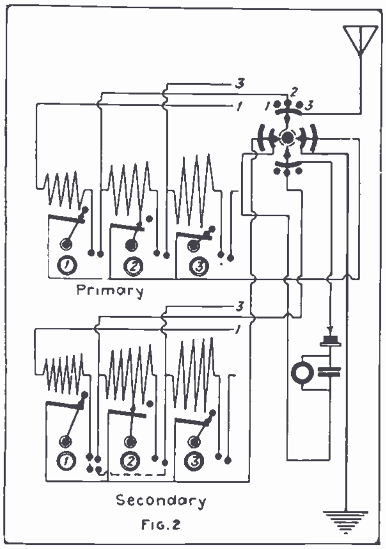
Fig. 3. M. S. on Studs 3. C. S. Nos. 1 and 2 on dummy studs enables No. 3 coil to operate and cuts out the other coils, Nos. 1 and 2, preventing dead end losses.

Fig. 4. Main Switch on Studs 1. Coil switch No. 1 bridging and connecting coil 2. Coil switch No. 2 bridging and connecting coil 3, the tuning being done with coil switch No. 3. The 3 coils in this case act as a single extra large coil.

Further operations that can be performed with this arrangement: Main switch on studs 1. Coil switch No. 1 bridging and connecting coil 2, tuning done with coil



An Ingenious Arrangement of Switching Members Permitting Any Combination of Coils Desired to Be Easily Obtained.



Coil No. 2 Operating and Remainder Cut Out of Circuit Preventing Dead End Losses.

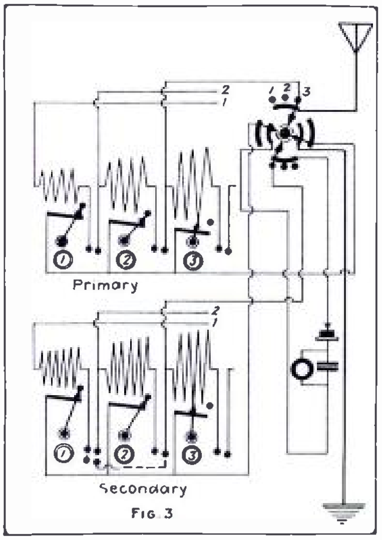
switch No. 2. The two coils in this case act as a single unit. Coil 3 is cut out of circuit and therefore there is no loss due to dead ends.

Main switch on studs 2. Coil switch No. 1 on dummy stud. Coil switch No. 2 bridging and connecting No. 3 coil, using coils Nos. 2 and 3 as a single unit, tuning being done with coil switch No. 3.

In all cases the changing of switches on primary coils must be carried out in unison with secondary coil switches.

Description of Inductance of the Coils

Coil No. 1 is wound for short wave lengths. Coil No. 2 should have twice the inductance of coil No. 1 and coil No. 3 twice the inductance



Coil No. 3 Operating and Remainder Cut Out of Circuit Preventing Dead End Losses.

of coil No. 2. Following out the switching arrangements we find that we can have the following operations:

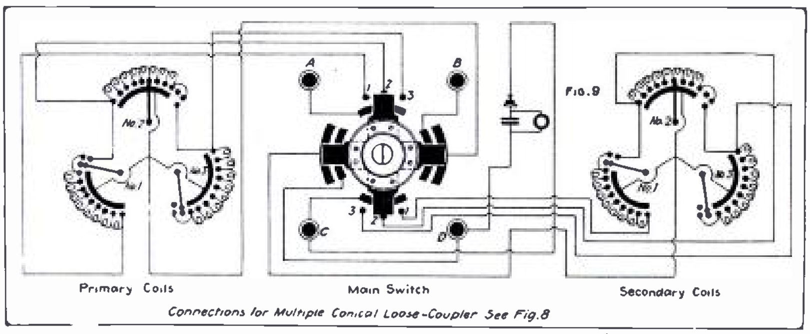
Coil No. 1 by itself	= Ratio 1.
Coil No. 2 by itself	= Ratio 2.
Coil No. 3 by itself	= Ratio 4.
Coils Nos. 1 and 2 combined	= Ratio 3.
Coils Nos. 2 and 3 combined	= Ratio 6.
Coils Nos. 1, 2 and 3 combined	= Ratio 7.

By adding two bridging studs where shown by dotted lines, with coil switch No. 1 on these two extra bridging studs, one could connect coils No. 1 and No. 3, giving a ratio of 5.

Fig. 5 represents a plan section and part elevation of main switch, which is of the bridging type, also the connections to Figs. 6 and 7.

Fig. 6 shows the connections used when the single switch shown in Fig. 7 is used. The same connections are used in primary and secondary.

Fig. 7 shows a single switch used to perform the end of the three switches. When long switch arm moves in direction of arrow A the three coils are connected up and used as one large coil. When long switch arm moves in direction of arrow B each coil comes into operation as a single unit. With the switch handle coil 1 can be in operation, coils 2 and 3 being dead, long switch arm passing over the stop marked +. This stop is a stud with two inclined faces which offer a resistance to



Diagrammatic Scheme of Connections Showing Clearly How the Switches are Connected So As to Provide Innumerable Arrangements.

switch blade, but with a little pressure the switch blade moves over onto coil No. 2 and cuts out coil No. 3 until the switch blade rides over stop + No. 2, puts coil No. 3 in action and cuts out Nos. 1 and 2.

Coil No. 1 by itself, Ratio 1: Coil No. 2 by itself, Ratio 2; Coil No. 3 by itself, Ratio 4—when long switch blade travels in direction of B.

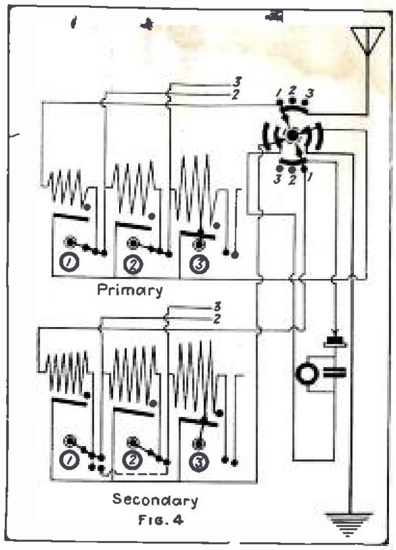
Coil No. 1 by itself, Ratio 1; Coils Nos. 1 and 2, Ratio 3; Coils Nos. 1, 2 and 3, Ratio 7—switch blade in direction of A.

With the switch handle coils Nos. 1 and 3 cannot be connected with coil No. 2 coming into the circuit.

The construction of all switches is the same as main switch, Fig. 5, each blade being a separate unit and insulated from its neighbor.

Fig. 8 gives a front and side view of the coupler with cardboard covering tube cut away to clearly show method of tapping and winding coils; also, end view of secondary with its switches suitably mounted. The taps of the secondary coil are taken from the inside of the coil to switch points (not shown in front view). The secondary is fixed and the primary coil is held upright and permitted to slide over the secondary by the grooved slots in the base into which the primary end support fits snug as shown in the drawings.

Fig. 9 shows the connections to both primary and secondary, also main switch, which is a bridging switch as clearly shown in Fig. 5 and shows coil No. 2 in action,



All Coils Connected in Series Acting as One Large Extra Coil in the Circuit.

Nos. 1 and 3 cut out completely, preventing dead end losses. There are four binding posts on main switch in this drawing, marked A, B, C, D.

When A is connected to aerial, B is connected to earth, C is connected to top of detector and D to bottom of fixed condenser.

A variable condenser can be placed between studs A and B. This enables capacity to be placed in shunt to primary windings.

A variable condenser can also be placed between C and D. This enables capacity to be placed across the secondary coils.

A tuning device of this type if constructed will provide an exceptionally flexible unit, applicable to most any circuit known.

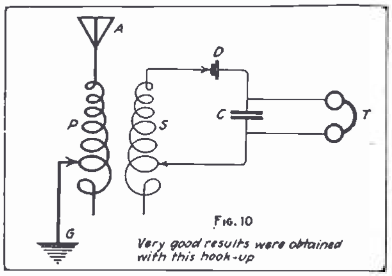


FIG. 10

Very good results were obtained with this hook-up

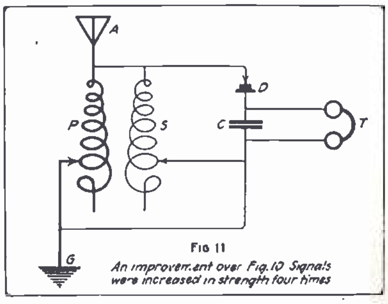
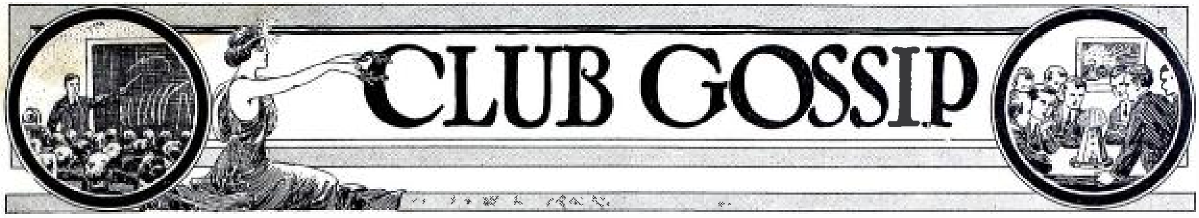


FIG 11

An improvement over Fig. 10 Signals were increased in strength four times



ARMOUR VILLA RADIO ASSOCIATION.

I have just finished reading the first issue of RADIO AMATEUR NEWS and I think it an excellent magazine. At the request of our radio club I am sending you this.

The Armour Villa Radio Association was formed in the darkest days of amateur radio, November, 1918. The club had a hard time keeping together but has now twelve members and is doing very well. A paper on radio telegraphy or telephony is read at every other meeting. The papers read up until the summer schedule of meetings were a series on elementary electricity and a course in the fundamentals and operation of simple radio-telegraph instruments. A distinctive feature of the club is that each member is given a copy of the paper read at the previous meeting. We have never heard of this being done in other clubs and we think it is an excellent idea as the members have a chance to study any part that they did not grasp when the paper was read.

The club supports a body of four members, all of whom have had at least three years' experience with radio, known as the Technical Committee. This committee develops the standard apparatus which the members are urged to construct. This committee drew up a list of parts which were to be used in the construction of apparatus. The main accomplishment by this is that it permits manufacturers to keep a smaller assortment consequently resulting in lower prices. If all associations were to make a list of standard parts all of which closely conform, it would help further. At present the committee is conducting experiments with trees as antennae for portable sets. It has and is at the present time experimenting with the two-element vacuum valve, consisting of a large six-volt lamp with an external plate, as an amplifier and detector. Also undamped wave transmitters utilizing regular vacuum tubes are being developed.

During the summer lull of activities a relay system, which includes every member's station, is being worked out. This is only for the purpose of training the members to handle relay work as the distances between stations are very short, in one instance two stations are about 600 feet apart. When working short distances the power input is limited to 100 watts to reduce interference. All stations not handling long-distance relay work are limited to the hours of 7 A. M. to 9 P. M. for communication.

Many transmitters and radiophone sets are being built this summer by the members and things will go at top speed when the season begins in September. The club would be pleased to hear from other clubs concerning their activities.

All communications should be addressed to Walter A. Remy, secretary, Desmund Avenue, Bronxville, N. Y.

ROGERS NOW DOCTOR OF SCIENCE

Georgetown University conferred upon the inventor of underground and subsea wireless the degree of Doctor of Science in recognition of his invaluable presentation to the Government during the world war and the wireless art.

In the tribute paid the distinguished Southern gentleman he was recognized as a disciple of Morse and a rival of Bell, Edison and Marconi.

ONE CENT A WORD FOR YOU.

If you have a good true story to tell us about yourself and your station or any unusual radio occurrence or matter connected with radio, we want that story. We will pay one cent a word upon publication for all accepted stories. We desire you to feel that this new magazine is your magazine, and we will do all in our power to make it so. We want to make it as human as it is possible. Will you help?

EXPERIMENTAL SCIENCE AND RADIO CLUB.

The Y. M. C. A. Experimental Science and Radio Club is going full blast. We have purchased a 1 K. W. set and are setting it up. Our receiving station is already working and we hear Arlington and some Commercials. In addition to this a long wave set and wireless telephone set is planned. A large laboratory containing all the necessary apparatus needed in research work is being fitted out. Our club has 37 members now, among which are some returned service men and several professional radio instructors. We are anxious to hear from other *Radio Clubs* and they should address The Y. M. C. A. Experimental Science and Radio Club, St. Paul, Minn., in care of C. J. Otterholm, president.

Honest to Goodness, Boys, Don't This Look Natural? Get Busy. Let's Have Some More Good Ones Like This.

CLUBS, PLEASE NOTE

We want the latest gossip from all clubs and associations. We will be only too glad to give them the widest publicity. We ask the secretary of each club or association to send us a monthly report of the doings of his club. Such notices will be published free of charge. All amateurs, no matter where they live, should know what our clubs are doing, and what is being done to further their members' welfare and interest. RADIO AMATEUR NEWS *will be an exchange place for ideas of this kind.*

What we want particularly is: A good photo of your club-room and of the members; a copy of your by-laws or constitution, rules, etc.; if a weekly or monthly paper is read, send us a copy for publication.

Address all correspondence to Editor, Club Gossip.

SAN FRANCISCO RADIO CLUB

The San Francisco Radio Club was organized in January, 1916, and steadily grew so that when war was declared it had a membership of ninety-six. Due to the fact that the Government shut down all the Radio stations many of these lost interest in the subject and dropped out, while still others nobly answered their country's call for operators. For a time it was feared that the club would have to disband during the war, but when practice sets and lectures were started those who were loyal held together all thru the long wait for the reopening.

The San Francisco Radio Club can brag of being the first club of its kind in the world to hold a Radio operators' dance, of being one of the few which carried on its meetings regularly all during the war, and we can show a service flag containing eight stars. On the 4th of April, 1919, the club incorporated under the laws of the State of California and now that Radio transmission is about to return we are going to strive to hold our position as the largest and best Radio Club on the Pacific Coast.

Address all communications to 349 Seventh Avenue, San Francisco, Cal.

BRAZILIAN RADIO CLUB

We have the pleasure to communicate with you in order to have you informed about the forming of a "Radio Club," the first we are proud to say, which has been founded here, and whose end is identical to that of your League.

As the U. S. of Brazil has no law for regulating the amateur installations, we are intending to do our best to obtain from our Congress a similar concession to yours, so we take the liberty of asking you the kindness to send us, if possible, a copy of same in order to enable us to compose a bill, which we intend to present the next meeting of the Congress.

We know that you have been the head of the patriotic Radio League of America, and that you published as many papers of importance regarding the matter as you could, thus we are just soliciting from your good selves the favor to act as our correspondent, or if it would be possible to affiliate our "Radio Club" to your League.

Of course, we suppose you will have no doubt to put us in contact with all dealers of good electrical experimental apparatus, papers, etc.

We know of the advantage that will result for us in writing you, soliciting your cooperation for our desideratum, and we are certain that you will try to do your best for us, that is to say, for the improving of "Wireless."

We are willing to obtain a few copies of the magazine you publish, and also of your statutes, which would guide us in the composition of ours.

All our members, in the great majority, are willing to import experimental apparatus and also subscribe to your valuable journals. In order to orient you as regarding to this, we are herewith enclosing a list with names and addresses of all of them.

Thanking you in advance for any help you may give us, we remain, Dear Sir,

Yours respectfully
RADIO CLUB,
AUGUSTO J. PERERA, *President.*

Low Potential Radio Frequency Arc

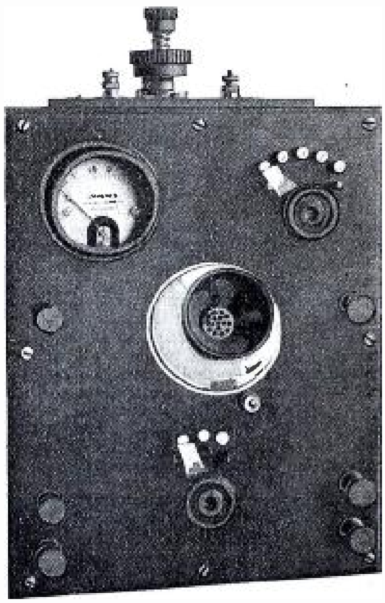
By CHARLES W. NOLLER*

THOSE radio engineers and experimenters who are thorougly familiar with the Poulsen radio frequency arc are aware of the fact that three of the greatest difficulties encountered with this type of arc are: (1) The necessity of a high voltage, (2) the necessity of operating the arcs with circuits tuned to high wave-lengths, and (3) the difficulty of maintaining such an arc, especially of very low power constant in its operation as a radio frequency generator.

In other words, the present type of Poulsen arc is inapplicable for small power installations of the order of one-fourth to two K. W. capacity. Thus far, all researches pertaining to the Poulsen arc have proved that it is impossible to operate the arc on potentials lower than 220 volts direct current and on wave-lengths not lower than 900 meters, and at the same time trying to maintain the radio frequency oscillations generated by this arc constant to any degree. These troubles, which are encountered in the operation of the Poulsen arc, cannot be eliminated to any great extent *as they are inherent properties of the arc itself.*

However, researches on an entirely different arc were conducted in 1914 by Mr. S. D. Cohen, a well-known radio engineer, on an arc different from the one bearing Poulsen's name. The undertaking of the researches for such an arc was that in obtaining a generator of high frequency oscillations *obtained directly from the ordinary 110-volt supply* and maintaining these oscillations at a high degree of constancy and generating frequency of the order of 2,000,000 cycles. With these researches, it was found possible to obtain an arc of this character and later a commercial type of arc was developed. The arc which has been developed thus far has given excellent results and from the data obtained it was found that by direct comparison of a Poulsen arc and that of the newly developed arc, that at least 100 per cent more energy can be obtained from the new arc and with an increase of 50 per cent of its overall efficiency. At the same time, the arc of the new type maintained its generated oscillations quite constant; however, that of the Poulsen arc was very inconstant. The Cohen arc, developed by him, operates from 110-volts supply and the voltage across the electrodes of the arc was 55 volts. The other voltage drop was across the D. C. resistance and choke inductances.

Here's the Little Devil We've Been Looking for for the Last Ten Years. It's a ¼ Kw. Arc Generator with Cooling Flanges and ALL!



At Last! Here It Is—a Short Wave, Low Power, Arc Radiotelephone Transmitter. The Forerunner of Amateur Radiotelephony.

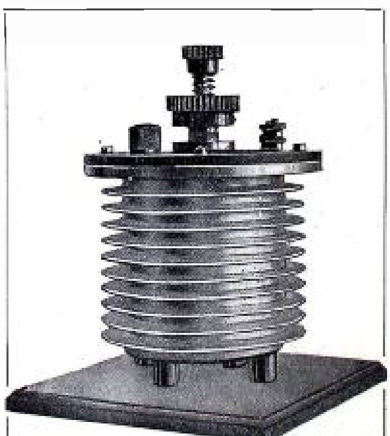
From a series of tests which lasted for a considerable length of time, with a comparison of standard arcs it was found that it was the first time possible to maintain an arc at 60 volts with an overall output of 80 watts. This data was obtained operating the arc with an oscillatory circuit having a period of 600 meters and the antenna tuned to the same period, which antenna had a capacity of .0008 mfd. and a resistance of 8 ohms.

