QST

AUGUST

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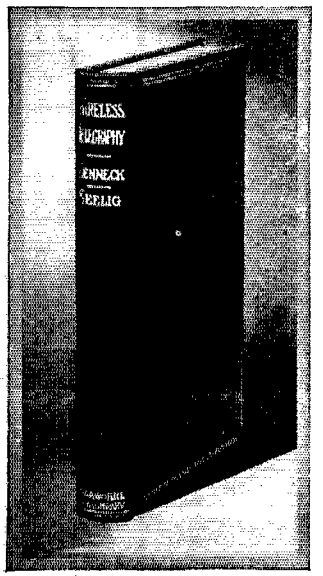
ZENNECK'S

Wireless Telegraphy

"The Book You Have Been Looking For"

By J. ZENNECK, Professor of Experimental Physics at the "Technische Hochschule," Munich. Translated by A. E. SEELIG, Mem. A. I. E. E., formerly General Manager, Atlantic Communication Co. 428 pages, 6x9, 461 illustrations, 13 tables, $4.00 net, postpaid.



CHAPTER HEADINGS

I. The Natural Oscillations of Condenser Circuits. II. Open Oscillators. III. The High Frequency Alternating-Current Circuit. IV. Coupled Circuits. V. Resonance Curves. VI. The Antenna. VII. Transmitters of Damped Oscillations. VIII. High Frequency Machines for Undamped Oscillations. IX. Undamped Oscillations by the Arc Method. X. Propagation of the Waves Over the Earth's Surface. XI. Detectors. XII. Receivers. XIII. Directive Telegraphy. XIV. Wireless Telephony. Development of Wireless Telegraphy During the Years 1909-1912. Tables—22 Pages of Useful Tables. Bibliography and Notes on Theory. Index.

EVERY amateur operator and every student of wireless owes a debt to Mr. Seelig who has translated Dr. Zenneck's "Lehrbuch der drahtlosen Telegraphie." This book has been a standard in Germany and now it is brought to America and translated for us. The book carefully covers all phrases of wireless telegraphy, from the fundamental principles to finished commercial apparatus. In the technical part you will find explanations which clear up every hazy point. Among the interesting features are the illustrations and photographs of dampened sparks. You can find out all about decrement. You see exactly how the ether waves travel. Once you read the book, you wonder how you did without it.

This text is of such great importance to the LEAGUE members that the Secretary has made arrangements to supply the book. Write for it today. There was never a book worth more. You need it: send to the Secretary.

The American Radio Relay League, Inc.

Hartford, Connecticut

QST

Volume I — AUGUST, 1916 — No. IX

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QST
A MAGAZINE DEVOTED EXCLUSIVELY TO THE AMATEUR

Transmission Variations

By Prof. A. Hoyt Taylor

THE variations in radio transmission which are due to actual changes in transmission conditions and not to variations in efficiency of sender or receiver are of peculiar interest to the amateur, because they are most noticeable on short waves.

These variations may be classified as daylight, nocturnal, and seasonal variations. There may be other long period variations concerning which we have so far little data.

Daylight variations are very seldom confirmed for short waves. This may be because of the very short range which it is possible to obtain by daylight. At any rate well authenticated cases of rapid changes in signals during daylight have rarely been reported except for the twilight period. Seasonal variations in the strength of both nocturnal and daylight signals have often been noted, particularly in overland transmission. The greater the distance between sender and receiver, the greater the variations to be observed. For instance, an amateur 300 miles from NAA will observe but little variation in the 2500m time signals but at 9XN, 1400 miles distant, the night signals are often a thousand times as loud as the daylight signals, and the mid-winter signals may be one hundred times as strong as in mid-summer. On the other hand an amateur only 300 miles from a 600m sending station may observe very great variations of that wave length, while on the 9400m wave of WSL only moderate variations are noticeable at 1200 miles.

In other words, the variations increase very rapidly with increase in distance, and decrease with increase in wave length.

Nocturnal variations in winter are therefore more interesting since this is the season when short waves may be used over long distances.