The new arc consists of two special *tungsten electrodes* operating in *a liquid consisting of alcohol or gasoline, mixed with a 10 per cent solution, volumetric measurements, of aqua-ammonia.* The liquid is held in a cooling vessel, one of the electrodes is held stationary while the other is mounted on a movable stem, which permits its adjustment for gap length. The same conditions hold true with this arc as that of the regular Poulsen arc in that a critical gap length is required in order that maximum efficiency and stability is obtained.

It was found that by the application of a harmonic oscillatory circuit bridged across the arc and which circuit has a frequency of any multiple of the first or fundamental circuit, the overall efficiency of the arc is considerably increased and also that it is possible to further permit the arc to generate oscillations of a much higher frequency than previously permitted by the arc. Thus, as shown in Fig. 1, circuit L_3C from experiment is tuned to 1,000 meters, while circuit C_1L_4 had a period of 500 meters. It was found by the addition of circuit C_1L_4 that the energy obtained from circuit CL_3 was far greater in value than when circuit C_1L_4 was omitted. Having obtained this information, further experiment was conducted by adding more such harmonic circuits across the arc and it was possible by such a scheme to operate the arc on wave-lengths as low as 100 meters. Thus, it is seen by such an arrangement that it is possible to operate the arc at any wave-length so desired by properly manipulating the shunt oscillating circuits across the arc.

It was thus possible to construct a radio frequency generator with such circuits that the arc becomes a practical generator for obtaining sustained waves extremely suitable for low wave-lengths. This naturally is of great assistance to the amateur who was handicapped to a great extent in obtaining such an apparatus suitable for operating on a 200-meter wave.

The actual scheme employed is shown in Fig. 2, where L_1L_2 are choke coils; R, variable resistance; A, ammeter. The high-frequency circuit comprises three distinct oscillatory circuits, circuit L_3C tuned to 800 meters, C_1L_4 to 400 meters, and the antenna circuit, which comprises its inherent inductance and capacity L_5C_3 of the antenna system, tuned to 200 meters. With this arrangement it is possible to excite the antenna with a practically sustained wave on



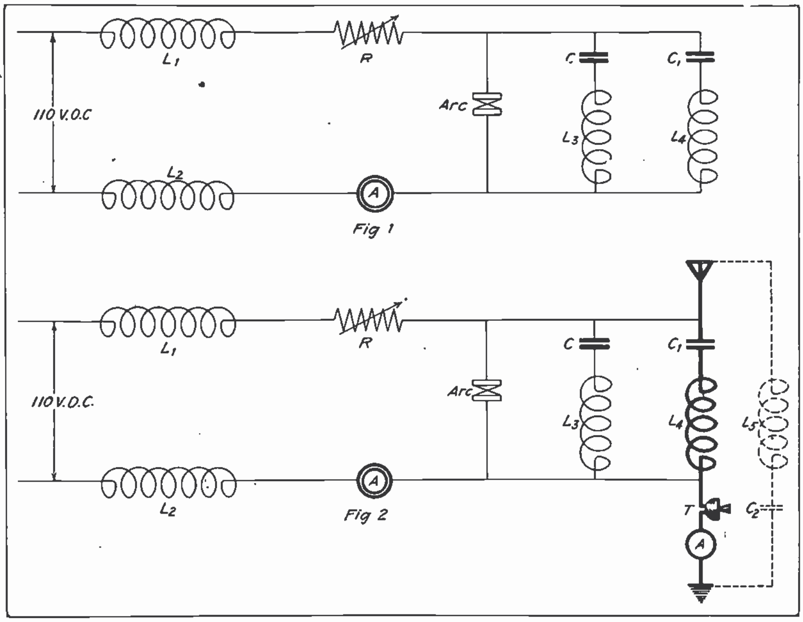
Now Look At Papa Arc Generator. This Rascal Can Stand ¾ Kw. Without Showing a Bit of Sweat.

* Assistant Chief Engineer Paramount Electric Co.

200 meters and the oscillations thereof will be maintained constant. The insertion of the telephone transmitter T makes the arrangement an ideal radio telephone transmitter. The arrangement operates successfully on an amateur wave-length of 200 meters and obtains a fair amount of energy from the source which is a necessity for long-distance transmissions.

With an output of 80 watts it was possible to obtain *radio telephonic communication of 100 miles and radio telegraphic communication of 300 miles.*

In Fig. 3 the new radio frequency arc is shown which is designed for experimental purposes and suited for the amateur as a radio frequency sustained wave oscillator, its rated capacity is one-half K.W. The liquid medium container is an aluminum shell containing a number of cooling fins. One of the electrodes is secured to this chamber, while the second electrode is mounted on a brass-threaded stem, which regulates the gap-length of the electrodes. An additional rod protrudes to this threaded stem, which supports the electrode by lowering this rod, thereby permitting the movable electrode to come in contact with the stationary one by lapping same and by the addition of a spring, the movable electrode is permitted to return to its position as desired and thereby maintaining the arc between the electrodes. The regulation is very simple and very little adjustment is necessary in order to make the arc operative.



With the Above Circuits It Is Possible to Generate Electric Oscillations of Extremely High Frequencies, Hence Low Wavelengths Permitting Same to Be Used in Amateur Radio Telephone Work.

Fig. 4 depicts a radio telephone and telegraph transmitter utilizing the new arc as a radio frequency generator. This set is solely designed to operate on wave-lengths from 150 to 600 meters. The overall efficiency of this set as measured has been found to be 24 per cent, which is exceedingly high for a set of that power which has an input of 400 watts. This efficiency, however, seems low as compared with quench-gap sets of the same input, yet when compared with standard Poulsen arc sets of the same power the efficiency is at least 70 per cent greater with this new arc than with the Poulsen type.

At last, realization has come forth that the amateur is given a new piece of apparatus which he has been looking for in vain since the advent of radio, in that, he is now at liberty in having an instrument which is capable of generating sustained wave oscillations from the ordinary 110-volt light supply and capable of using it for a radio telephone and telegraph transmitter and operating same on the restricted wave-length of 200 meters.

Developments in Wireless Telephony

By DR. F. B. JEWETT

Chief Engineer Western Electric Company; Director Research American Telephone and Telegraph Company

APPARATUS for this purpose had been considered from almost the start of wireless communication of any kind. It was assured if we could provide the facilities for one human being to talk to another and eliminate intermediary operators, that the utility of the telephone could be increased tremendously.

In the early days it seemed almost impossible to do anything with radio telephony, because the spark system only was known, by which system with a sudden impulse you produce a train of waves with big spaces between them. This did not lend itself to speech because the continuous nature of telephone communication entailed continuous wave train type of transmission. In 1913 and 1914, the American Telephone and Telegraph Company, in connection with the development of their transcontinental line, found an amplifying apparatus now commonly called the vacuum tube. It seemed that it not only possessed the requisite properties for generating the continuous wave of radio frequency and of putting the voice frequency on this, but also could amplify it up to sufficient horsepower for long distance transmission. The result was that in the latter part of 1914, his company set up a radio station on Long Island and in the early part of 1915 they actually telephoned from there to the Dupont Building at Wilmington, Del.

Talked With Paris in 1915

The experimenters were then convinced that it was possible to transmit conversations by radio over very great distances and in the latter part of 1915 they talked from Arlington Naval Station in Washington to Panama, to San Francisco, to Honolulu, and later to the Eiffel Tower in Paris. In all of these conversations wire lines formed part of the circuit at the terminal station.

The United States navy saw the possibility of using the radio telephone for certain short range service and from then on energies were devoted to the short-range type of set—from ten to fifteen up to two hundred miles.

The author was called to Washington in 1917 by General Squier at the beginning of the war to have a conference with the British liaison officer on aeroplane service. It was pointed out that the wireless telephone was of particular interest at that time, the problem being to communicate between the various planes of a squadron and between the ground and the aeroplane. The work done up to that time was sufficient to give assurance that this was a reasonable possibility, and in July of the same year they actually had a squadron of aeroplanes in the air with crude wireless equipment, and in November, with finished forms of equipment.

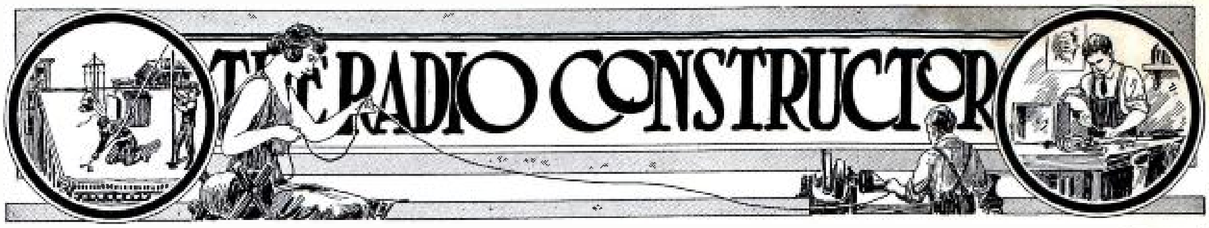
The principal problem was the actual use of the telephone on the aeroplane on account of the noise of the engine and the wind. What was practically the greatest difficulty was the design of a transmitter and receiver and a form of mounting and helmet which would enable a man to talk to another man in the same aeroplane. Finally a device was produced by which a man could talk in an ordinary tone of voice with his mate in the same plane, and could also talk with a man in another plane or on the ground by simply throwing a switch. In training, it was possible for the instructor on the ground to advise the men up above what they should do.

Instant Control of Battleships.

After a certain date, all the submarine chasers that left the United States were equipped with radio telephones with a range of ten or fifteen miles. The equipment was placed on the bridge, so that the commander could talk to any other boat in the line. Neither was it necessary for those receiving the message to hold receivers to their ears as the receiving apparatus shouted out the words in a loud voice. The writer himself had accompanied a squadron of chasers to see how the system worked out, and it was really wonderful to note the quick response to a command. When the captain decided to stop, he gave the order in an ordinary tone of voice and in anywhere from 30 to 40 seconds every boat, some of them miles away, had been stopped. The result was that a squadron of chasers was put in the same position as an officer and a squad of men.

The radio telephone has probably played a greater part on the boats than on the aeroplanes. Only a small quantity of equip-

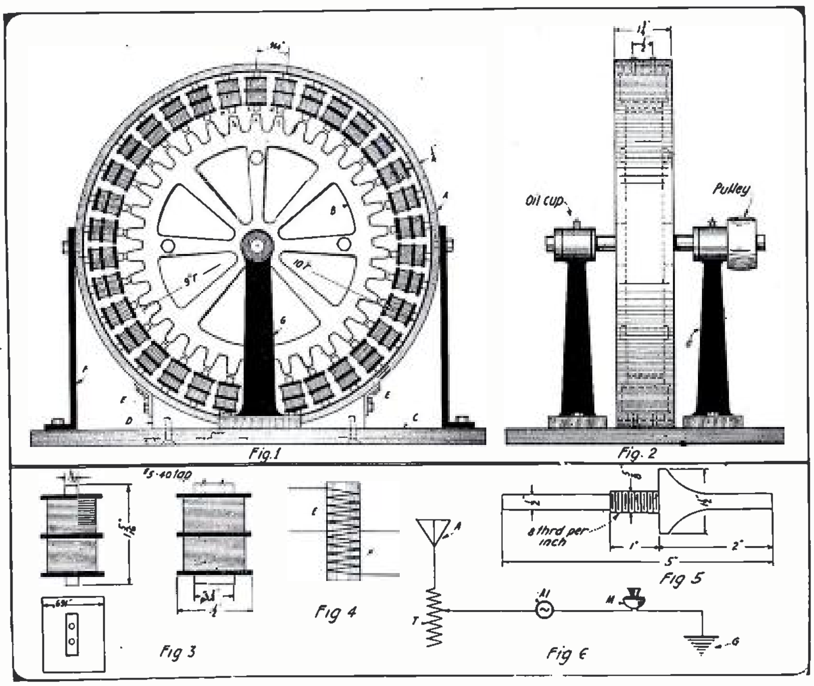
(*Continued on page* 88)



A 15,000 Cycle Radio Frequency Alternator

By HOMER VANDERBILT

An army of experimenters have been looking in vain for a number of years for some data as to the construction of a simple radio frequency alternator. The writer was one of these experimenters, but after a considerable amount of labor in digging up information regarding the past and present type of commercial high-frequency dynamos, he has finally been able to design a very simple machine which can be easily built by the average amateur.



Constructional Details of 15,000 Cycle-Radio Frequency Alternator Which May Lead to a Practical Type of Short Range Radio Telephone Transmitter.

Before starting with the construction, a few words regarding the general design of such a machine will not be amiss. The generator will be of the inductor type; that is, a solid iron rotor will be used without any winding for changing the magnetic flux in the field or stator coils. The stator coils consist of a double winding, one for excitation while the other is for developing the radio frequency current.

The periodicity of the current depends upon the number of poles on the rotor and the number of revolutions at which the rotor revolves.

The equation for the frequency obtained from any alternator is:

$$F = \frac{N \times S}{120}$$

where: F = frequency in cycles per second.
N = number of poles on rotor.
S = speed of rotor in R.P.M.

The expression is divided by 120, as the result required must be in seconds and there are two alternations to each cycle.

The amount of current generated by such an alternator depends upon several factors; first, the character of iron used and the manner in which the stator and rotor are laminated. It should be borne in mind that in increasing the frequency in an iron circuit the hysteresis losses are increased with a poor lamination scheme.

The windings of both the exciting and generating coils must be so that a minimum amount of eddy currents are produced and at the same time receiving the maximum effect with a minimum number of turns and current excitation.

The intensity of the current generated also depends upon the rapidity at which the magnetic lines of force between the rotor and stator are altered and upon their strength. Thus it is necessary to employ an air gap between the stator and rotor as small as possible. It is evident, therefore, that this problem of design of a radio frequency alternator is not as simple as it looks. A great deal of patience and precisional machine work is necessary in order to build successfully such a generator. The builder should take extreme pains in constructing the various parts and seeing to it that each part is made to the exact dimensions given in the plans.

The first thing to come under consideration will be the stator A, which is cut from a 20-inch iron pipe and is 1¾ inches wide, as shown in Fig. 2. The number of coils used on the stator is 98 and the distance between each coil is .964 inches. It is therefore necessary to mark out on the edge of the stator 98 lines, squaring a line across the face. Two holes are bored with a No. 20 drill at each of these lines and the distance between each is shown in Fig. 2. The field coils are made as illustrated in Fig. 3.

The cores consist of a soft grade of iron 15/16 of an inch long by 3/32 inch wide, as shown, also two 5-40 threads are tapt in each end. Three hard rubber bobbin ends, the dimensions of which are given in the diagram, are made for each core. The central one is used as a separator for the two windings.

The excitation coil E, Fig. 4, is wound on the end where the core is fastened to the stator, and this consists of 100 turns of No. 24 enameled magnet wire. This can be wound either by hand or in the lathe, the lathe being preferable. The other bobbin, F, is fully wound with No. 26 B. & S. enameled magnet wire. Before winding it should be understood that an insulation over the bare iron core is necessary, and the leads from each coil brought out separately. The winding of each coil must be made in opposite directions so that one will not interfere with the other, due to mutual induction.

After winding completely the 98 coils and properly testing them, they are fastened to the stator frame by means of two 5-40 screws placed on each hole. Care should be taken to see that the length of each coil when secured to the frame should be exactly the same, as the success of the machine depends in a great measure upon this. The complete stator is then mounted upon an iron base, C, Fig. 1, which measures 26 x 8 x 1 inches. It is supported at the bottom by means of two brass blocks, D, D, cut to fit snugly against the face of the stator frame and perpendicular to the base as seen. It is screwed to the base by two 5/16 inch flat-head machine bolts. Two angle irons, E, E, are fastened to the blocks and frame A by No. 12-24 bolts. These are used to prevent the stator form moving. The main supports F, F, are made from ⅜ iron and are 1¾ inches wide. Tho a little difficulty will be encountered in bending the bottom, this can be done, however, by heating to redness and bending it in a vise; or else an additional piece is made for the bottom and both the upright and bottom strips secured together by No. 14-20 flat-head machine screws. These are fastened to the base and frame by ¼-inch No. 14-20 screws. Care should be taken to see that the stator is secured perpendicular to the base.

The second important step in the construction of the alternator is the rotor B. This is made from 34 sheets of No. 24 gage annealed sheet iron, having the highest permeability factor possible. There are 98 teeth on the rotor and they can be made either by punching them out with a die or by sawing each of them individually. The latter method is preferable for the amateur, as it eliminates the necessity of employing dies, which are quite expensive. Some kind of form is required as a guide for cutting the teeth on the strips. The best one for the purpose is using two gear wheels having 98 teeth and a diameter of 18 inches between extremities of two adjacent teeth as indicated in Fig. 1.

The 24 circular iron discs, which are 18 inches in diameter, are clamped firmly between the gears by means of four bolts past thru the gears and discs. The complete arrangement is then placed in a vise and each of the teeth cut with the aid of a hack-saw. After they have been cut, the edges are finished with a file in order to make them of size. The discs are then removed and coated with a thin layer of shellac for lamination. After permitting them to dry, they are fastened together by four or more ¼-inch bolts which are also dipt in shellac. (The teeth can also be milled in the rotor.)

A ⅝-inch hole is made in the center of the rotor, and into this the shaft is inserted. This is made as shown in Fig. 5. It consists of a solid (tool) steel rod 1½ inches in diameter turned down in a lathe as indicated. The threaded portion is made either with a die or on the lathe, the latter being the best. The complete rotor is secured to the shaft by means of two nuts and a key. One should be careful to see that the rotor is held very rigidly on the shaft and that it is held in line.

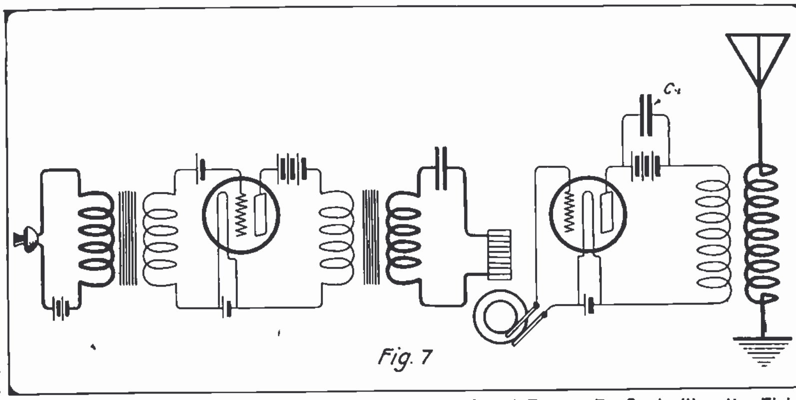
The shaft and rotor are supported on two 10-inch shaft hangers, G, G, which are secured firmly to the base C by means of ⅝-inch iron bolts. The hangers should be fitted with phosphor bronze bearings and also oil cups of the self-feeding drip type. A collar is placed on each end of the shaft resting against the bearing. This is used to prevent the rotor from shifting sideways when running. It is advisable to employ ball-bearing thrust instead of the ordinary collars. An iron or wooden pulley is placed on one end for driving the rotor by means of a belt, or a small gear wheel can be used, which is meshed with another gear wheel of the same pitch on the prime mover.

The various coils are now connected together. The exciting ones should be so connected that the polarity of one is different from its neighbor. This is done by connecting the lower with the upper leads of the coils. The second ring of current-receiving coils are terminated in the same manner. The complete circuits of both windings are tested for open ends and the polarity of each pole piece is examined carefully by means of a compass. When the above is thoroly tested the machine is ready to be used.