It can be shown that if wireless signals spread out in a perfectly non-absorbing medium their loudness or audibility would vary as the inverse square of the distance from the sender. In other words, doubling the distance between sender and receiver makes the signals four times as weak. In fact this law has been well verified by experiments over short distances with many different wave lengths. For distances of over 150 miles, or less for very short waves, the daylight signals fall off in intensity much more rapidly than the inverse square law would indicate. For instance an audibility of 16 for a 300 meter wave as received at a station 100 miles distant by daylight would indicate that at 200 miles a similar receiver would pick up the signals with an audibility of 4. But as every amateur well knows, the 300 meter signal would in fact not be heard at all at 200 miles.

This difference is thought to be due to absorption of the energy of the wave, both in the atmosphere through which it passes, and in the earth surface over which it travels. It is definitely known that brilliant sunlight and dense vegetation have a disastrous effect upon radio transmission on short waves.

When the behavior of short waves at night is examined, such extraordinary irregularities are noted that the facts seem very confusing. Often signals are received with an intensity far in excess of that calculated on the basis of zero absorption, but these same signals will sometimes inside of a few seconds fade away until quite

inaudible. The diffusion of energy according to the inverse square law, and the uniform and heavy absorption experienced by daylight do not appear to govern the transmission by night.

The gradual disappearance of the conditions created by sunlight during the daytime seem to cause a gradual improvement in transmission which reaches a maximum shortly after the solar midnight, and an abrupt falling off about a half hour before sunrise, when the sun is already lighting up the higher layers of the atmosphere. But this gradual improvement and abrupt weakening is often mixed with rapid fluctuations and periods of good and bad transmission. These periods may be of only a minute duration, or they may last as long as a half an hour.

It has seemed to the writer that these rapid changes could only be due to interferences between waves which pass directly from sender to receiver with other waves from the same sender which reach the receiver after reflection from some upper layer of the earth's atmosphere. Such a reflection could take place if there were regions present in space which were of different electrical or magnetic properties. There are many reasons for thinking that regions of different electrical properties do exist in the atmosphere.

These two waves would in general travel different distances, and come together at the receiver in different states or phases of vibrations, thus producing strong or weak signals according to whether they combined in such a way as to help each other or to interfere.

To test this point, two waves were radiated from 9XN, one of 1500m and one of 500m; so that, whenever the path difference might correspond to a whole number of half waves for 1500m, it would also be a whole number of half waves for 500m. Thus 750m is one-half wave for the one wave and three half waves for the other. Due to this "three to one" wave length ration, all fluctuations observed in the though the 500m may contain fluctuations not present in the 1500m wave.

A number of all night tests were made during the winter of 1914-15. The audibilities were measured by shunting the telephone receiver with a variable resistance box, recording the smallest shunt value with which the signals were barely audible. The method of calculating the reduction effect of the shunt is too complicated to present here, involving as it does the effective resistance and inductance of the phones as well as the pitch of the signals received. It may be stated roughly that a shunt of 100 ohms on a 3200 ohm Brandes phone, with pitch of signal 1000 sec., corresponds to an audibility of 100, and that for fairly strong signals the audibility is nearly proportional to the reciprocal of the shunt resistance.

From the curves which represented the variations in transmission throughout the night it seemed as if the conditions demanded by the interference theory were generally present. The April number of the Proceedings of the Institute of Radio Engineers contains a full account of the experiments.

Definite confirmation might be obtained if transmission on equal waves of equal decrement could be shown to be reciprocal, and if two waves one of which was twice the length of the other could be shown to have opposite types of transmission variations. Some tests on these points have been attempted between 9XN and 9XV, and between 9XN and NAJ, but are as yet incomplete.

Much valuable information might be obtained by amateurs who can obtain a variable resistance, range 1 to 1000 ohms, with which to shunt their phones, although great care must be taken to keep the detectors used in reliable adjustment, and to discount variations in senders due to defective insulation, poor tuning, etc. Since in overland transmission across 750 miles a wave of 300 meters or less will show rapid fluctuations of perhaps 500 fold in signal strength, it is evident that even a meager equipment will serve for the semi-quantitative observation of nocturnal transmission variations.

Cases where the waves seem to skip an intervening station are of especial interest and should be carefully noted. A number of well proven cases are on record where signals have been more audible at say 700 miles than at 350 miles, the sender and two receivers being all in a line. It is difficult to explain such cases except by the action of interfering reflections.

In concluding it will be well to point out the fallacy of rating the range of a station by the freak records obtained at night in the winter. These records are interesting, but they certainly do not prove that one station has any longer range than another. For instance, 9XN has a freak record of 2100 miles, to Vera Cruz, on a 650m wave, power 1.7 K. W. On the other hand the standard time and the weather forecasts sent out at mid-day central time on 1500m at 5 K. W. are consistently received by 7BD at Lewistown, Montana, distant 587 miles. The latter performance is a far better indication of the range of the station than the former.

Rotten Luck

By The Old Man

The "Rotten Articles" by The Old Man are becoming a source of keen enjoyment every month. Several of our readers have inquired as to who writes them. Frankly, we don't know, but we are sure they come from one of our League Helpers. About the first of each month we discover one of these articles in our monstrous stack of mail—each time with a new postmark. We are afraid to search for the writer for fear we shall kill the goose who lays the golden eggs. This one's gold all the way thru. Don't fail to read it. What will "The Old Man" send us next time?—Editor.

WE have had something about ROTTEN SENDING and we have had something about ROTTEN RECEIVING. Now let me tell you something else that is rotten. This happens to be Radio Luck.

There is something about radio work which attracts rotten luck. I have noticed it several times. Just at the time when you want things to be their best, is the time that luck steps in and makes them act their worst. Listen to this pitiful hard luck tale of mine.

The troops in my State mobilized a week ago last Monday, and the Signal Corps were among the first to reach the State Encampment. They had a nice little Government portable set, and of course they were to set it up right away and get some practice. When they went away they asked me if I would stick around my station evenings and give them some practice. I said I would. The distance by air line was about fifty miles, and my one k. w. would certainly get there and my receiving set was sensitive enough to hear them without much question. They telephoned up when they were ready, and we arranged for eight o'clock that night for a test.

I just naturally looked things over a little carefully during the day. I cleaned up my gap and got three good strong amperes into my antenna, and adjusted everything up where it seemed just about right. At seven o'clock I worked her a little just to be dead sure that nothing had been done by the children.

Eight o'clock came, and with it my hoodoo. I sent the State Camp's call and a few QRK? sigs. and signed in just once when things stopped dead. The key was as dead as a doornail. I knew several dozen of the young squirts were listening to me and it was of course plainly evident by the way I stopped in the middle of a sign in, that the Old Man was on the bum. It was not at all pleasant. I noticed when I held the key down, that my transformer would not hum. I knew then that the trouble was not in the high tension side. It must be "an open" some where in the primary. I was working full power, so I said to myself, FUSES.

Now, the fuses in my set are away down in the cellar over in the far corner where you could develop a photographic plate without danger of getting it light struck. It is the darkest hole I know of. I knew that those fuses meant a candle, and this would take time, and in the meanwhile, the State Camp would be coming in. So I listened. Nothing doing. After five minutes nothing doing. It seemed time to then hustle for the candle.

The rotten part of the luck then began showing. I could not find that candle. Our cook is supposed to have charge of the one candle we own. Whether she had eaten it, or fixed it up so the family ate it, or whether she had used it for chewing gum, I don't know. It was gone, and my wife and the children and myself all searched and tumbled over each other and lost our tempers. I was in a rush and I suppose some nervous and irritable. I dove down into the cellar with a fist full of matches, knowing as I went that I could not possibly handle tight fitting fuses in a 220 circuit and keep matches going at the same time, and not get a shock. Nevertheless, something had to be done and done quickly.