At first the generator is secured firmly to the ground or floor and the pulley of the prime mover is placed in line with that of the dynamo pulley. The oil cups are filled with machine oil, which is permitted to flow at the rate of about 10 drops per second into the bearings. The rotor is then allowed to run at moderate speed until everything limbers up. The speed is gradually increased until it reaches 9,200 R.P.M. At this velocity the alternator delivers a frequency of 15,000 cycles per second with an output of about ⅛ kilowatt high frequency energy, when the exciting coils are supplied with 100 watts (4 amperes and 25 volts). This can be obtained either from a storage battery or an auxiliary D. C. dynamo.

The generator can be used for radio telephony for the production of sustained waves. It is connected as indicated in Fig. B, where A L is the alternator; A, the aerial; M, the microphone; G and T, inductance coil and ground. The microphone

(Continued on page 89)

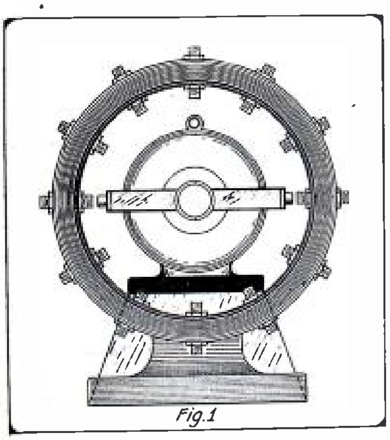


Proposed Circuit for Vacuum Tube Modulation of Radiated Energy By Controlling the Field Excitation Current.

High Spark Frequency In The Amateur Field

By ROLAND H. LAMB

The present-day radio amateur is continually striving to increase the efficiency and radius of his transmitting set. Restricted as he is to a wave length not exceeding two hundred meters and a maximum power input of one kilowatt, it is up to him to find other means of extending his radius of communication. One of the best ways to do this, as many modern experimenters have found, is to increase the spark frequency of the transmitting set and make the other necessary changes essential to resonance. A large majority of the amateur stations thruout the country, holding long-distance records, owe the enviable performances of their sets to the good carrying properties of their signals due to the clear, musical and penetrating note of the high-pitched spark.



Don't Kill the Speed of Your Gap By Mounting the Rotor Full of Electrodes. Try This Stunt and Increase Your Efficiency as Well as Save the Life of Your Motor.

The reasons for this increase of range accompanying the use of a high spark frequency are easily understood after a little consideration. The modern long-distance receiving set invariably uses the telephone as a means of making the radio oscillations audible. It has been proved by experiment that the type of telephone used in wireless telegraphy is far more sensitive to high frequency currents than to those of low frequency. From tests made at the U. S. Bureau of Standards by Mr. L. W. Austin, a pair of wireless telephone receivers showed an increase in volt-sensitiveness of approximately one thousand, from 60 cycles to 900 cycles. The human ear also seems to be more sensitive to sounds of high than of low frequency, besides being better able to distinguish the high notes of the radio signals from atmospheric and other low tone interference. There appears to be a practical limit to high frequency, however, at about 500 cycles per second. Above this frequency there is not as material an increase in sensitiveness and also there is the additional difficulty for the amateur of excessive rotary gap speed.

There is furthermore a very desirable quenching effect produced by increased frequency. The condenser will be charged and discharged at a more rapid rate and should be *decreased* in capacity. This results in a very material increase in efficiency, since the losses in a small condenser are much smaller than those in a large one; besides, it allows more of the primary of the oscillation transformer to be put into use without exceeding the two hundred meter wave length. As the rate of oscillation of the closed circuit is increased the current in the open circuit will be increased and the emitted wave trains will be more continuous, resulting in a decrease in the damping of the set and a greater transmitting range.

It might be well to consider here the construction and characteristics of a rotary spark gap suitable for high frequency operation. The prevalent custom in amateur rotary gap design is to employ a metal disc or ring insulated from the shaft of the motor on which it is mounted and having from eight to twelve studs on the perifery, and revolving at a speed of 2,000 to 2,500 r. p. m. Assuming a gap of this type with ten sparking studs and revolved at a speed of 2,400 r. p. m., there will be 400 sparks per second, which is equal to a frequency of two hundred cycles.

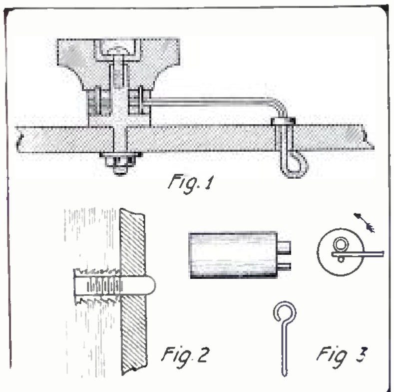
Now by using the same motor with a different gap design a very appreciable in-

(Continued on page 89)

Ingenious Stunts Used by Manufacturers

By F. H. SWEET

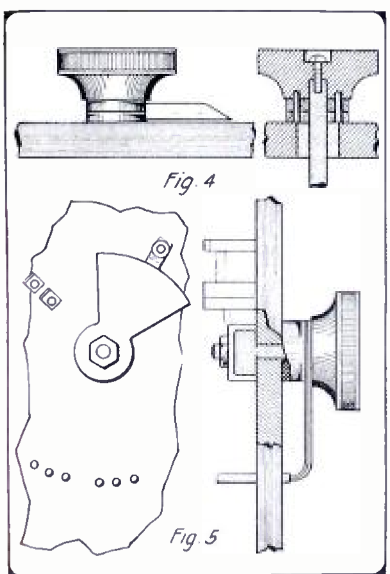
THE designing of commercial receiving apparatus brings up many problems, the most important of which is permanence. When a set is in constant use under the most trying conditions, it must be built to last. That is, the various parts, when subjected to the



Some Clever Stunts Which Every Experimenter and Constructor Will Appreciate. Try It Out On Your Workbench the Next Time You Build.

vibration on shipboard or in wagons of portable sets, must not come loose and fall apart. Imagine, for example, what would happen to most of the apparatus sold in the supply stores, if it were used on an aeroplane, jolted by the shocks of landing, and strained by the rapid vibration of the engine. Under such condition nuts come loose and drop off, wires break, contacts, binding posts and switch parts work out of place. All this increases the resistance of the circuits, reducing the efficiency, or making the apparatus inoperative. The diagrams show some of the precautions taken to prevent troubles of this kind.

Fig. 1 is a cross-sectional view of an inductance switch. The main shaft does not turn but is bolted permanently to the back of the panel. When the connecting wire is soldered to it, the nut cannot work

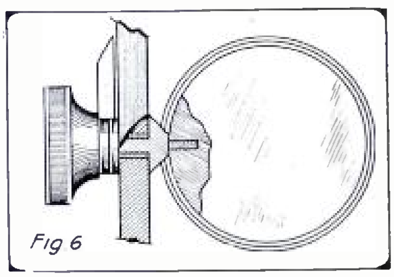


Pointer and Dead End Scheme Employed By Manufacturers of High Grade Apparatus—Take a Hint.

away. The laminated contact arm is pinned to the handle with two small steel pins thru washers above and below the contact. Therefore, the handle, contact, and washers turn together around the stationary shaft. At the top of the handle is a small brass bushing. Thru this a machine screw is put into a threaded hole in the shaft, just deep enough so that the handle and bushing turn freely. The switch points are made with a slightly tapering shank forced into the holes in the Bakelite front. Connection is made to a wire sweated into a hole in the shank. A switch made in this way can be subjected to the roughest handling without working apart.

Receiving sets are usually made with a Bakelite panel at the front of a wooden case. It is often necessary to remove the panel, but if this is done too frequently, wood screws lose their hold on the case. For this reason the method of fastening shown at Fig. 2 is often used. Here a round brass insert, threaded for the panel screw and grooved at the outside, is set into a hole in the case. If the fit is snug, the wood curls under the straight part of the grooves, holding the insert tightly. A little shellac will cause it to hold still stronger. Now the metal screw can be put in and taken out without injuring the wood.

Fig. 3 shows a tool for forming eyes on connecting wires. The usual practice in wiring receivers is to use No. 12 bare copper wire, insulated with Empire cloth tub-

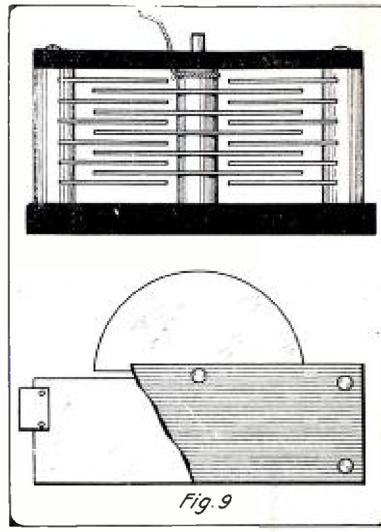


Here's a Guaranteed Method of Securing Your "Tickler" to the Panel; a Method Which Should Be Universally Adopted.

ing. Connections must be soldered around the screws, not on the top, or in holes thru the screws. The tool in Fig. 3 consists of a brass rod fitted with a short steel rod of the diameter of the screws used, and a smaller rod, as far from the first as the diameter of the wire. To form the loops, the wire is inserted as the diagram shows, and bent around the pin in the direction of the arrow. Then the whole loop is moved around the larger pin, the wire caught behind the smaller one, and bent back. This makes a perfect ring as the drawing shows.

A pointer for a condenser, coupling coil, or tickler, is shown in Fig. 4. The pointer is a square brass rod, filed back at one end, and turned round at the other. The round end is inserted in a hole drilled between the washers and into the main shaft. Then, when the screw which holds on the handle, is turned down to the pointer, it is held tightly. Pins thru the handle and washers hold all the parts together. There is a knurled bushing preferably of tobin bronze, pressed into the panel to act as a bearing.

One of the most satisfactory dead-end switches is shown in Fig. 5. This particular switch has five contacts and two breaks altho any number can be used. The handle is made like that in Fig. 1, except a heavier washer is used under the contact. At the back is a Bakelite sector, to close the breaks. This is pinned to the shaft, which, in this case, turns with the handle. The arms of the breaks are made of light phos-



The Last Word In Condenser Design. Note That the Plates are Supported By a New Improved Method.

phor bronze, with small blocks of silver for contacts. As the handle and contact are turned, the sector turns also, pushing the inner break-arm against the outer one. This causes a slight rubbing at the contacts which helps to keep them clean.

Tickler coils, for regeneration purposes, are usually wound in pancake form, mounted at the end of the secondary of the loose coupler. A tickler coil mounting is shown in Fig. 6. The coil is wound in two grooves out in a Bakelite disc. The shaft of the handle is forced into a hole between the

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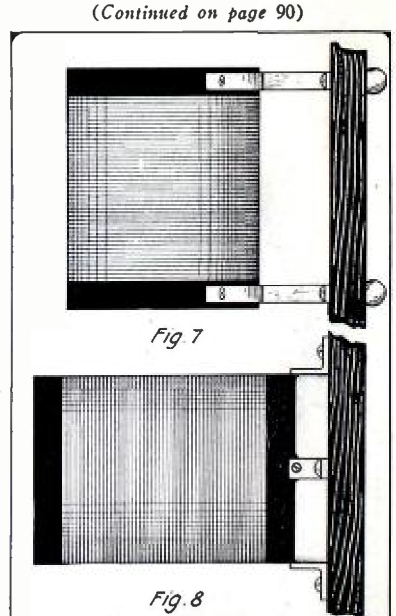
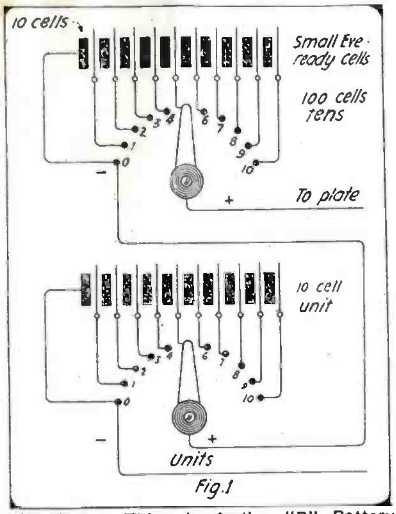


Commercial Method of Mounting Inductance Coils Which If Adopted Will Increase Appearance and Efficiency 100 Per Cent.

Construction of an Audion Control Panel



The Latest Thing in Audion "B" Battery Switches Which Gives More Accurate Adjustment and Saves the Life of Your Batteries.

IT is very convenient as well as necessary to have one of these instruments which affords a method by which the experimenter can change the connections from the receiving apparatus thereto, as is required with the various regenerative circuits. At the same time it makes it unnecessary to handle the vacuum tube or other accessories which always go with an audion to make it of use and value in the circuit.

The panel described below will meet the requirements of every Amateur, and while being cheap in cost it is highly efficient in operation.

The adapter for the bulb will, of course, raise the question as to what type of adapter should be employed. That question can easily be answered by stating that the adapter suited for the type of bulb for which the constructor has a preference naturally will be used. But for convenience sake the regular DeForest type of adapter is shown in the drawings, Fig. 2, as it is readily understood that this type of adapter would not be suitable for use with the Audiotron or other make of bulbs varying greatly in their mode of construction.

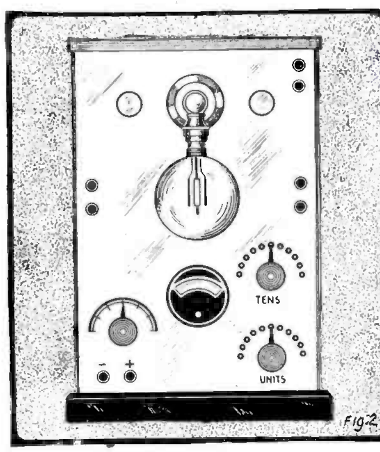
The "A" battery rheostat is none other than the porcelain base variable resistance unit which sells for sixty cents and is very well suited for the purpose.

A small ammeter reading up to 1.2 or 1.5 amperes is inserted in the circuit so that the operator may get a fair idea of the amount of filament current he is employing and thereby increase and protect the life of his vacuum tube.

In the present commercial type of panels the "B" battery circuit is shunted across a resistance measuring well up in the ohms and the trouble is that there is a continuous flow of current, no matter how small, which can easily be considered a waste, especially when the Amateur pocketbook is to be taken into consideration. Therefore, with our friends in mind the writer presents the method shown in Fig. (1) where the "B" battery current is regulated by the unit and tens method, an extra contact point makes it possible to throw the "B" battery plate source of supply off when the apparatus is not in actual operation, thereby saving the life of the batteries during that period.

The "B" battery supply controlling switches are similar to those used on the primary of the regular receiving tuner, and in much the same manner the batteries are cut in by units and tens. This gives a much finer adjustment in respect to plate voltage and the results of this arrangement prompt the writer to believe that it is the better of the two.

The number of contact points furnished on the switch (marked tens) need not be ten, as it is only necessary to put as many

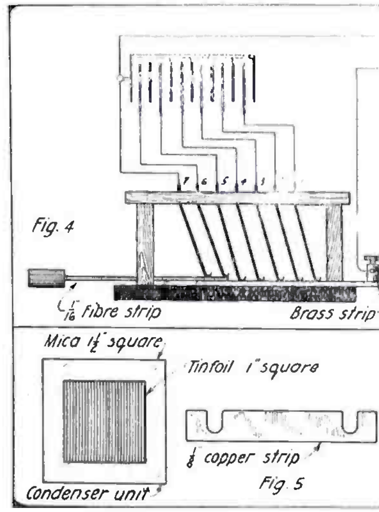


The Completed Audion Control Panel Which Will Give a Commercial Aspect to Any Amateur's Station.

as are required. This varies with the different types of vacuum tubes. However, it is advisable to put the ten points, as there may be a possibility of their necessity later on.

The bridging condenser which is in series with the grid element of the audion is constructed as follows: Twelve pieces of tinfoil 1 inch square. Mica is used for the dielectric—thirteen pieces measuring 1½ inches square are required. There are seven connections, the last cuts the condenser out and the grid direct to the receiving inductance. The switching arrangement shown in Fig. (4) is employed to cut in the condenser capacity sheet by sheet, and it will be found that this type of switch is very easy to construct, while the types employed on the commercial audion control panels are far beyond the possibilities afforded by amateur workshops.

The stopping condenser which affords a by-pass for the audio frequency currents; shunted across the telephone receivers and the "B" plate battery supply is constructed in the same manner as the switch described



Above—A New Design in Switches Which Permits the Capacity in the Grid Circuit to Be Varied At Will. Below—The Condenser Units and the "Tickler" Post Jumper.

above, with the exception of larger capacity being employed for this purpose. The dimensions of this condenser are as follows: Seven sheets of tinfoil 4 inches square separated by eight pieces of thin mica, each piece measuring 5 inches square.

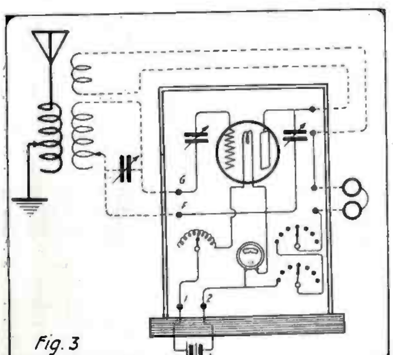
This stopping condenser is not absolutely necessary, as it is practical to make use of the arrangement shown in Fig. 6 where a 1 mf. paper condenser is shunted across the "B" battery supply and a variable condenser having a capacity of .001 mf. is shunted across the telephone receivers.

Connections

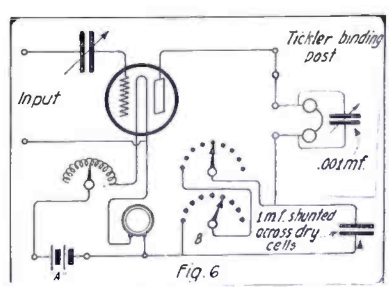
As shown in Fig. (3) the "A" battery supply is brought to the binding posts 1 and 2 which have their polarity signs + and — correctly stamped. Just above these two posts are the connections to which the receiving inductance is connected, marked G, and F, G, going to the grid of the audion thru the bridging condenser, and F directly to the filament which completes the input circuit to the vacuum tube.

The plate connection is opened at binding posts 3 and 4 for the purpose of inserting the "Tickler coil." When this is not the case the small lug shown in Fig. (5) is employed to short these two posts, which causes the plate to connect directly to one side of the receivers. From the other side of the receivers a connection is made to the

(*Continued on page* 95)



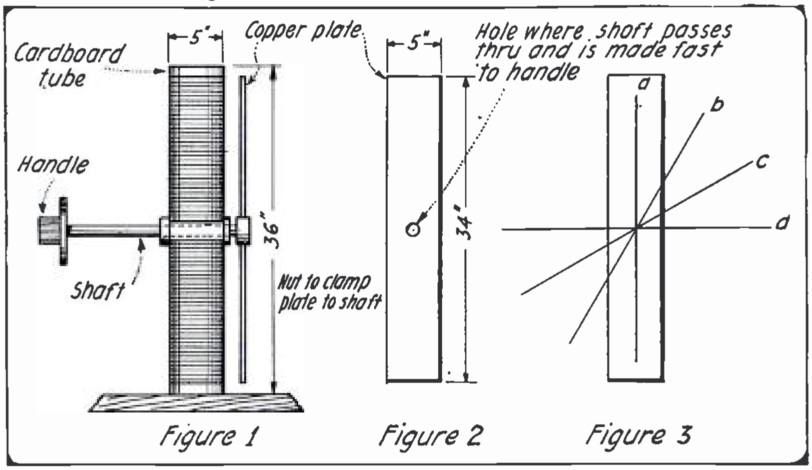
Diagrammatic Sketch of Connections In Panel.



An Economical Method for Those With Scant Pocketbooks. Shunt a 50c 1 mf. Condenser Across the "B" Batteries and the Small .001 V. C. Across the Phones. Nothing Better.

Increasing the Wavelength of a Coil

Many are not aware of the far-reaching effects of this novel means of coupling; and we might add—economical as will be revealed in the following.



Stop Winding Lengthy Inductances—Here's a Nifty Scheme for Practically Doubling the Wavelength of Any Coil When Employed in Conjunction with the Audion.

When employing a long-wave receiver it was found impossible to receive from Canarvon which was transmitting on approximately 14,000 meters; because, there were no more coils of inductance to be had. This was immediately remedied by making use of Buchers' novel scheme of electrostatic coupling, and as shown in the drawings a large copper plate as long and as wide as the coil itself was caused to have electrostatic relation with the windings of the coil. This worked so well that I was prompted to construct a coil with the electrostatic coupling attachment and thereby provide means of increasing the available wavelength of a certain coil approximately twice its initial value.

The drawings are self-evident, and the copper plate can be revolved to approximately zero relation with the coil (at right angles) and thereby making the arrangement variable over a wide range of wavelengths. This scheme works admirably well when tuning in arc stations whose wavelengths are approximately the same. One or the other can be had as desired. It therefore also provides very sharp tuning in this respect.

To build all the coils necessary for long wavelengths, such as this (14,000 meters); it will only be necessary to build but half the number actually required, when employing the scheme outlined herein. The value of such a circuit is therefore easily recognized in view of the fact that these long coils offer a great amount of losses, and it is believed that with this arrangement said losses are greatly decreased, as the intensity of the signals prove.

By referring to Fig. 3 (a) shows the plate in maximum relation to the winding of the coil, (b) shows a slight decrease, (c) a decided decrease, and (d) a total reduction to zero coupling as the coil is at right angles to the copper plate.

In this experiment the plate was connected to earth.—Contributed by EDGAR TERRAIN JOHNSTONE.

CORRECTION.

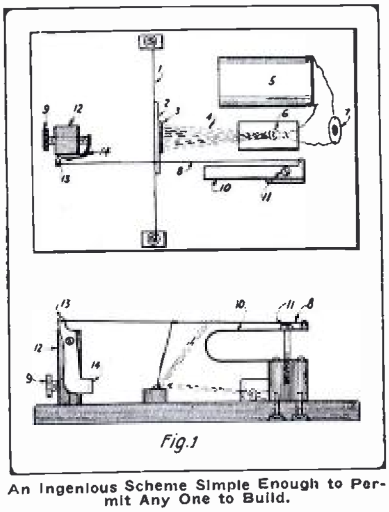
In the July issue, Mr. Herrolds' article "Experiments on Ground Antenna with Their Relation to Atmospherics," the connections shown in Figure 18 in respect to the plate and grid of the audion should be reversed.

An Efficient Hot-Wire Meter

By L. M. Lafave

I needed a very sensitive Hot-wire instrument, but did not have suitable material on hand to construct one of the usual type, so I designed the one shown in the sketches. It has the advantage of being easily constructed of cheap materials, and at the same time is very sensitive when made with reasonable care.

The principal reason for its sensitiveness lies in the fact that a long filament is used; the multiplying arrangement is a silk fiber attached to the filament and wound on a wood or metal cylinder which is supported under tension by a silk thread at either end, and the indicator is a narrow pencil of light controlled by the mirror on the cylinder. The cylinder should be a little over one-sixteenth inch in diameter and the mirror, which is secured to it, is the same width and about one-half inch long. The silk thread is secured on the blocks under the washers by screws driven in the base of the instrument.



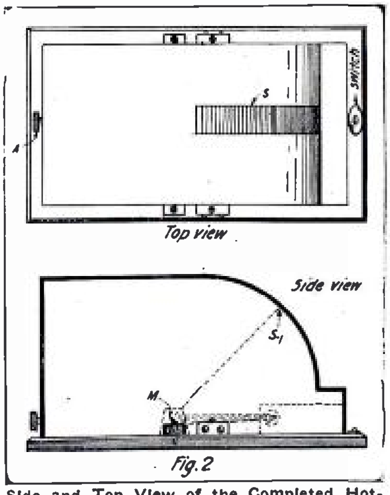
An Ingenious Scheme Simple Enough to Permit Any One to Build.

The filament is adjustable at both ends, one for alignment and the other for tension. The lighting unit is a flashlight battery and bulb, together with a suitable switch. The bulb is enclosed in a wood or metal casing with a hole large enough for light to fall on the mirror.

The mirror reflects light on the translucent scale in the top of the cover. The best method of installing the multiplying arrangement is to wind about a dozen turns of fine silk fiber on the cylinder and then fasten the loose end of it temporarily while the cylinder is placed in position and the thread tightened under the washers. After fastening the filament, the loose end of the silk fiber is unwound a few turns and fastened to the filament. This results in placing the thread (1) under tension so when any sag occurs in the filament it is taken up by the turning of the cylinder and this changes the position of the pencil of light on the scale.

The direction of winding the silk fiber on the cylinder depends on whether zero position on the scale is at the top or bottom. I could not get any platinum for the filament but found that a piece of very fine steel wool is a good material for weak currents. By adjusting the vertical screw (11) the best tension may be found for the turning power of the thread (1). It should promptly take up any slack of the filament caused by expansion.

No scale dimensions are given because the sketches are to illustrate the principal and constructional details may be changed without sacrificing efficiency.



Side and Top View of the Completed Hot-Wire-Meter.

MUSIC BY WIRELESS.

Recently a remarkable demonstration of the possibilities of transmitting music by wireless was conducted by the Bureau of Standards. Musical vibrations caused variations of like nature in the modulating circuit of the telephone circuit. This was accomplished by placing a phonograph directly in front of the mouthpiece of the wireless 'phone. The receiver installed some 600 feet distant transformed once more the electrical waves into sound waves which were greatly increased in volume.

RADIO DIGEST

RADIATION FROM ANTENNAE OF VARIOUS SHAPES.

W. Burstyn.

The radiation characteristics are calculated for a number of types of antenna for all directions in space, and the ratio of the maximum to the mean radiation is determined. It is shown that an antenna of U-shape radiates with virtual equality in all directions under certain conditions, and that an antenna of spiral shape emits a rotating field.—*Abstracted from Jahrbuch der Drahtlosen Telegraphie, January,* 1919.

NAUEN EMPLOYS INGENIOUS DEVICE FOR TIME SIGNALLING

The operation is initiated by a single current pulse. This pulse actuates an electromagnet and sets a pendulum free. The pendulum in its swings causes a disk to rotate in jerks, following the swings of the pendulum. On the edge of the disk projections are provided that make a series of contacts by pressing against the tongue of a spring, and these contacts control the signals. After the series of time signals has been given in one revolution of the disk, a cam on the disk closes a second contact, which causes a second electromagnet to be energized. This electromagnet releases an armature that catches the pendulum and arrests it ready for its release for the first electromagnet at the succeeding time signal.—*Abstracted from Zeitschrift für Instrumentenkunde, January,* 1919.

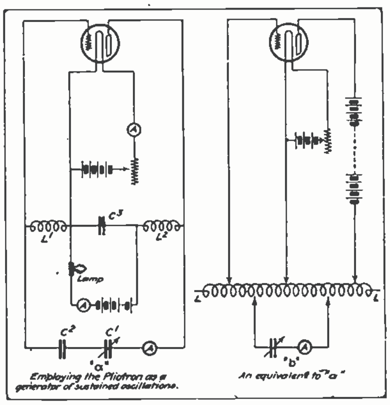
THE VERTICAL GROUNDED ANTENNA AS A GENERALIZED BESSEL'S ANTENNA.

By taking account of the variable distribution of inductance and capacity along a vertical grounded antenna the general expression for the current at any point of the antenna is obtained. For the case of an antenna having zero current at the top and maximum current at the (unloaded) bottom, the particular solution for current and voltage distribution is obtained.—*Abstracted from Proceedings Inst. Radio Eng., December,* 1918.

ELECTRON TUBE AS GENERATOR FOR MEASUREMENT PURPOSES

It is desirable in generating oscillations for measurement purposes that the amplitude and frequency of the generated current shall be constant and that the set-up shall be simple and flexible. By the latter term is meant that a wide range of wavelengths may be obtained with the same apparatus.

Constancy of amplitude and frequency are easily obtained. The main requirement being steadiness in the batteries supplying the filament heating current and the electron current between plate and filament. High-frequency current, constant both in magnitude and in frequency to better than



Here's a Real Hook-up for Your Audion as a Generator of Sustained Oscillations for Laboratory Measurement Purposes.

one-tenth of 1 per cent over long intervals of time, is readily obtained. When two or more tubes are operated in parallel on the same B battery changes occur in the intensity of the current furnished by one tube at the instant the second tube is put into operation or when the operation of the second tube is changed. Independent filament batteries should always be used.

A circuit which has shown itself to be convenient is shown in the drawing at A. Here the coils L_1 and L_2 may be wound in a single layer adjacent to each other on the same form. Taps may be brought out on each coil so as to use the number of turns desired. The condensers C_2 and C_3 are large fixed-value condensers which should be of low resistance. C_1 is the tuning condenser. A tungsten lamp is introduced in series with the B battery to protect the filament of the tube in case of an accident. The measuring circuit may be coupled directly to the coils L_1, L_2, or to a special coil of a few turns inserted in series with either of these coils, preferably on the side connected to the B battery since this point is held at constant potential by the large capacity of battery to ground.

The B battery may be inserted directly in the lead from the plate instead of adjacent to the filament as shown above. With such connection, however, care must be taken that there is very little capacity between the two batteries or their leads; if the batteries or their leads are not well separated and insulated from each other, the high-frequency current is much reduced. An advantage of locating the B battery adjacent to the plate is that a single continuous coil may provide all the inductances required in the circuits. Thus, as shown at b, connections may be made to the coil LL from filament, grid, plate, condenser, and high-frequency ammeter by movable contacts. Great latitude of adjustment of the several inductances is thus allowed, and the connections are very simply shifted from one type of circuit to another, so that the proper connections to give maximum current for any wavelength are made by simply sliding these contacts. An advantage of the mode of drawing the circuits shown at b is that it brings out that the several types of connections are equivalent.—*Circular of Bureau of Standards.*

THE LOOP AS A WIRELESS RECEIVER.

W. Burstyn.

The calculations show that the receiving power of a closed loop is approximately proportional to the third power of its linear dimensions and decreases with increasing wave length at a more rapid rate than in the case of an open receiver.—*Abstracted from Jahrbuch der Drahtlosen Telegraphie, January,* 1919.

Radio Vacuum-Tube Litigation is Settled

During the war litigation over rights for the manufacture and sale of vacuum-tube detectors for radio work was suspended by common consent, and tubes or "bulbs" for government use were made at various plants. As the situation stood at the close of hostilities an attractive market for bulbs was in prospect but patent rights prevented any one manufacturer from entering the field independently. The Marconi company held rights covering the use of a two-element bulb, Dr. De Forest's patents protected the use of the third element, and the Moorhead Laboratories in San Francisco had patented still other features also essential to the commercial production of the best tubes, among these being the use of a chemical process for exhausting air. During the war the Moorhead company had developed manufacturing facilities rapidly and bulbs were being turned out for the Allied governments at the rate of 30,000 per month.

Early in May representatives of the Marconi, De Forest and Moorhead companies held a conference in San Francisco and agreed that patent rights of all three should be extended to the Moorhead company, for which the latter should make payment to the other two on a royalty basis. In this connection it should be noted that this company is only permitted to make receiving and amplifying tubes, the Western Electric Company having the rights to manufacture the transmitting tubes. It was also agreed that the Marconi company would become the sole sales and distributing agent for the Moorhead output. The tube produced under this agreement is to be known as the Moorhead audion. Government contracts still operative will call for 15,000 bulbs per month, and within sixty days after the date of the contract the Marconi company, in the capacity of main distributing agent, is to receive bulbs at the rate of 50,000 per month.

DR. DE FOREST RECEIVES UNIVERSITY DEGREE.

Dr. De Forest, inventor of the audion vacuum tube, received from Syracuse University the degree of doctor of science.

IRON WIRE ANTENNA FOR TRANSATLANTIC RECEPTION

With a Marconi 118-A special receiver and a bank of seven French audions, we were able (in France) to hear Annapolis fifty feet from the receivers, and Lyons a half a block away, which is going some, considering that **our antenna consisted of two standard iron wires six hundred feet long, stretched between two small pine trees,** and that French audions in general are very poor in quality.

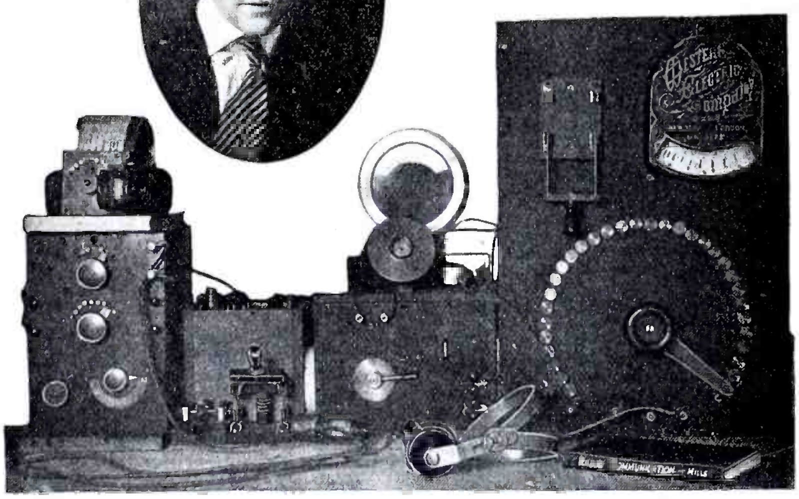
We heard all the principal arc stations in America, including NPL at San Diego, and the Bolsheviki at Moscow (MSK) came in like the old home town fire whistle. This latter station would register a space current change of from six to ten mill-amps on the plate circuit of our receiver, and I think that is remarkable considering that it is 2,000 miles from Moscow to Bar-Sur-Aube, where we were located. Besides prior to this great war we had serious objections to the use of iron wire as a collector of passing hertizian waves.

G. M. Best, A.E.F.

THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.
We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.
PRIZES: One first monthly prize of $5.00. All other pictures publisht will be paid for at the rate of $2.00.

Francis R. Pray—His Radio-Phone Set

Prize Winner $5.00



Well, Bugs, Here's a Real Amateur Radio-Telephone Set with All the Apparatus Which Makes for Future Amateur Radiophone Communication. Who's Next?

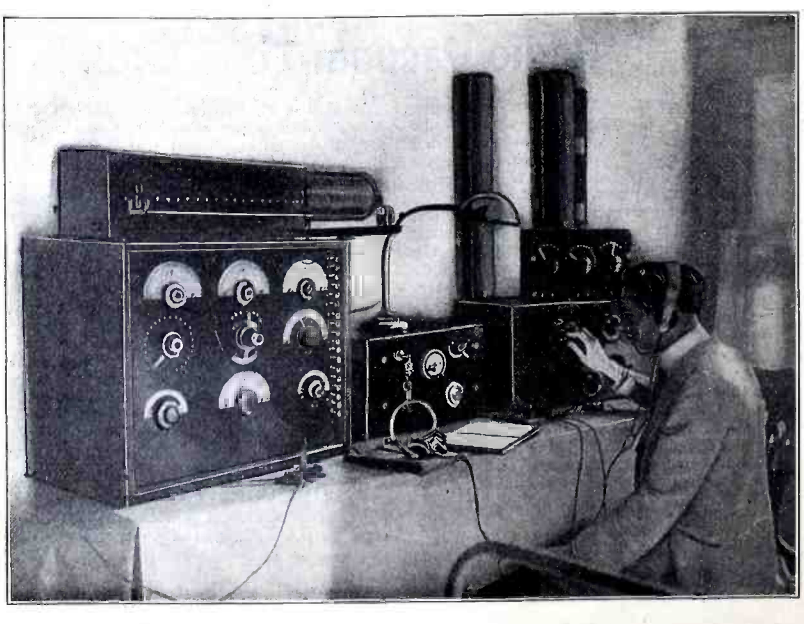
In order to dispel a seeemingly popular impression that I am an old guy with smoked glasses, long white beard, large family, and all that, I enclose my photo. As a matter of fact, I am twenty years old, been in the wireless game six years and am not yet out of school. Contrary to the general trend, my interests do not lie in the line of long-distance 200-meter communication, but rather to radio research and designing. However, I enjoy listening-in on cross-country relays, et cetera, and participating in the local gossip for which I have the small radiophone shown in photo.

From left to right, in photo, is the receptor panel for short-wave spark and C W work with small loader on top for Navy stations and press news. Note that the electron relay is mounted in rear of cabinet and observed thru hole. Next is a vacuum tube control box (without bulb at present), formerly used to generate C W for a long-wave heterodyne receptor, now dismantled. In front is the change-over switch, waiting for the ratification of the treaty before it can be used to connect the radiophone into the antenna circuit. Nearby, a Western Electric V T can be seen which will be incorporated in a compact and very efficient amplifier now being designed; no high or low voltage controls being necessary with this type of highly standardized bulb. Next is the radiophone panel, using a simple oscillating circuit with inductive feed-back. Inside is the inductance, General Radio variable condenser and a Western Electric power tube with oxide-coated filament. No high or low voltage controls used here, either, because of the excellent design of the vacuum tube. At the top is the microphone transmitter, for which a special mouthpiece is being made, and in the rear is the radiation meter. At right is the power control panel. The lower switch is the 110-volt rheostat. The radiophone D. C. is obtained from 110 volt A. C. lighting service, rectified into pulsating D. C. by chemical rectifier, and smoothed out into practically pure D. C. by means of a number of choke-coils and telephone condencers. Since the transmitting V T does not function very well on 80 volts D. C. I now have another high voltage device under construction to supply 300-500 volts, which will be completed as soon as I can connect with a couple of two-member power V T's.

I would be glad to hear from amateurs in or around Greater Boston who plan to have radiophones in the near future. Address me, 102 Heath Street, Winter Hill, Mass.

De Jonge Station

All instruments except three variable condensers are mounted in mahogany cabinets. I am using a short-wave regenerative receiver, visible at left side of photo. With this short-wave receiver and a single "V T" bulb I hear L P working on 750 meters,



If You'd Listen in One Night at Mr. De Jonge's Place You Wouldn't Sleep for a Month. Nauen and Japan Are "Small-Town" Stuff With Him.

also B Z R on 900 meters when weather is favorable. I am using with this set a four-wire aerial 90 feet long and 60 feet high. With the large loose coupler on top of the receiver cabinet and the large inductances with five variable condensers, two variometers and a single ship "V T" amplifier I hear Berlin and Hong-Kong. These are some of the stations I hear every night: N P W, N P M, N P O, M U U, B X Y, B Z M, F L, Y N, U A, I D O, I P, O U I and L C M. I hear these stations every night when there is no Q R M or Q R N. I also pick up all wireless telephone stations, that is five or six. I hear every day W F F, New Brunswick, July 5. N F F was trying to get the George Washington on 8,000 meters. The aerial I am using with this long-wave set is a single wire 600 feet long. Well, boys, if you want to know how I do it, drop me a card and I will be glad to give you hook up

JOHN DE JONGE,
218 De Mott Avenue,
Clifton, N. J.