I got my shock all right, but could not find any black spots on the little green paper on the fuses so I put them back in and beat it upstairs to look at the connections of the primary and key circuit under the table. These seemed to be all right. Then the question was, if the fuses were all right, and the circuit was all right, where in blazes was the "open." I had to think quickly, and being fussed, I of course did the stupid thing. I snatched a piece of No. 16 bell wire, and thought I would snap it quickly across the 220 terminals of my transformer. A flash here

Continued on Page 233

The Radio Club of America

New York City

Fellow Amateurs, this introduces to you the Radio Club of America. As the A. R. R. L. is a leader in relay work, so the Radio Club of America is the head of all practical amateur theory. Let us try to become better acquainted through QST. Editor.

THE Radio Club of America was founded in New York City in 1909 by some of the foremost amateur workers in the city and vicinity. The purpose of the Club is to promote co-operation between those interested in the development of the art of radio-communication due to the purely scientific satisfaction derived from its study, rather than from the hope of any material recompense.

The present membership is composed of practically all the more advanced and most interested amateurs in New York City and vicinity, and also includes many persons prominent in radio work in New York and elsewhere. All Club members who are accustomed to devote considerable time to operating regularly are members of The American Radio Relay League.

Club meetings are held monthly at Columbia University. At these meetings there are presented papers containing information and data which are the results of the most recent experimental developments in the art, greatest stress being laid upon those developments which lend themselves most readily to amateur adaptations. Lectures on the fundamental theory and operation of many forms of apparatus are also occasionally given but effort is made in all cases to avoid mathematical and other deeply involved discussions, and to make each paper or lecture of such a character as to be thoroughly comprehensible to the average well-informed amateur worker. The meetings also offer excellent opportunity for discussions and conferences between the members. Informal dinners which proceed each meeting aid in promoting social intimacy throughout the membership.

A Club Year Book is at present undergoing completion and will contain much interesting and instructive information and data.

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Applications of the Audion

By Paul F. Godley
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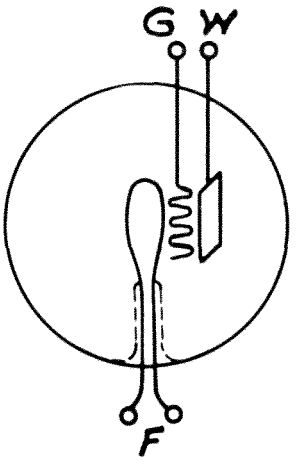
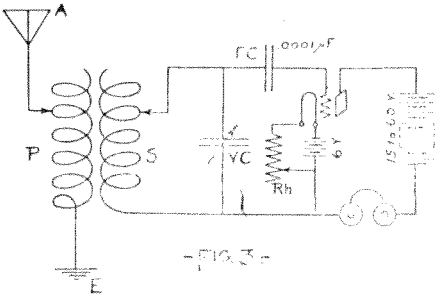
THE popularity of the **audion** as a detector and amplifier is unquestioned. Yet there seems to be a general lack of familiarity among a great many amateurs with the audion and its operation, to say nothing of misunderstandings concerning its value as a detector. The misunderstandings are due in the majority of cases to lack of knowledge and to the attempts on the part of manufacturers of other detectors on the market, unfortunately, poor audions just as there are poor crystals of galena or silicon, but, notwithstanding, due to its inherent properties, the audion is, and probably will remain, the detector superior.



-FIG. 2-

The audion consists of a filament, a "grid," and a plate or "wing" enclosed in a bulb from which to a degree the air has been exhausted. (Figure 2) Figure 3 shows the simple audion circuit, and we have here the **combined action of rectification** and **amplification,** and it is because of this relay action that a properly constructed audion must of necessity excel any simple rectifier.

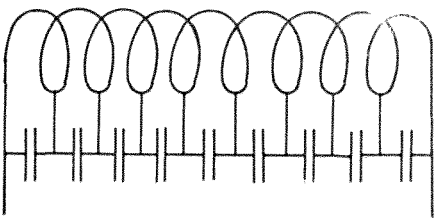
The audion is a voltage operated device. That is, the greater the potential of the charges applied to the grid, the greater will be the corresponding change in the wing circuit, or telephone currents, so that the first thing which concerns us in the selection of apparatus suitable for application in conjunction with the audion is how we



-FIG. 3-

may insure at all times under given conditions maximums of potential at the grid. In this connection it will be well to look for a moment at a certain relationship existing between the electromotive force and capacity in any oscillatory circuit.