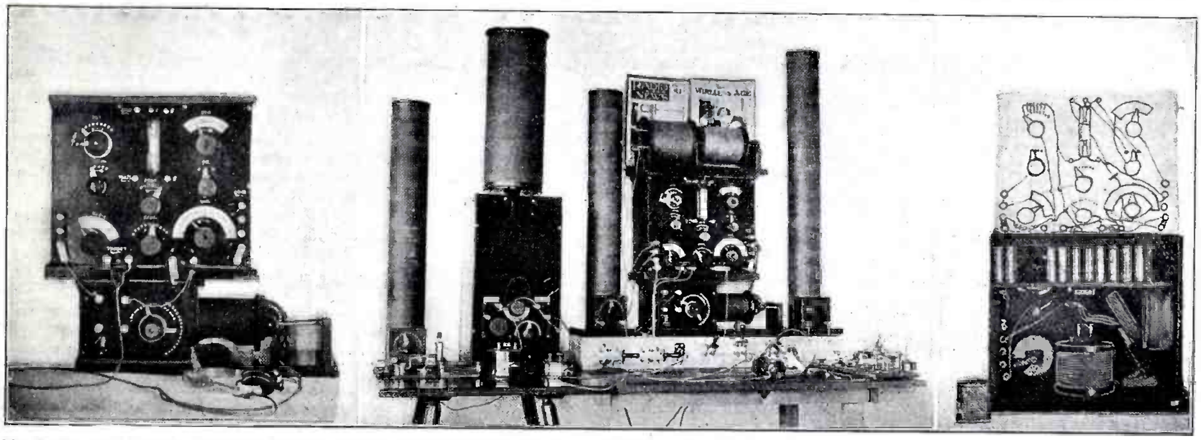
OSCAR H. BONTER'S STATION

Here is a picture of my wireless set which consists of a short-wave regenerative set, a couple for long waves up to 4,000 meters, and then a large loose coupler and suitable loading coils for the arc stations.

You will notice that my regenerative panel is so designed that I can use my Audion bulb in any hook-up I desire by just breaking the bridges on three of my binding posts.

You might state for the benefit of the amateur who lives in congested districts that by running one wire from his electric light line to a stopping condenser and then to his instruments he will get excellent results using this wire as an aerial. It is not necessary to shut off the current, as the condenser stops it from grounding and blowing out your fuses or burning your tuning coil. I have heard M, Havana, Cuba, W S T and numbers of those stations down South in the West Indies Islands, as well as B Z R, Bermuda.

OSCAR H. BONTER,
76 Fairfield St., Buffalo, N. Y.



Ye Gods! and Here's Another One of Those (Commercial) Amateur Outfits. Mr. Bonter Cares So Little for Patent Litigation That He Unprejudicely Prints His Connections So That You Too May Imbibe in the Reception of that Romantic (and Often Elusive) Foreign Signal.

MONTHLY PRIZES.

This department pays the highest prizes for illustrations of amateur radio stations.

We give a monthly prize of $5.00 for the best picture. All others publisht are paid for at the rate of $2.00. When do we get YOURS?

SALE OF GOVERNMENT RADIO APPARATUS

The United States Shipping Board Emergency Fleet Corporation has invited bids for the sale of radio apparatus now on or removed from 203 requesitioned vessels. This apparatus was purchased from the American Marconi Company and each main transmitting set is accompanied by a Marconi receiving set. These sets are to be complete and in good repair.

"Radio Amateur News," or "Radio News"?

When it was first decided to publish this magazine, we contemplated a great many different names. It is no easy matter to pick out a name for a new magazine, and inasmuch as we could not ask our readers before we started the magazine, we take this occasion to put the name to a popular vote. We feel that you, the reader, have just as much to say about it as ourselves.

The question was, should we name your magazine "Radio News" or "Radio Amateur News"? Some of our friends thought it wise to use the former name, and we think perhaps the advice is good, as after a year or so, when the magazine becomes big enough to carry all kinds of radio news, the word "amateur" will then be superfluous. Of course, we will always have the amateur at heart the same as now—you have our pledged word for that. But someone was of the opinion that the amateur does not like to be called an amateur. Now, what is your idea of this? We have prepared a blank below, which we ask you to be good enough to fill out. Place an X in the square showing your preference. Please cut out, paste it on the back of a postal card and mail to us. In the next issue we will tell you whether it is going to be "Radio Amateur News" or just plain "Radio News." Understand that this is *your* magazine. *You* are the boss, and must decide.

What Shall We Name It? Amateur Radio News or Just Radio News

At the time this issue goes to press but one-half the answers expected were received. We need your answer to finally settle the question. At the present time the results are as follows:

FOR
RADIO AMATEUR NEWS
3,560
RADIO NEWS
4,286

It's a close race and your vote may settle the question—mail it to-day.

I, A READER of your new magazine, have carefully considered the matter of the title for the magazine, and I have checked below the name which I like best.

☐ RADIO AMATEUR NEWS.

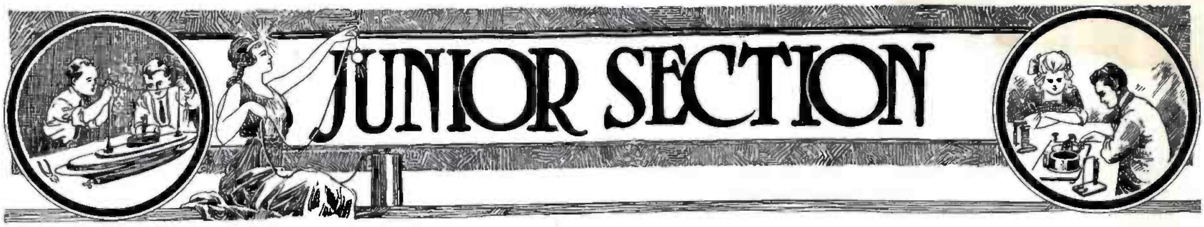
☐ RADIO NEWS.

Name ....

Address ....

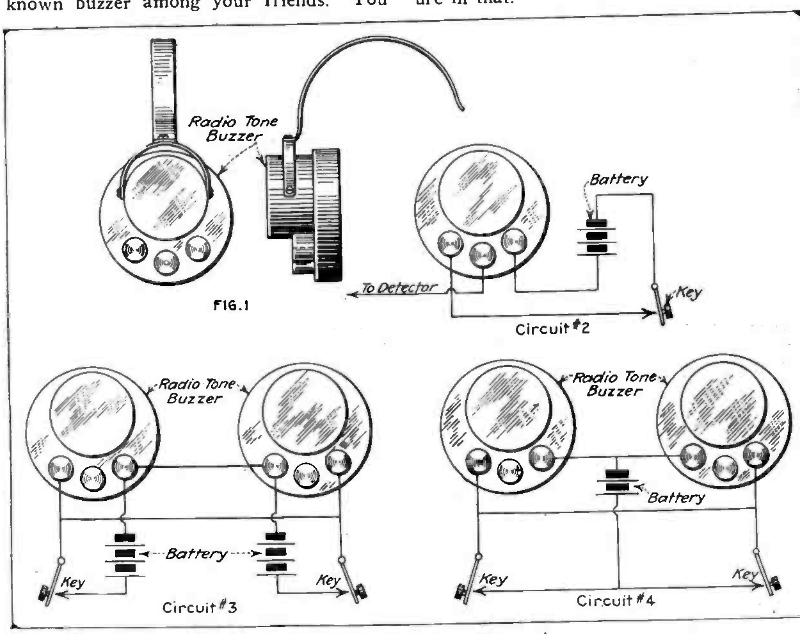
City ....

It being the policy of this publication not to publish the names of manufacturers of apparatus and devices described in these pages, our "Technical Service Bureau" will be glad to forward the required names upon receipt of a stamped envelop or stamped postal card.



Radio Tone Buzzer with Headband Attached

Brother Amateurs! Don't be impatient because of restrictions on transmitters. Here are a few new ways to use this well-known buzzer among your friends. You will have that pleasing high frequency note coming in and so will your friends, and there sure is some satisfaction and pleasure in that.



A Combined Receiver and Buzzer Practice Set. A Very Clever Stunt But We are a Little Skeptical As to the Safety of Mr. Hanhouser's Life, As the Manufacturers of Receivers Will Certainly Be On His Trail Shortly.

Soft rubber caps, such as used on phones, may be attached to these buzzers, this means more comfort when using the buzzer as you would a watch-case phone.

First, obtain a single leather-covered headband (see fig. 1). Then spot the buzzer with a small drill so that the headband will grip it the same as a phone.

Next get a three-conductor flexible phone cord and connect up to the three posts on the buzzer.

Make a three-post connection block and bring the other ends of the cord to it. The color scheme on the three-conductor will keep things straight.

Circuit No. 2. This is a combined buzzer test for detector adjustment, can be used to excite a wavemeter, *but best of all a good code practice outfit without the use of a phone*. A very simple circuit.

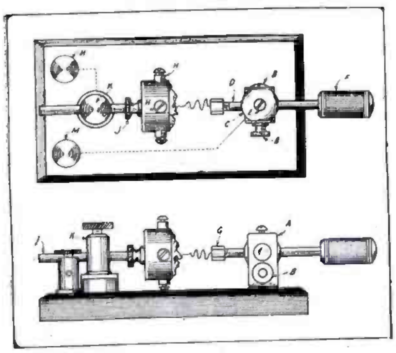
Circuit No. 3. A two-station telegraph circuit with a two-cell battery, key and buzzer at each end. Either key operates both buzzers.

Circuit No. 4. A two-station telegraph circuit with buzzer and key at each end, but with a central battery which will operate both buzzers when either key is worked.

If your line resistance is so great as to prevent the buzzers from working, take out the buzzers and put in relays, then add sufficient battery to make both relays work. Connect relay armature and contact screw so that it will make and break a local battery operating the buzzer. This must be done at the other end of the line too. Use only one or two dry cells on local buzzer circuit and no more.—Contributed by J. C. HANHOUSER.

A Universal Detector

The following is a description of a detector having a large range of usefulness. All the metal parts are made of brass which is preferably nickel-plated. The base may be made of hard wood stained and varnished, but for best results the base should be of hard rubber or bakelite.



A Couple of Binding Posts, a Rod. Handle, Cup, and Base-Zingo-detector.

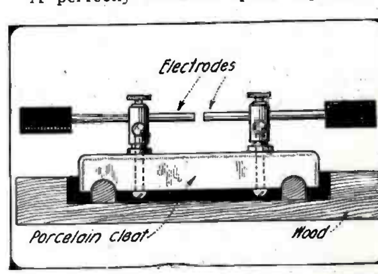
The standard (a) is made of springy brass-strip, which is first marked, drilled, and then bent into shape. The binding post and screw (b) serve to regulate the tension of the spring (a) upon the brass ball (c).

The brass ball (c) is first drilled thru the center to admit the brass rod (d). Another hole is then drilled at right angles to this hole and is threaded for the set screw (e). Both ends of the rod (d) are threaded, one end for the knob (f) and the other end for the nut (g) on which end the cat-whisker is soldered.

The crystal holder is made from the cap taken off an old cartridge fuse. It has three bushings (h) soldered around its periphery which hold the screws necessary to secure the crystal with. This crystal holder is secured to the rod (i) by means of two battery binding post nuts (j), one in the inside of the cup and the other on the outside. The rod (i) is held in the binding post (k) which is raised sufficiently by a thick washer (l). Wires are connected to the brass spring (a) and the binding post stand (k and l) and then brought to two suitable binding posts (m). When correctly made this detector will prove highly satisfactory.—Contributed by A. J. HANALE.

AN EXCELLENT AND CHEAP SPARK GAP.

A perfectly insulated spark gap with a commercial appearance can be easily constructed by the average experimenter. The



Here You are, Fellows! A Very Efficient Spark Gap Made from Parts to Be Found At Every Experimenter's "Joint."

following data covers its construction: First obtain an oblong piece of wood for the base of the instrument, a cleat (the long type) and two of the largest binding posts you can purchase, the two-connector type. The binding posts are made fast, as shown (to the cleat), which is in turn made to rest on two small pieces of wood 1, 1a; near the bottom of the countersunk hole—which should be twice as wide as the cleat and about as deep to permit the insulating compound 2, to separate the heads of the screws holding the binding posts from the wood base and thereby furnish a good means of insulation.

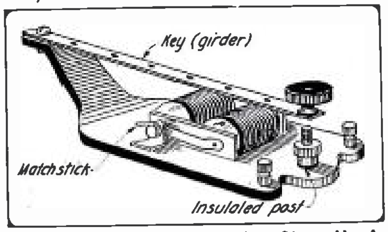
The rods may be made of copper wire of suitable diameter, but zinc is to be preferred; and the hard rubber handles can be found amongst almost any experimenter's collection of spare parts.—Contributed by I. D. LUICHAN.

COMBINATION CODE PRACTICE INSTRUMENT.

Remove the gong and hammer from an ordinary bell. Mount an ordinary battery binding-post on the frame between the two bind posts of the bell, insulating it from the frame by rubber washers. The key is a 6-inch girder from a model engineering set, fitted with a knob at one end. The other end is fastened to where the gong was, using the same hole, nut, and screw. This time be sure connection is made with the frame.

To make the buzzer hy-tone, insert a piece of match stick between the armature and the vibrator.

All that is necessary now is to connect one wire from the battery to the magnet binding-post, and the other to the insulated one, which serves as the contact for the key. Connect the phone terminals to the unused post and to the vibrator point. Pressing the knob so that it touches the contact will cause the buzzer to operate.—Contributed by ROBERT HERTZBERG.



The Two-In-One Practice Set Gives Us An Instrument Which Performs the Same Stunt Ford Pulled On the Other Manufacturers.

IDEAS.

Mr. Benson explains the practical operation of his balanced receiving circuit in the July issue of RADIO AMATEUR NEWS.

The lamps used should be the small miniature battery; lamps, 2.8 volts. The resistance coils may be any convenient size, say 5 ohms; they are merely used to form a bridge circuit. The condenser is the usual blocking condenser and serves to prevent one lamp being short-circuited by the secondary of the coupler.

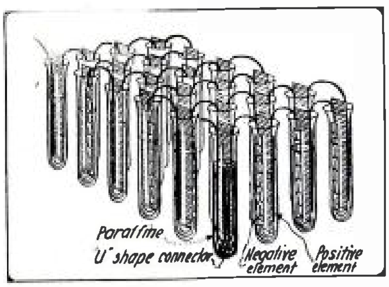
Since the amount of current is so small three dry cells being sufficient, it is hardly advisable to use 110 volt supply.

The operation of the detector is based on the principle of the Fessenden Barretter, namely, the change of resistance of a fine wire with variations in temperature. The lamp filaments should just glow when the bridge is balanced, any incoming signals will cause a current to flow in one of the lamps, increasing the temperature and naturally the resistance of that lamp. This causes an unbalancing of the bridge and a signal in the phones. It is not as sensitive as a good mineral detector but should be excellent for stand-by work over short distances being sturdy, reliable and not easily put out of adjustment.

New Radio Apparatus

NEW "B" BATTERY FOR VACUUM TUBES

With the advent of the vacuum tube in commercial and amateur "wireless" installations, there has been created a demand for an inexpensive and reliable "B" battery for use with this device.



Exposing Constructional Details of the New Audion "B" Battery.

To meet the demand, a storage battery is now being placed on the market by a New York manufacturer who, for a number of years, has made a specialty of "potential" batteries of the lead-sulphuric acid type.

The illustration shows a 40-volt battery of the new type, with cover removed and one of the cells raised from the box.

The elements are of the pasted lead type, in "couples" of hair-pin shape, the positive and negative plate of a couple being placed in contiguous cells in a battery. The separator between the plates is a thin strip of unperforated hard rubber, the electrolytic action taking place around the edges of the separator.

The containers are small glass tubes or jars held in place in the wood box in "nestings" formed by strips of hard rubber strung between the sides and ends of the box.

To facilitate the removal of any acid that may be spilled into the box as may occur when filling the cells with the electrolyte, the bottom of the box is open, as may be seen in the photo.

The cells have a capacity of 0.40 ampere-hour, or 50 milliamperes for a continuous discharge of 8 hours. At lower rates of discharge the capacity is somewhat greater, in the manner characteristic of lead storage cells.

To retard the evaporation of the electrolyte, a few drops of paraffine oil are put into the cells, and as the oil forms a froth with the gas evolved towards the end of the charge, a visible indication of the charged condition of the battery is afforded.

With reasonable care, the elements will last for several years, and, when necessary, can be replaced by the user with ease and at a small cost.

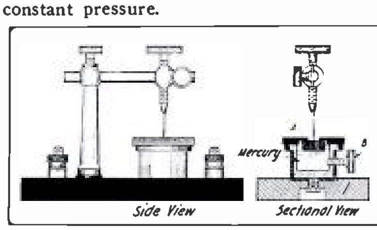
The outside dimensions of the box of the 40-volt battery shown in the illustration are: 5⅛" x 3⅞" x 6" high. The weight of the battery, complete, with electrolyte, is 5¼ lbs.

This Moderately Priced Battery Fills a Long Felt Want.

Photo, Courtesy Marcuson Storage Battery Co.

MERCURY-CUP DETECTOR

Many times when a wireless message is received the point of contact on the crystal becomes defective, and it is essential to procure a new contact immediately in order to continue with the message. The difficulty in doing this is to be able at all times to keep a perfect contact under a constant pressure.



The New Detector Whose Mineral Is Supported By Mercury Which At the Same Time Regulates the Pressure On the Mineral At the Point.

In this type of detector the crystal (A) is floating on the mercury and is firmly held against the needle point at a constant pressure, this pressure being adjustable by the displacement screw (B) on side of the cup. When a new point of contact is necessary, a slight pressure with the point of a pencil on the crystal permits it to sink into the mercury, returning instantly, when released, to a new contact with the needle point, always remaining at a constant pressure.

The numerous benefits derived from a crystal detector, which is instantly adjustable, having at the same time a perfect contact under a constant pressure, are known to one well versed in the art and need no further explanation.

RADIO ENGINEERS' MEETING.

The Institute of Radio Engineers held a meeting on Wednesday evening, June 4, at the Engineering Societies' Building, New York City. A paper was presented on "Navel Aircraft Radio," by Mr. T. Johnson, Jr., Expert Radio Aid of the Navy. The paper presented covered recent remarkable radiophone developments for Naval aircraft and was profusely illustrated by moving pictures and slides.

WHAT THEY THINK OF IT

FROM DR. DE FOREST

My dear Mr. Gernsback:—

I have just looked over with great interest the first copy of RADIO AMATEUR NEWS. *I had expected to find it in the same bright, clean-cut, and attractive form which has characterized the "Electrical Experimenter," and must say that its appearance exceeds my expectation. It is certainly in every way creditable to its editorial staff, and to the large and growing field of endeavor which it is designed to survey.*

I can only hope that succeeding numbers will be equal to the standard which this first one has set, and that it will achieve in every way the success it so well deserves.

Very sincerely yours,
LEE DE FOREST.
New York, June 9, 1919.

FROM DR. LOUIS COHEN.

LOUIS COHEN, Ph.D.
Consulting Engineer
Washington, D. C.

Dear Mr. Gernsback:—

I have examined with considerable interest the copy of R. A. N. which you were good enough to send me. It is certainly a splendid publication containing valuable information and suggestions on radio matters; I am sure it will be useful to the engineer as well as the amateur. I trust this new publication will serve to stimulate still further the interest of the amateurs in the rapidly growing radio art.

Wishing you best success,
Sincerely yours,
LOUIS COHEN.
Washington, June 14, 1919.

FROM THE DESERT.

Dear Mr. Gernsback:—

Herewith my subscription for RADIO AMATEUR NEWS. *Hurrah! Hurrah! Hurrah! Just what we need, and right in line. May you reach your most sanguine expectations regarding this new venture. I feel confident the boys will hail it with delight. Success surely awaits all its issues.*

Very sincerely,
J. B. ELLIS,
Rancho de Casa Loma.
Cochise, Arizona, May 27, 1919.

BOUND TO MAKE A HIT!

Dear Mr. H. Gernsback:—

Your first issue of RADIO AMATEUR NEWS *leaves nothing to be desired, and I feel certain that the magazine is bound to make a "hit" with wireless men. All the members of the school to which I belong have signified their intention of becoming subscribers and I am now getting up a list which I shall forward you in due course. Everyone seems very much impressed with the general "get up" of the journal, and all are looking forward to the next issue, with eagerness, impatience and anxiety.*

Wishing the RADIO AMATEUR NEWS *every success, I am Dear Sir*

Yours Faithfully,
GEORGE A. TELLES.
New York City, July 12, 1919

FROM AN OLD-TIMER.

Say, Gernsback:—

Go to it, old top. Plenty room at top. Can I help a little? Here's a 100-to-1 shot R. A. NEWS *will fit in fine. Wish you success. Give us some dope real quick about amateur wireless telephones.*

Yours,
OLD 9 X. E.
(W. H. KIRWAN.)
Davenport, Ia., July 1, 1919.

FROM THE U. S. RADIO INSPECTOR.

DEPARTMENT OF COMMERCE
RADIO SERVICE

Mr. H. Gernsback,

Sir:—

I have your letter of June 7th, also copy of the first issue of RADIO AMATEUR NEWS *for which accept my sincere thanks.*

We have many men inquiring in this office as to which is the best strictly radio publication and I believe the RADIO AMATEUR NEWS *fills a long felt want.*

Many frequently wish for the days of MODERN ELECTRICS, *as that magazine seemed to appeal to the boys due to the numerous hook-ups, etc.*

I passed the copy of RADIO AMATEUR NEWS *around the East Side Y. M. C. A. on Monday evening for the radio students to examine, and on Wednesday night noted quite a few copies about.*

The .... and .... magazines do not appeal to the average man who is interested in radio like the new publication, due to the fact that it is not a publication for amateurs only and it contains suggestions that are well worth being considered by all men in the radio game.

Many are interested in large stations such as Arlington, Cape Cod, Eiffel Tower, etc., also various types of commercial sets such as Marconi Panel, Poulsen, Telefunken, Kilbourne & Clark, E. J. Simon, etc., and articles along these lines would make the magazine a tremendous success.

Wishing you success with your new magazine, I am,

Respectfully,
CHARLES D. GUTHRIE.
U. S. Radio Inspector.
New York, N. Y., June 12, 1919.

HE WANTS IT WEEKLY.

Dear Mr. Gernsback:—

The announcement of your new magazine, the RADIO AMATEUR NEWS, *received to-day, and I wish to heartily congratulate you upon its publication. That may not mean so much to you, but I am sure that everyone who received that announcement felt the same way about it, if he is at all interested in wireless, altho they may not all take the trouble to tell you about it.*

Have read the "Modern Electrics" since it was a thin yellow-covered paper and have now every copy of the "Electrical Experimenter," and I am looking forward to having a complete file of the new publication. (Find subscription blank and check enclosed.)

The main trouble with most technical papers is that they try to cover too much ground and contain too much that is far beyond the lay reader. The new magazine will, I am sure, remedy this and make as near a perfect magazine as it is possible to print. Am only sorry to hear that the RADIO AMATEUR NEWS *is to be monthly instead of weekly, for I know that it will be just as interesting as the "E. E.," and that did not come half often enough.*

Hope you will run the Construction, How-to-Make-It and similar departments as usual.

Wishing you and "R. A. N." all success,

Yours truly,
JAMES W. LOWRY.
Uniondale, Pa., May 27, 1919.

FROM DR. J. HARRIS ROGERS.

Dear Mr. Gernsbuck:—

I have just read the first issue of RADIO AMATEUR NEWS *and hasten to express the sincere gratification I feel. From cover to cover it is pregnant with news that will interest not only every amateur but every scientist as well—it more than gratifies my every anticipation.*

Again congratulating you as well as the scientific world upon your latest achievement and wishing you success and prosperity in your splendid work, particularly for amateurs in the radio art. With cordial good wishes, I remain,

Very truly yours,
J. HARRIS ROGERS.
Hyattsville, Md., June 12, 1919.

FROM SAMUEL COHEN

My dear Mr. Gernsback:—

I am in receipt of the first copy of your newly created RADIO AMATEUR NEWS *and I take this opportunity of congratulating you on the wonderful effort you have made in bringing out a much needed radio magazine for the amateur.*

Every page of the first copy of the new magazine was of great interest to me and I certainly believe that the same attention has been given it by others who have had the opportunity of looking over this magazine.

I trust that the coming issues will contain material just as interesting as the first, and can assure you that the magazine will take a great leap in the radio field.

Wishing you the greatest success in making the RADIO AMATEUR NEWS *the leading radio magazine, I am,*

Very sincerely yours,
SAMUEL COHEN,
Chief Engineer.
New York, June 16, 1919.

"THE MOST COMPLETE MAGAZINE"

My dear Mr. H. Gernsback,

Dear Sir:—

The writer considers it a privilege to express to you his appreciation of your new publication. It is without doubt the most complete magazine that has ever been devoted to any single subject. To read it would fire even a foe of the Wireless Amateur to high ideals of science and invention.

The name RADIO NEWS *seems to me to be the only appropriate title for the magazine as a very large number of the most ardent readers of its columns will be men who earn their daily bread from wireless operating or radio engineering. I am certain that a magazine bearing such a non-professional title as* RADIO AMATEUR NEWS *would look on the desk of a radio designer or engineer rather out of place.*

Please accept my best wishes for continued success.

Very truly yours,
J. STANLEY BROWN.
Menominee, Mich., July 7, 1919.

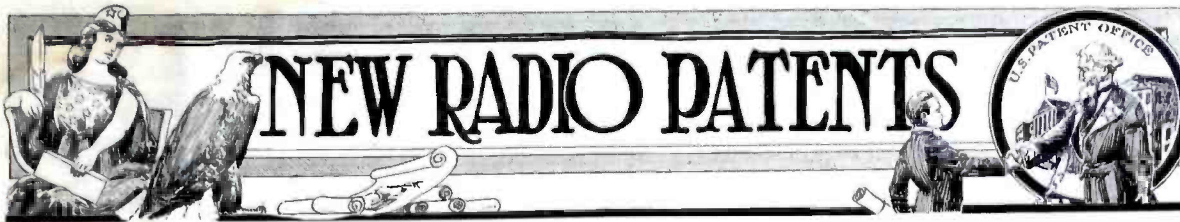
"DELIGHTED"

Dear Mr. Gernsback:—

I am certainly delighted with your new magazine and am sure that the Phenix, Radio Amateur, as it arises from the ashes of War Restriction, will grasp at R. A. N. as its elevating vehicle.

Your firm belief in the coming popularity of radiophone communication among amateurs is encouraging to me as I think along the same lines. All it needs is publicity.

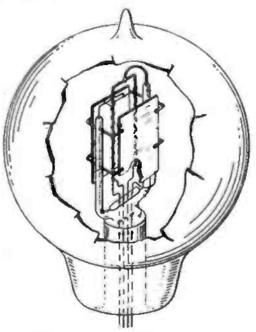
Yours very truly,
FRANCIS R. PRAY,
Somerville, Mass., July 5, 1919.



Thermionic Repeater

(No. 14,572. issued to Alexander McLean Nicholson.)

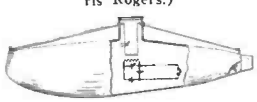
It has been found that the closer the input electrode and the cathode are brought together, the stronger the electric field and the more efficient the control of the thermionic current. This is true whether the repeater be one, say of the audion type, having a high-voltage output or one having a high-current output. The bringing of these two elements into as close relation to each other as possible without permitting them to contact electrically is brought about in accordance with the persent invention, by arranging them on opposite sides of, and perferably touching the opposing surfaces of a dielectric film. Furthermore, the interposed film is greatly beneficial in that it enables the amplifying efficiency of the audion to be increased by permitting the input electrode to be insulatively supported in exceedingly close relationship to the cathode. It has also been found that in the high-current output audion, it is desirable that the cathode present a large active area and that the input electrode present minimum obstruction between the cathode and the output electrode. These desirable features may best be obtained by entwining the two elements as by winding a filament directly about the input electrode. The input electrode preferably consists of one or more



wires having an insulating coating, and the insulating coating preferably consists of a thin film of nickelous oxid, such coating having been found in practice to be a good dielectric for the purposes of this invention.

Submerged Submarine Telegraphy

(No. 1,303,729, issued to James Harris Rogers.)



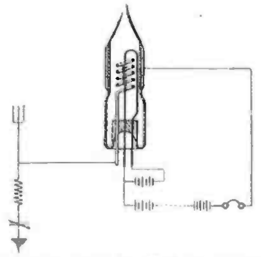
Previous to this invention it was not possible to transmit or receive wireless telegraph signals when the submarine was submerged. It is the object of this invention to provide such a means.

A thoroughly insulated cable is employed for the antenna, which is strung lengthwise from the conning tower to either end of the vessel or both.

New Electron-Valve

(No. 1,291,441, issued to Harold P. Donle.)

This new form of valve is said to increase the efficiency of sensitiveness over all ordinary valves, also this type is more durable and less complicated in structure than those brought out heretofore. It essentially consists of a glass chamber wherein an incandescent filament is



mounted within the bulb and a conductor surrounding the filament. On the outside of the bulb on the glass surface is mounted a conductor of a material that does not polarize when in contact with warm glass. It operates on the principle of what is believed to be a new effect, viz., electrolytic conduction in a hot dielectric.

DEPARTMENT OF COMMERCE
RADIO SERVICE

The Radio League of America, New York City — Office of Inspector

July 19, 1919

Sir:

Replying to your letter of inquiry of July 17th regarding amateur radio operations, amateur radio stations are not allowed to transmit. I have received no definite information as to the probable date on which these stations may reopen for transmission, and I have no way of predicting the probable date. Amateur stations are permitted to receive, but this work does not require a license either for the station or operator. In this district we have suspended the licensing of amateur operators because of the great number of commercial operators requiring examination for license, and it is impossible to examine amateur operators with the present limited force of the Radio Service in New York.

When authority is received to again permit transmission by amateur stations this information will be furnished to you and other radio publications for dissemination among the amateurs, and amateurs can communicate with this office after that date with regard to their station and operator licenses.

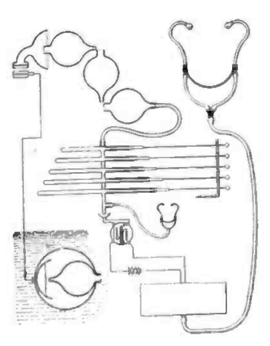
Respectfully,

(Signed) L. R. KRUMM,
Chief Radio Inspector.

Sound Interference Device

(No. 1,301,035, issued to J. A. Burgess and G. B. Hutchings.)

By means of this device it becomes possible to select any one sound from composite sounds by interference. The undesired sounds are sifted out by causing them to interfere with themselves, and the desired one made audible by suitably arranged resonators. The device comprises a group of connected tubes termed "interference tubes" of different lengths, which are also variable in respect to their individual maximum length. When suitably adjusted and a plurality of sounds are passing, eacch of the undesired sounds are caused to interfere with themselves and are thereby silenced, permitting to pass only that sound which is desired to be heard, which of course is of a different harmonic from any of those cancelled by the interfering tubes. The object of this invention is for marine work, but it has many other uses.



Radio Signalling System

(No. 1,303,730, issued to James Harris Rogers.)

This pertains to underground reception employing the Rogers' system as a collecting means.

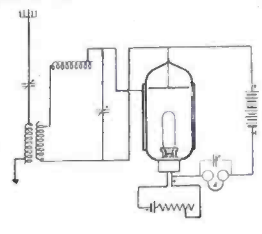
The wires are encased in iron pipe, the "sheath" of which is caused to be broken every twenty or more feet by suitably arranged insulating, connecting tubes which fit snugly over the outer surface of the iron pipe.

Greater reduction of static interference is claimed and longer wires can be employed, thereby increasing the signal strength from long wave transmitters and at the same time preventing the reappearance of the statics as is the case with unsheathed buried wires.

Wireless Signaling Apparatus

(No. 1,289,981, issued to Roy A. Weagant.)

A vacuum valve which is a slight improvement on the well known Fleming valve and does not offer any startling innovation with regard to the common form of tube of this character. It consists essentially of a glass bulb containing a filament which is heated by an external battery and a plate sealed in horizontally over the filament. On the outside of the bulb there is a capacity area of metal such as copper, electroplated on the exterior surface of the valve chamber, and its outer member is fixed in such a position that its surface area is in parallel with respect to the path of the electrons within the vacuum chamber moving from the hot element at one end toward the cold element at the other end. This type of valve was originally evolved by DeForest, also by Moorehead, the latter placing this device on the market.

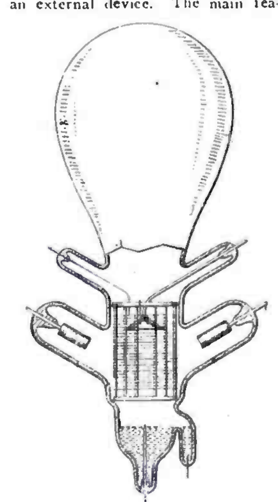


Electric Discharge Controlling Device

(No. 1,289,823, issued to Irving Langmuir.)

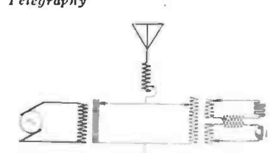
This device which consists of a lamp form is essentially used to replace many complicated circuits requiring relays, etc., for controlling large amounts of energy. For example, the small variable current of a transmitter is unable to directly control and vary a powerful oscillating circuit. It consists of a glass bulb containing a body of easily vaporizable material, such as mercury constituting the cathode. The anodes consist of graphite, tungsten or other highly refractory material.

The current is introduced in the usual manner thru sealed end wires, and above one of the cathodes is provided an anode from which an arc is constantly running to this cathode, the arc being controlled by an external device. The main fea-



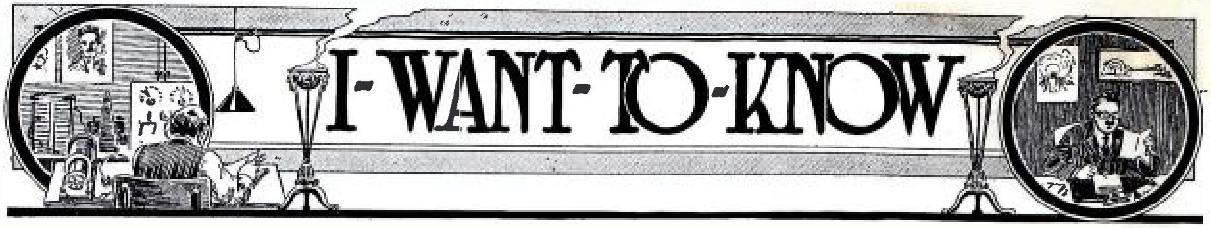
ture of the device is a method of varying and alternating currents in accordance with variations of another electric circuit which impresses the current to be varied on the ionized arc path in the gas. A means for utilizing rectified wave impulses for the transmission of signals.

Modulating System for Wireless Telegraphy



(No. 1,304,188, issued to David G. McCaa.)

As a result of this invention the microphone transmitter is called on to modulate current values materially less than has been the necessity hitherto. A microphone with suitably arranged auxiliary circuits, when spoken into, causes the radiated energy from the generating system to increase materially. An antenna current of 10 amperes has been modulated when a current of one and one-half amperes was present and modulated in the microphone circuit.



I-WANT-TO-KNOW

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editors a personal favor if you make your letter as brief as possible.

TUNING QUALITIES OF SHUNT CONDENSER.

(20) J. M. Berner, Mt. Washington, Pa., asks:

Q. 1. Why is it that at times the variable condenser which I have shunted across the primary of my loose coupler fails to furnish any tuning qualities; can it be an open circuit in my receiving primary or in the condenser?

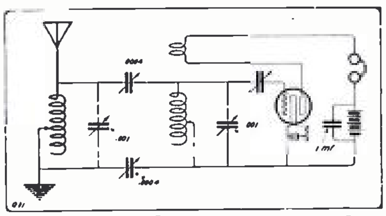
A. 1. The trouble you experienced with your shunt variable condenser to the primary has been a mystery to some of the uninitiated and from the following you will readily understand the cause. It is possible that the condenser circuit has an opening in it, but it would not be possible to receive signals were the primary at fault. There is a very curious phenomenon which presents itself in the tuning of the primary circuit when employing a variable shunt capacity. At times this condenser and the primary inductance act as two separate circuits in parallel and in which case the condenser robs energy from the primary and while the tuning qualities of the primary circuit is as critical as usual, it will be found that the condenser variations have a very small effect upon the circuit as a whole under these circumstances. It is always best to employ an inductance in the form of a loading antenna coil to increase the wavelength of the primary circuit beyond the range of the primary windings.

ROGERS UNDERGROUND FOR AMATEURS.

(21) Arthur Sarah, Omaha, Neb., inquires:

Q. 1. Is there any system which permits the amateur to make use of the underground Rogers system, that is, one which is within the limits of the average amateur's back yard?

A. 1. At the present time there is no method which permits the amateur in a cramped location to make use of the highly effective Rogers system, but in a forthcoming edition of RADIO AMATEUR NEWS, the issue of which will be announced sometime previous to its appearance we will furnish you with some exceptionally interesting data in connection with *Amateur Underground Reception*. For the present it might be mentioned that you can make use of the large coils described in the July issue of this magazine by Major Charles A. Culver.



Connections for Cohen's Receiver in Conjunction with Audion Circuits.

Q. 2. What other apparatus is necessary for me to have in order to employ the receiving circuit designed by Dr. Cohen if I have in my possession at the present time two double slide E. I. Co. (small) tuners; also please furnish connection of the circuits.

A. 2. It will be necessary for you to purchase two small variable condensers of .0004 mf. for the capacity coupling; two variable condensers measuring .001 which are shunted across the primary and secondary inductances of the receiver respectively. Your double slide tuners will be well suited for the inductances shown in the diagram. Two connections are furnished as you did not state whether you were going to employ the receiver in connection with crystal detectors or an audion circuit. In the latter it will be necessary for you to construct a small *tickler coil* and place it in inductive relation with the tuner employed as the secondary inductance. A 1 mf. condenser is shunted across the "B" batteries proper and a variable condenser shunted across the telephone receivers having a capacity of .001 mf.

VARIABLE CONDENSER CONSTRUCTION.

(22) John Pace, Chicago, Ill., wants to know:

Q. 1. Is it possible to construct a variable condenser of the rotary type without making use of metal plates. If so, please give dimensions and material necessary to construct an efficient condenser.

A. 1. It is quite feasible to construct a good variable condenser without adhering to the metal plate method. It is only necessary to get some good stiff cardboard about 1/16" thick such as employed by laundries to maintain shirts in a neat appearance until delivered to their customers, and cut from this cardboard semi-circular and square pieces just as you would from the metal. The tin foil is made fast to the cardboard cut by applying a good quality of shellac. The number of plates and sizes are left to the constructor as they may or may not be cut similar to any of the standard condensers on the market. 10c type phonograph records can be used equally well.

Q. 2. What chemicals are employed in making a fluoroscope screen for X-ray work

A. 2. Several chemical preparations are used for this purpose, particularly sulphide of zinc, tungstate of calcium, platino-barium-cyanide. The latter is the most used, giving excellent results, but is rather expensive.

HOOK-UP.