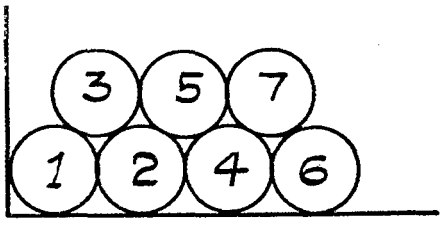
Every electrical conductor has a certain capacity depending upon its size, its shape, and surrounding conductors. The larger this conductor, the greater the charge required to bring it to a certain potential. Hence the potential is directly proportional to the charge and inversely proportional to the capacity, or $E=Q/C$ where E is the E. M. F., Q the quantity, and C the capacity. Therefore if we have a closed oscillatory circuit in resonance with an exciting circuit and we decrease the amount of variable capacity, in order to maintain resonance we may increase the amount of inductance and by so doing we increase the E. M. F. Inasmuch as all coils have more or less distributed capacity it would be ad-



-FIG. 4-

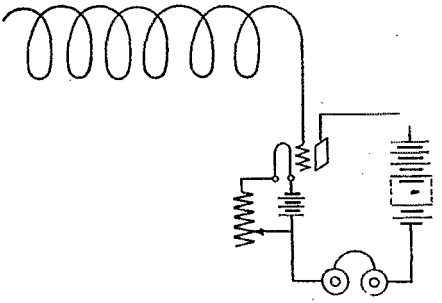
*Presented before The Radio Club of America, June 9th, 1916.

vantageous to eliminate entirely the variable capacity providing we could adopt some suitable means of continuously varying the inductance. The distributed capacity of any coil may be considered as in Figure 4. It will be noticed that the capacities between turns appear as in series with each other as far as the coil as a whole is concerned and it is therefore apparent that, providing the coil consists of sufficient turns, the value of the capacity as compared to the inductance will have fallen to a relatively small value. Mr. H. E. Hallborg, in the Proceedings of The Institute of Radio Engineers (Vol. 1, Part 2), in discussing the paper read before that body by Mr. F. A. Kolster on "The Effects of Distributed Capacity of Coils used in Radiotelegraphic Circuits" says, "The distributed capacity of two similar coils is half that of one, obeying the same law as condensers in series; and when connected in parallel, double." The exact value varies with the degree of coupling, as Mr. Kolster has stated. Hence, with a straight coil of considerable length, the distributed capacity of the coil as a whole falls off in definite proportion to the increase in coil length or number of turns." With reference to Figure 4 we see therefore that the shorter the length of the wave to be received the more important becomes the consideration of distributed capacity because of the few number of turns in the inductance. Dis-



-FIG. 5-

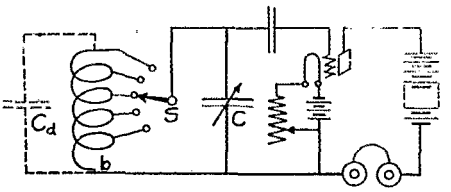
tributed capacity effects may depend upon **the cross-section of the wire used, the specific inductive capacity and thickness of the insulation, the diameter of the coil, length of tap leads, or the design and disposition of switch points.** In this connection the following will be of interest. A coil 3¼" in diameter consisting of 167 turns of No. 26 D.C.C. magnet wire had a natural wave length of 148 meters. After being shellaced, its natural wave length was found to be 186 meters. Twelve taps were taken off to switch points, and the natural wave length was found to be 222 meters. The coil was mounted as the secondary of a tuning transformer, the carrying rods being used to bring out connections, and the natural wave length had increased to 268 meters. It is quite apparent that better signals would have been obtained with this



-FIG. 6-

coil in conjunction with the audion had the coil been taken in its original form and sufficient winding added if necessary to bring its natural wave length up to the desired value. By the addition of this disadvantageous capacity the natural wave length of this coil has been raised to the point where other serious losses begin to occur when this coil is used in the reception of wave lengths in the neighborhood of the final natural wave length of the coil. These losses are known as end-turn losses and will be referred to later.