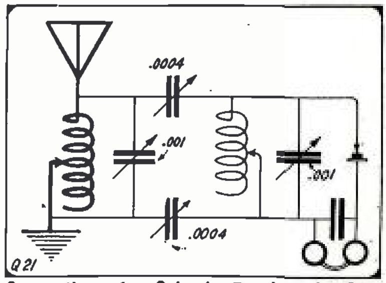
(23) Alex Martin, Austin, Texas, asks:

Q. 1. The hook-up for the following instruments: One 2,800-meter loading coil; one loose coupler, 1,500 meters; two 43-plate variable condensers, one audio-tron detector bulb, one fixed condenser, one pair of 2,000-ohm phones, one galena detector, and all necessary switches for changing from one detector to another.

A. 1. Complete connections of such an arrangement are given in the diagram shown. One D.P.D.T. switch is employed.

Q. 2. Would it be more advisable to have a smaller variable condenser in place of one of the 43-plate condensers? Please advise me as to the right size condenser.

A. 2. This depends upon what purpose you intend to use the condenser for; if it is to be employed as a shunt to either the primary or secondary inductance, the condenser mentioned will be well suited for that purpose. However, if you desire to place the condenser in the grid circuit of an audion it will be necessary to have a condenser of much smaller capacity. Of course the one in question will do, but it will be a waste of material and money, as



Connections for Cohen's Receiver in Conjunction with Crystals.

it will be found that only a small portion of the condenser will be employed at any one time, whereas for the first-mentioned purposes the condenser will serve the purpose admirably well.

Q. 3. Also whether the two condensers in each circuit would be of more benefit?

A. 3. It is not necessary to use two condensers. You will notice in the drawing that one condenser will suffice in respect to secondary shunting condenser.

WAVELENGTHS.

(24) H. R. Baglou, Los Angeles, Cal., desires to know:

Q. 1. The wavelength of the largest undamped wireless station in the world and its location.

A. 1. There are at the present time so many new stations working on long wavelengths which sprung up during the war that it cannot be stated authoritatively which station employs the longest wavelength, but for your information a few of the long-wave transmitters are mentioned: Annapolis, Md., 17,000 meters, probably one of the longest; Belmar, New Brunswick, 13,000 meters.

ANTENNA MEASUREMENTS.

(25) Albert Toth, New York, asks several questions about antennæ:

A. 1. After a careful study of the arrangements submitted it can be stated that for such small antennæ as employed it matters not in what manner the wires are connected. Of course, as the antennæ increases in size an antenna connected as shown in your first drawing would form a large loop which would give very favorable results under varying conditions. For transmitting on short wavelengths this is a very good arrangement, but for reception better results will be experienced by making use of the arrangement shown in figure 3 of your letter.

Q. 2. What is the natural wavelength of an antenna composed of two strands 90 feet long spaced 5 feet apart and a lead-in running to a third story about 50 feet long? The antenna is six stories high.

A. 2. Without knowing the exact height of each story of the building mentioned it is a difficult matter to find the height of your antenna; however, if the antenna is as we calculate (approximately 70' high), then the natural period of such an arrangement is 150 meters.

Q. 3. Please furnish me with the name of a good book treating on antenna construction.

A. 3. For the nominal sum of twenty-five cents you can purchase from The Experimenter Publishing Company, 233 Fulton Street, New York, publishers of this magazine, a book entitled "How to Make Wireless Receiving Apparatus," which contains a lengthy article on antenna construction.

SUBTERRANEAN RECEPTION.

(26) Morgan Davis, Philadelphia, Pa., asks several questions in regard to the Rogers underground antenna system of receiving:

Q. 1. What is the proper length of wire to use for short wave reception?

A. 1. The proper length of wire depends entirely upon the capacity to earth per unit length; therefore it can be readily understood that the smaller the thickness of insulation the shorter the length of wire required for a certain wavelength. The optimum length depends on the foregoing: for instance, it was found that No. 12 rubber-covered wire gave double the capacity to earth value as was had with Packard cable; therefore it was necessary to employ just twice the amount of the latter. For 600 meters 125 feet were found to be the optimum length, and the Packard cable required 250 feet.

Q. 2. Does it matter whether the wires are grounded slightly?

A. 2. Very strong signals have been received with bare wires laid in the soil, but naturally the static ratio is higher in respect to the signal strength as compared to insulated wires. When the optimum length of an underground wire is found, a slight ground will greatly effect the system as a whole, but if the wire has not been measured for optimum length no serious disturbance will be experienced.

RADIO ENGINEER.

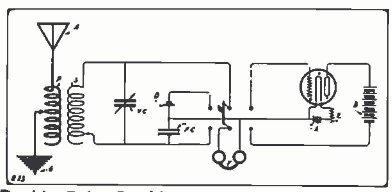
(27) H. T. Patterson, Mobile, Ala., desires to know the training necessary to become a radio engineer.

A. 1. To become a first-class radio engineer, worthy of the name, it is necessary to have a complete knowledge of mathematics and more or less information on general electrical subjects. The best thing to do is to take a course in electrical engineering at some college or university, and after graduating from same to take post-graduate work of about two years in some school that teaches radio telegraphy.

LICENSE.

(28) R. H. Chambers, Galveston, Texas, requires information on the necessity of obtaining a license for wireless apparatus.

A. In answering this we can do no more than quote the law on this point, which states that no person, company or corporation shall use apparatus "for the transmission of radiograms or signals, the effect of which extends beyond the jurisdiction of the State or Territory in which the same are made, or where interference would be caused thereby, with the receipt of messages or signals from beyond the jurisdiction of the said State or Territory, except under and in accordance with a license, revocable for cause, in that behalf granted by the Secretary of Commerce and Labor upon application therefor. No license is required for receiving wireless messages.



Double Pole, Double Throw Switch Permits Mineral Or Audion Circuits to Be Employed.

TRANSFORMER INFORMATION AND CONDENSERS.

(29) P. Viosca, San Francisco, Cal., desires to know: 1. Which type of transformer is used most in wireless work? 2. A formula for calculating the capacity of condenser for any transformer with a given secondary voltage, etc.?

A. 1. Closed core transformers are used almost exclusively at the present time, because they have the highest efficiency and the arching at the gap is prevented by rotary or quenched gaps. Open core transformers were used extensively at one time, but they were required, due to the fact that the science had not progrssed to the point of using the rotary gap, and as open core transformers have a very sharp peak in their secondary wave form, they gave better results with the straight gap formerly in vogue.

A. 2. We give you herewith formula for calculating the necessary condenser capacity for any transformer with a given secondary voltage, etc.:

$$C = \frac{K.W. \times 10^9}{f \times \text{Sec. Volts}}.$$

In this formula, sec. volts is the secondary voltage of transformer; f is the frequency of the primary current of same; C is the capacity in the micro-farads, and K.W. is the kilowatt rating of the transformer.

POULSEN TIKKER AND AERIAL CONSTRUCTION.

(30) J. F. Wells, St. Louis, Mo., asks for information on: 1. The Goldschmidt tone wheel and Poulsen tikker. 2. Which is the best way to connect an aerial, to leave the free ends of the strands open or to connect them together?

A. 1. You probably would do best to experiment with a "tikker" of the Poulsen type as described in the April (1915) issue of *The Electrical Experimenter* on page 228 thereof. When the Goldschmidt tone wheel is employed, no other detector is utilized, as you mention.

A. 2. It has come in practice to consider a wire grid aerial of the "L" or "T" type as simply a large capacity condenser and hence will be seen the idea involved in cross connecting the free ends of such aerials. In other words, they simply act as a large metallic spread which comprise a few wires spaced several feet apart, and it has been found that this gives practically the same effect as if the aerial were made of a broad metal sheet.

TRANSFORMER DESIGN.

(31) Lewis Hammer, Boston, Mass., asks several questions regarding transformer construction for wireless purposes, particularly the action of the magnetic leakage type.

A. 1. A transformer will work quite efficiently indeed in this manner, provided a variation in the output is controlled by adjusting the amount of primary inductance used.

The one-quarter kilowatt wireless transformer to be used under the requirements of the radio law, now in effect and specifying 200 meters wavelength, should yield 12,000 to 20,000 volts preferably. This is necessary, owing to the very small condenser capacity, which is allowable in the oscillatory circuit, when 200 meters wavelength is to be adhered to, and also in due consideration of the inductance which must be used in the circuit.

You may have as many taps in the primary winding of your transformer as desired; but, of course, it is not well to take taps from such a small number of turns that it will cause fuses to be blown, when the transformer is hooked up across the circuit.

RADIO PHENOMENA.

(32) P. F. Thomasson, Tampa, Fla., desires to know: 1. Why it is that the color of his spark gap changes from blue-white to a yellowish hue when the aerial is disconnected from same? 2. An explanation of why a 220-volt, 75-k.w. alternator has the effect of attracting a 25-watt lamp suspended three feet above it. The latter being equipped with a tin shade.

A. 1. When the aerial is connected to your spark gap it acts as a capacity and increases the intensity of the discharge, but when the aerial is disconnected this capacity is removed and the current merely arcs in the gap.

A. 2. The large generator, having a powerful magnetic field, will no doubt attract the lamp, due to the tin shade on same, but as the current also sets up a magnetic field around the lamp when it flows through the filament this may also be a factor in the attraction of the lamp. Magnetism might be set up in the tin shade, also, by induction currents flowing around it.

SPARK COILS AS OPEN CORE TRANSFORMERS

(33) M. B. Sawell, Detroit, Mich., writes us, asking several questions: 1. Why it is that he can obtain a spark from the secondary of his inductive coil when same is connected direct to the 110-volt, alternating current mains and vibrator is screwed up tight? 2. Why it is that a small condenser connected across the 'phones has the effect of cutting out the signals? 3. What effect the wide spacing of his aerial wires will have on receiving range, and if the addition of more wires will increase the range?

A. 1. When a spark coil is connected direct to the 110-volt, alternating current mains and the vibrator is screwed up tight the coil will operate as an open core transformer; but it will be very inefficient, due to the fact that it is not properly designed for such work.

A. 2. The condenser connected across the 'phones should be in series with a switch, which will enable you to cut out the instrument under certain conditions.

A. 3. It will be of no advantage to add three or more wires to your aerial, for it should give very good results as it is, and the addition of more wire will not merely lower the inductance, but will increase the capacity also and the gain thereby will be very little.

LIGHTING SWITCH

(34.) Edward McLaughlin, New York City, desires information:

Q. 1. On the outside of my window I have a 100 ampere lighting switch. When the apparatus is not in use this switch connects the aerial to the ground; well, for the ground connection from the switch I have learned that a No. 4 B. & S. gauge is necessary. but instead of having No. 4 I have a 25-foot length of No. 16 fixture wire running on the inside of the house to a water-pipe. I want to know if it is against the fire regulations to have such a small wire as No. 16, or must I replace it with a No. 4?

A. 1. You should employ the larger size wire for grounding your antenna. If you do not care to purchase at No. 4 solid copper wire, the equivalent will be the result of making a stranded cable employing 16 No. 16 wires, a total area in circular mills of 41,328, that of No. 4 being 41,740 c. m.

NO ANTENNA NEEDED

(35) T. J. M. Daly, Little Rock, Ark., submits what he thinks a new receiving system and asks our opinion.

Q. 1. I have found that it is not necessary to make use of an antenna employing the circuits shown in my letter. Very sharp tuning results from its adoption. Another peculiar feature of this circuit is that very sharp tuning is not had on the primary windings, reducing or increasing 20 or 30 turns does not show any material change. But very sharp tuning is had on the secondary circuits. What do you think of such a system, and how do you account for it working like it does?

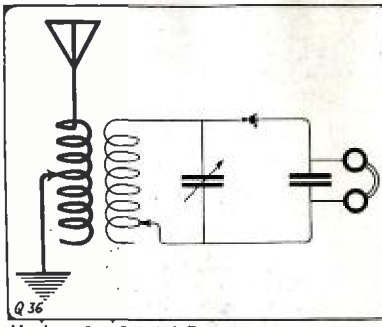
A. 1. Before going into details, if you will refer to the front pages of this issue you will thoroughly understand the function of such a circuit as described "Is the Antenna Doomed?" And the effects you noted were evident thruout the tests which the writer of that article described similar to yours.

It is not necessary to employ an antenna with the present-day audion circuits. Naturally, the tuning of the primary is not sharp, owing to the fact that up to a certain length of an ordinary antenna (of which the coil is replacing) there would hardly be any effect noticeable. Again, the sharpness of tuning experienced with the secondary was due to the fact that it was directly in the receiving circuit, and any minute change therein changed the constants of the whole circuit, which ordinarily require other adjustments to be made in order to bring the circuit to resonance. You will recall from the article mentioned of in this issue that only the secondary coil was employed, and the extremely small dimensions of the coil could not have had anything to do with the collection of the passing waves.

Q. 2. Does the circuit shown infringe on any patents already granted?

A. 2. Yes, it matters not whether you employ a "tickler coil," as it is termed, in inductive relation with the primary or secondary, it accomplishes the same results in respect to regeneration.

A. 3. The method of constructing the tuner while new has practically no advantages over the present types.



Hookup for Crystal Detector, Loose-Coupler Condensers and Phones.

BED SPRING AERIAL

(36.) Emanuel Nyman, New York City, asks:

Q. 1. In using a bed spring for an aerial does the bed have to be insulated from the floor? If so, how?

A. 1. The bed must be insulated from the floor for most efficient results, and most iron or brass beds are really insulated by the "rollers or wheels." However, if this is not the case you can easily make use of a piece of insulating material under each foot, such as rubber, fiber, etc., or even a magazine.

Q. 2. What would be a good hookup for the following instruments: Electro-loose coupler, galena detector, fixed variable condenser 2,000-ohm phones?

A. 2. Connections are furnished in the drawing.

A. 3. With the antenna described and the above instruments your radius would be about 1,000 miles under favorable conditions.

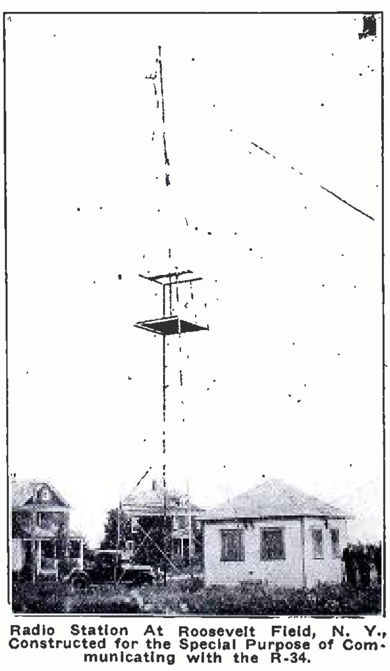
The R-34 Radio Equipment

(*Continued from page* 54)

stable aircraft radio communication.

The receiving set consists of a late design regenerative type and in conjunction with a two-step amplifier. Clifden was received for the entire voyage, this being the station designated to broadcast messages, weather, and other valuable data to the R-34.

In order to provide radio-telephone communication with the R-34 at Roosevelt Field, the station shown in the photo was specially erected by the Navy under Lieut. Horn USNRF. The tower measured approximately sixty feet in height and supported for an antenna two wires two hundred feet in length stretched in a northwest and southwesterly direction. A 250 watt Marconi Seaplane telephone transmitter and receiver was installed and the operators of the R-34 reported picking up this transmitter four hundred miles distant, which also demonstrates the selectivity and sensitiveness of the big ship's receiving apparatus. Lieut. Durrant explained that while exceptionally long ranges were covered, but one other phenomena of interest was experienced. He states that while experiencing very heavy static at a height of 8,000 feet (surrounded by clouds) and that as the ship was ascending to 9,000 feet between the two layers of clouds, which was very clear, no static was perceptable. Upon reaching the 9,000-foot height the static reappeared in its same strength as was had at the 8,000-foot position. (Here too the ship was surrounded by heavy clouds.) This is a very peculiar phenomena and may have been due to the neutralization of the static between the two clouds which was therefore not perceptable in the receivers of the R-34's radio set. He also explained that while he is considerably interested in the direction finder problem—that at present the vessel had not been installed with this type of apparatus; but in the near future on one of its preceeding voyages he expects to be in a position to inform the master of the vessel his exact location every half hour; based on prearranged transmitted signals from Clifden and another station situated in this country. He is very much in favor of Amateur Operation and claims it would burst any amateur's heart with joy if he could take one trip on the R-34 as radio operator and we fairly agree with him.


Radio Station At Roosevelt Field, N. Y., Constructed for the Special Purpose of Communicating with the R-34.

CORRECTION NOTICE

Referring to article, "A New High-Note Shunt Radio Buzzer," in the July issue of Radio Amateur News, we desire to state that Mr. E. Schwartz is the patentee of the New High-Note Buzzer.

MONEY FOR YOUR ARTICLES

We want good, live radio articles. For these the highest prices will be paid by us. Articles with snappy illustrations are particularly desirable. **One cent a word for all accepted articles.**

Is the Antenna Doomed

(*Continued from page* 66)

side of the usual audion circuit, and signals were received with good audibilities from ships reporting their distance some two hundred miles from New Orleans. No long wave tests were conducted but it can be said that better results were expected from such transmitters.

It is clearly shown that the ground was employed for the conducting medium and the size of the coil was such that its effect in respect to its action as a collecting means is quite evident.

This clearly points out that all we need is some form of capacity to offset local conditions, and balance the receiving circuit of the present design. This is accomplished in the underground circuit, where the coils are in close proximity to the earth and finally the tree wireless, where the tree is really connected to the earth, and as pointed out, with the introduction of some resistance.

In connection with tree wireless, could it not be possible that the coils employed for loading the antenna, which must necessarily be large, in comparison to those employed on a large overhead antenna, could form a close circuit similar to the one shown in Figure 4, which is quite similar to the one employed by the writer, *and that the earth instead of the tree formed the conducting medium.*

The concentrated coil antenna in close proximity to the earth is much the same as a coil in its same position in series with a small condenser of fixed value, in respect to the intervening medium, and therefore bears the same relation to reception as the overhead antenna does *which, we will finally come to understand, is of no value whatsoever.*

The underground antennae action is generally accepted as forming a closed loop thru its capacity ends and is therefore similar to the closed inductance antenna, the only difference existing in the signal-static ratio of which the former has the advantage over the latter due to the shielding properties of the earth.

These are probably other instances of what so often takes place in our everyday life. We are prone to find only what we hope to find, and, indeed, often deceive ourselves in believing that we have at last found that which we earnestly hoped to discover. Take as an instance the discovery of what finally led to the Voltaic cell when Galvani who was making a careful investigation of the effect of atmospheric electricity on animal organisms and for which purpose he was employing the hind legs of some recently killed frogs. Immediately Galvani hailed the conclusive movement of the frog's legs as a proof that he had at last unearthed the elusive fluid "vital force" for which he in common with other anatomists and scientific men generally, had been so long searching. Volta next advanced the theory that the electricity present was due to the contact of dissimilar metals, where as a matter of fact if currents were produced by contact they would be immediately neutralized and no current would flow. The Chemical action theory next advanced by Fabroni proved correct and is accepted to the present day. This is true to-day where we are treating purely local conditions, such as the reception of signals by employing the trees for a supposedly collecting means whereas, inside the receiving station a coil not much smaller than those which have proven successful for transatlantic reception was installed. As pointed out, could not the tree have acted as a means of closing the loop circuit? If this be the case, better results would be had by eliminating the tree and substituting a better grade of conductor to complete the circuit such as copper wire.

Developments in Wireless Telephony

(Continued from page 71)

ment got over to France in time to be of much use on the latter.

From November or December, 1917, when it was finally decided that the wireless telephone was good military material, the production of vacuum tubes, which had previously been purely a laboratory product, rose from two or three hundred a week up to 30,000 a week at the time of the signing of the armistice.

The human voice makes use of a certain range of frequencies, which has been found by experiment to be from 200 per second to 2,500 per second. Actually, there are some overtones which run up above that, but for practical purposes this is the range the telephone is designed for. The radio frequencies are up in the hundreds of thousands or the millions. For the short-range type of apparatus, the frequencies are measured by the millions. The problem then was in some way or other to impress on the high frequency carriers the voice frequencies and when they got to the distant end to catch them on antennae, sift out the high from the low and bring the latter to a reasonable amount so that they could be heard. The whole thing is done by the vacuum tube.

One other problem in connection with the use of the radio telephone on the aeroplane was the question of the source of supply of the electrical energy for the radio apparatus. There were three methods of getting the power. One was to hook up a dynamo to the main power plant of the aeroplane; another was to carry along a storage battery, as large as possible, and with a life as long as might be needed; and the third was to use a little wind-driven generator, fastened to the aeroplane and furnished with a propeller. The first plan was abandoned because the aviator did not care to have any attachments to his engine and, furthermore, the engine would not always run at the same speed and might be cut off altogether just at the moment when it was necessary to telephone. The storage battery was not favorably looked upon because of its weight and relatively short life, and also on account of the shortage of shipping for conveying them to the points where they might be needed. So they were forced to the wind-driven generator. The requirements put up were these—that the telephone should transmit satisfactorily and at maximum range whether the machine was climbing at the steepest angle, or nose-diving with engine on. It was actually found that the wind-driven generator had to operate with a speed varying from 400 to 14,000 revolutions of the propeller per minute. The solution of this problem again was a vacuum tube. The generator armature had two windings, one to give about 30 volts for the filaments of the radio set and the other to give about 300 volts for the plate circuits. There were two shunt field windings—the main one was in series with the filament of the regulating vacuum tube and the field current was sufficient to heat the filament and cause it to give off electrons, the other was differentially wound with respect to the first and was in series with plate and filament. If the machine increased speed, more current tended to flow thru the field and heated the filament up. The hotter it got, the more electrons were given off, providing more current for the differential circuit. Finally they got a machine that would keep the voltage constant within about 10 per cent. over this range of speed variation.

Construction of 15,000 cycle Radio Frequency Alternator

(*Continued from page 73*)

can be of the standard telephone type and it will be found that it serves the purpose very well. In order to obtain the most efficient results from the apparatus, it is at first necessary to carefully synchronize or tune the antenna system to the wave length which the dynamo will work best on at the required frequency. The antenna system must have a wave length of 20,000 meters in order to work properly with the alternator at a frequency of 15,000 cycles per second. The wave length can be diminished or increased with a decrease of the frequency. The periodicity of the machine can be determined from the first formula, while the wave length should be determined by a wave meter or dividing the frequency into 300,000,000, which is the velocity of light in meters per second.

It is hoped that the above description of a high frequency alternator will serve as a stepping-stone to the radio experimenter who has been looking in vain for a successful radio telephone.

*(Mr. Vanderbilt opens the way to a probable successful radio telephone transmitter for amateur operation. With the advent of recent improvements in audion control and modulating circuits it should be possible to control the field excitation current in such an alternator so that radio telephone work over considerable distances could be effected. A connection proposed by Carson is shown in Fig. 7.—*EDITOR.*)*

High Spark Frequency in the Amateur Field

(*Continued from page 73*)

crease in speed can be obtained. The comparatively heavy disc requires considerable power to keep it in revolution at a speed of 2,400 r. p. m., due to inertia forces, resistance of the air, etc., and even if the power is no object, there is the difficulty of unbalance and the danger of rupture of the disc or the flying off of the studs due to centrifugal force. These difficulties can be overcome by making the studs stationary and mounting a discharger arm carrying two points on the motor shaft, as shown in Fig. 1. There are many ways in which this design can be worked out and the average experimenter has his own ideas as to detail. In addition to permitting higher speed, this type of gap possesses the advantages of quick starting and stopping, and lower air resistance.

If the motor is of the shunt wound D. C. type, still greater speed can be obtained by connecting a rheostat in series with the field coils; increasing the resistance will increase the speed. In the case of an A. C. motor this is not as easily accomplished, but the speed can be increased by raising the voltage of the supplied current thru a small step-up transformer or auto-transformer of small ratio. Very often such a transformer can be built at small cost from the usual stock of the average amateur's odds and ends.

By all means the amateur should endeavor to bring his set up to a maximum of efficiency and the high tone spark will go a long way toward accomplishing this end.

Salt water and polished brass do not agree. In comes a big water splash from a beam of a tramp and inundates the entire cabin. This happens at two A. M. and your Radio man is soundly asleep. He gets out of the bunk and makes use of several towels upon his own self, but forgets the "junk." The chink calls him for breakfast at eight and upon arising he finds all brass parts colored a lovely sea green. Brass polish.

Ingenious Stunts Used By Manufacturers

(*Continued from page 74*)

grooves and held in place by a set screw at the center of the disc. The conical-shaped part of the shaft holds the tickler at the proper distance from the panel. The handle and pointer, to indicate the position of the coil, are put on as in Fig. 4.

Figs. 7 and 8 show two methods of mounting inductances. The first is adaptable to primary coils, loading coils, or stationary secondaries, at the end of which a tickler can be placed. The supports are made of brass strips, bent at right angles at the bottom, and curved to the shape of the tube at the top. This provides a secure and strong mounting. The second method is for coils placed at right angles to the panel. Here a part of the tube is cut away to form four legs. A right angle piece at each leg holds the coil in place. The purpose of the legs is to make it possible to bring taps or other wires into the center of the coil.

Condensers are often the cause of trouble, since they are ordinarily built of plates spaced by washers, which, under vibration, work loose. The condenser shown at Fig. 9, however, has no washers nor is it cast. Two brass or aluminum strips, milled with slots, hold the fixed plates. To prevent their coming out, the two screws which hold the Bakelite and the fixed plates are put clear thru the seperator strips and holes in the plates. The movable plates are also inserted in slots out half way thru the round brass rod, and held by a pin passing the length of the rod. Since the strips and bearings can be milled at the same time, there is no difficulty in aligning the plates, as is the case with washers. Another feature of this condenser is the bearing supports. Approved construction required the use of a solid plate of insulating material for the bearings, instead of insulating bushing set into metal plates. In this condenser the Bakelite plates, which hold the parts together, act also as bearings. It has been found quite satisfactory in cases of this kind to use Bakelite as a bearing surface. The holes for the stationary plate supports and the movable rod can be drilled in both plates at the same time. This eliminates any possibility of having the movable plates at an agle to the stationary ones. Connection is made to the variable plates by a flexible wire soldered to the shaft, and to the fixed plates with a wire soldered to a separator strip.

These examples of constructional features, altho limited in number, at least serve as a guide to the better and more substantial construction of apparatus for experimental as well as commercial use.

U. S. TO DROP RADIO STATION

Orders have been received by Ensign W. C. Finch, in command of the naval radio station, to withdraw all the naval forces on August 1 and to return the New Brunswick, N. J., station back to the Marconi Wireless Company from whom it was taken over in the summer of 1917.

The station will be closed for six weeks or more, as all the naval equipment is to be removed, according to the instructions from Washington, and the Marconi people will have to install new apparatus before they will be able to take up commercial work.

Tree Radio Telephony and Telegraphy

(*Continued from page 55*)

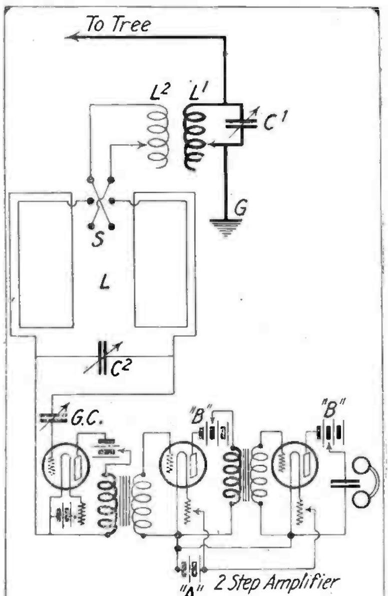
therefore, the design of receivers should be materially altered in order to utilize to the best advantage the energy impinging upon the tree in the form of electromagnetic radiation. Except for very weak signals, however, it is not necessary to utilize this energy to the fullest extent, so that receivers of present design may be used, and when so used, are responsive to any wave length of radiation.

Goniometric Methods Applied to Tree Antenna

One of the special lines of radio development caused by the war has been the application of radio methods to direction finding for military purposes. The Signal Corps has evolved and standardized certain sets possessing extreme compactness for the use of the mobile forces.

Under the intensive study of this subject, stimulated by the war, a large amount of technical information has been obtained which is now available for use and application to the purposes of peace.

Through the coöperation of F. A. Kolster of the Bureau of Standards, who has spe-



Showing General Squier's Mode of Connections.

cialized in this work for the Navy Department, some applications of these methods have been applied to tree antennae.

Coil aerials of extremely small dimensions as compared with ordinary antennae, may be effectively used for both long and short-wave long distance reception. It is therefore entirely possible to make use of such a coil aerial in combination with the tree system, without in any way detracting from the remarkable simplicity of the tree system, for the purpose of obtaining the desirable feature of unidirectional reception or so-called "barrage" effect.

Coil aerials of very small dimensions as compared with the wave length received are nothing more or less than ordinary inductance coils directly and magnetically exposed to the incoming electromagnetic wave, and may form the entire or the major portion of the inductance of a simple series resonant circuit. Such a circuit is shown in Fig. 3, consisting of coil aerial L, the inductance L_2, and the capacity C_2. This circuit to which there is connected the detector and amplifier forms the secondary receiving circuit of the system, and is coupled inductively to the primary circuit L_1C_1 to which the tree and ground wires are connected at T and G.

The system is unique in that both primary and secondary circuits are directly exposed to the incoming wave. It is by virtue of this double exposure that the unidirectional characteristic of the system is obtained. In other words, both primary and secondary circuits are simultaneously operated upon by the incoming electromagnetic wave, and by the proper adjustment of the linking coils L_1 and L_2, the effects produced in the secondary circuit may be entirely neutralized or accumulated. Switch S shown in Fig. 3, is a reversing switch connected to coil L_2 which controls this neutralizing or accumulating effect.

Complete "barrage" effect was obtained with this system on stations such as New Brunswick, New Jersey; Annapolis, Maryland; Nauen, Germany, etc. This makes it possible, for example, to receive signals from San Diego, California, while the New Brunswick station is operating and using practically the same wave length as the San Diego station.

The coil aerials used in the experiments made with the system above described are but four feet square and therefore are located within the station, forming a part of the internal receiving apparatus and in no way complicating the simple tree system.

We have then a simple two-circuit receiving system requiring no extensive and costly outside aerial structure and have the following modern features:

a. Long distance reception at any wave length.
b. Direction finder giving not only the line of direction but the absolute direction.
c. Elimination of interference by virtue of the unidirectional characteristic or "barrage" effect.
d. Simultaneous reception of two or more wave lengths or of two similar wave lengths coming from opposite directions.

Heretofore, in existing operating stations the receiving circuits, of whatever nature, have operated primarily on the generation of alternating currents in the receiving antenna system, and because of this it has been necessary to tune the antenna system itself to the particular frequency of the signals. In the experiments in tree telephony and telegraphy, we may rather consider that we employ an aperiodic system in the form of potential effects at the upper tree terminal of this antenna, selecting from this reservoir of all frequencies the particular frequency desired, by means of external receiving devices now known to the art.

(*Continued on page* 95)

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Exchange

For Sale or Trade. For wireless receiving apparatus, General Electric portable direct current, Milli-Voltmeter 200 milli-volts 025 amps. Brown Sharp 1 and 2 inch Micrometers and one-cut meter. Perfect condition. George Wolf, 5133 Main Ave., Norwood, Ohio.

Sell: Five Dial Onnigraph. Eight Dollars. Good condition. Fred Timper, 1190 Washington Ave., Bronx, N. Y.

Bargain—Audion Cabinet set, with bulb; new, never used. Cost over $20.00. Sell for $15.00. I. Simpson, 207 6th Ave., Brooklyn, N. Y.

For Sale. $23 Navy receiving transformer $15, Electro Oscillation transformer $5, Crystaloi detector, buzzer, resonator $3.50, Ferron Universal detector and crystal $4, Handle Variable condenser $2, Duck 75 watt dynamo or 1/6 H.P. motor parts, new $9. First draft or money order takes them. Burrows Rogers, Cainsville, Harrison Co., Missouri.

Will Exchange $90.00 chemicals, up-to-date radio apparatus for soprano saxophone; milliammeters, 0-2 ammeter, voltmeters. First $18.00 takes Western Electric radiophone VT; $8.00 takes Collier-Marr $20.00 microphone. Bucher's "Vacuum Tubes" new; $1.50. Pray, 102 Heath, Sommerville, Mass.

Wanted: Wireless receivers. Have Ukulele and wireless books. E. Murdock, 5033 Broadway, Chicago.

For Sale: Cheap wireless Instruments. Geo. Proscher, 567 Amsterdam Ave., N. Y. C.

For Sale or Exchange—8x10 Studio Camera, etc. Worth $150.00. Want wireless or what have you? Please enclose stamp. Lawrence Johnston, Fairfield, Ill.

Wanted: Quenched gap for use with 15,000-volt transformer. Herbert deBen, 1044 City Park Ave., New Orleans, La.

For Sale: Rotary Converter 110 Direct Current to 80 Volts 80 Cycles Alternating Current 1 K.W., has ball bearings, extended shaft for synchronous gap, never used, $30. 15,000 meter loading inductances, Audion, key Hot Wire ammeter variables, etc. Valentine Bremer, 3613 Boulevard, Jersey City, N. J.

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(Continued on page 95)

(*Continued from page* 92)

The physicist and engineer, accustomed to deal with inanimate material, is here confronted with the employment of living vegetable organisms of growing trees. From the moment an acorn is planted in fertile soil, it becomes a "detector" and a "receiver" of electromagnetic waves and the marvelous properties of this receiver, thru agencies at present entirely hidden from us, are such as to vitalize the acorn and produce in time the giant oak. In the power of multiplying plant cells, it may, indeed, be called an incomparable "amplifier."

From this angle of view, we may consider that trees have been pieces of electrical apparatus from their beginning, and with their manifold chains of living cells are absorbers, conductors, and radiators of the long electromagnetic waves as used in the radio art. For our present purposes we may consider, therefore, a growing tree as a highly organized piece of living earth to be used in the same manner as we now use the earth as a universal conductor for telephony and other electrical purposes.

TABLE I.

Apparent Series Capacity and Resistance of Antenna Lead,
(Measured between ground and lower end of conductor upper end of which reached to but was not connected with a nail in the tree at height indicated. Substitution method of measurement.)

Height h metres	Wave length λ metres	Frequency f Cyc./sec.	Resistance r_s ohms	Capacity C_s micro-micro-farads
4.6	152	1,975,000	118	70
4.6	300	1,000,000	133	65
4.6	500	600,000	228	65
4.6	700	429,000	310	65
4.6	980	306,000	400	65
6.1	109	2,750,000	61	100
6.1	161	1,863,000	120	90
6.1	300	1,000,000	179	85
6.1	500	600,000	326	80
6.1	750	400,000	500	85
8.5	111	2,700,000	80	100
8.5	160	1,875,000	94	80
8.5	275	1,092,000	136	80
8.5	386	777,000	196	80
8.5	700	429,000	420	90
8.5	1,000	300,000	490	90
10.7	102	2,942,000	92	340
10.7	126	2,380,000	108	150
10.7	183	1,640,000	128	120
10.7	280	1,074,000	206	110
10.7	380	789,000	290	110
10.7	480	625,000	390	100
10.7	805	373,000	710	110
10.7	905	331,000	820	110
12.2	100	3,000,000	290	210
12.2	130	2,308,000	109	150
12.2	186	1,615,000	160	120
12.2	288	1,042,000	270	110
12.2	435	690,000	386	110
12.2	635	472,000	680	110
12.2	810	370,000	600	100
12.2	810	370,000	860	100
14.0	110	2,727,000	65	440
14.0	147	2,041,000	100	190
14.0	198	1,516,000	140	152
14.0	304	987,000	209	148
14.0	445	674,000	330	145
14.0	880	341,000	710	148
17.4	127	2,360,000	67	570
17.4	164	1,829,000	92	240
17.4	220	1,364,000	121	200
17.4	340	883,000	182	180
17.4	485	618,000	276	174
17.4	787	382,000	450	190
17.4	870	345,000	517	185

TABLE II.

Apparent Series Capacity and Resistance of Antenna Lead Connected to the Tree
(Measured between ground and lower end of conductor connected to a nail in the tree at the height indicated. Substitution method of measurement.)

Height h metres	Wave length λ metres	Frequency f cyc./sec.	Resistance r_s ohms	Capacity C_s micro-micro-farads
4.6	103	2,910,000	248	90
4.6	107	2,800,000	122	90
4.6	153	1,962,000	211	85
4.6	235	1,276,000	300	85
4.6	354	847,000	440	85
4.6	595	504,000	1,110	85
4.6	650	462,000	1,290	85
4.6	885	339,000	2,050	70
6.1	117	2,563,000	123	115
6.1	165	1,820,000	202	95
6.1	260	1,154,000	317	90
6.1	382	786,000	660	90
6.1	440	682,000	625	95
6.1	500	600,000	85.	105
6.1	525	572,000	820	105
6.1	550	546,000	910	135
6.1	745	403,000	1,260	130
6.1	800	375,000	1,590	100
8.5	103	2,910,000	230	205
8.5	113	2,653,000	192	110
8.5	156	1,923,000	245	85
8.5	280	1,072,000	418	90
8.5	395	760,000	665	95
8.5	700	428,000	1,500	110
10.7	102	2,940,000	220	110
10.7	137	2,190,000	118	160
10.7	190	1,579,000	165	130
10.7	290	1,034,000	286	120
10.7	346	868,000	384	120
10.7	500	600,000	630	130
10.7	800	375,000	1,160	140
12.2	102	2,940,000	210	670
12.2	133	2,250,000	127	150
12.2	185	1,622,000	196	130
12.2	288	1,042,000	325	110
12.2	415	722,500	553	120
12.2	690	434,000	1,060	130
12.2	740	405,500	1,150	130
14.0	108	2,780,000	144	780
14.0	144	2,083,000	130	203
14.0	200	1,500,000	170	163
14.0	312	961,000	280	148
14.0	445	675,000	476	145
14.0	805	372,000	980	150
14.0	835	359,000	980	166
17.4	130	2,309,000	66	640
17.4	165	1,280,000	109	260
17.4	220	1,360,000	134	200
17.4	343	873,000	200	185
17.4	490	612,500	325	180
17.4	870	344,000	596	181
17.4	875	343,000	606	185
17.4	925	323,700	670	180

All through the ages there is shown in literature a feeling of reverence, sympathy and human intimacy with trees. It is significant that this practical thing possessing utility and natural strength, architectural beauty of design, and endurance far superior to artificial structures prepared by man, should be able yet further to minister to his needs.

(*Communicated by Major General George O. Squier, Chief Signal Officer, U. S. Army, to the Franklin Institute.*) (*Excerpted.*)

Audion Control Panel

(*Continued from page* 75)

TENS battery switch—from contact point (Zero—or no tens in) a connection is brought to the arm of the unit battery switch; from there the circuit is completed by connecting same to the filament. The stopping condenser is shunted across the phones and battery supply by connecting it as shown in the diagram. The "B" batteries are placed inside the panel.

This instrument will prove of great value to the amateurs and experimenters at large who desire to own an efficient instrument of this kind. Any regenerative circuit can be had by the use of the panel type control box. It will come in very handy to those interested in the development of audion circuits and the reception of long distances.

Contributed by L. M. J.

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(*Continued from page* 94)

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