Again referring to coil design, the following may also be of interest. 118 feet of No. 28 D.C.C. magnet wire were wound on a tube 3 1-16" in diameter, and had a natural wave length of 148 meters. The same wire wound on a tube 5½" in diameter was found to have a natural wave length



-FIG. 7-

of 180 meters, and when this same wire was wound on a tube 9" in diameter it was found to have a natural wave length of 244 meters.

	Diameter in inches	Length in inches	Number of turns	Measured Natural Wave Length in Meters	Calculated Inductance in Microhenries	Calculated Capacity in Microfarads
(1)	3 1-16	3.13	150	148	1520	.00000406
(2)	5½	1.67	80	180	1850	.00000493
(3)	9	1.08	50	244	1675	.00000997

No. 28 D.C.C. Magnet Wire 48 turns per inch

$$L = \frac{2\pi^2 A^2 N^2}{BK}$$

A = Radius
N = Number of turns
B = Length
K = A Constant

Values of K
Coil (1) 711
Coil (2) 414
Coil (3) 230

It might be well to add that multilayer coils, that is, coils of more than one layer of wire, are entirely out of the question for short wave work, and usually should not be used in any case unless some special means is taken to reduce the capacity effects encountered. Figure 5 shows a method sometimes employed when multilayer coils are desired for their economy of space.

In general, for the best results it is far better to use separate pieces of apparatus than to attempt the assembly of a complete receiver in a small cabinet. Such a compact arrangement usually entails a maze of connections, braces of conducting material, various complicated mechanisms, etc., etc., all of which tend to decrease the efficiency due to counter inductive effects, resistance losses at various switch points, and above all losses resulting from undesirable capacity, for even the mere presence of conducting bodies in proximity to the audion circuits may result in a surprisingly great decrease in signal strength.

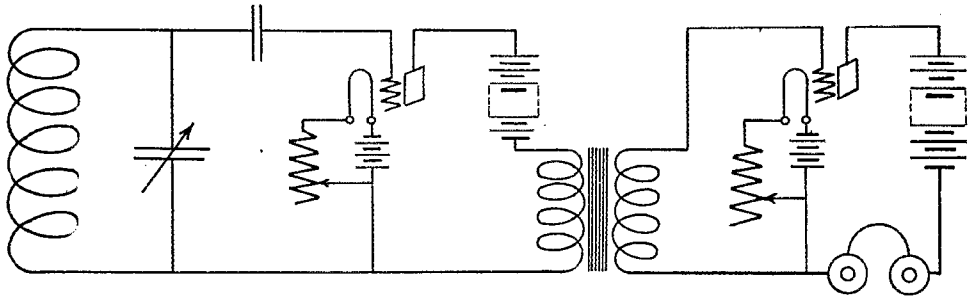
It is readily seen that the more sensitive the detector, the more apparent becomes a given percentage of lost energy and the more apt is the presence of lost energy to become noticeable. Using an audion it is a very easy matter to show the marked presence of high frequency resistance losses, leakage due to poor insulation, and above all, end turn losses in about 99% of the radio apparatus manufactured, and especially that on the market for amateur use. In many cases those losses aggregate apparently as high as 80% on certain wave lengths, and on wave lengths usually used for amateur communication, 50% loss appears to be quite the rule. Inasmuch as the restrictions to which amateurs are subject in the operation of transmitting apparatus limit to a very great degree the range to be covered with a given power, the importance of loss elimination in the receiver can not be overestimated. The radio frequency dealt with on a wave length of 200 meters is 1,500,000 cycles per second. Ten meters of No. 22 copper wire has a resistance of .431 ohms for direct current, but for an oscillatory current of a frequency of 1,500,000 cycles the resistance of this same length of wire has increased approximately ten times due to the fact that the "skin effect" which takes place in the wire allows the passage of the high frequency current on, or very near, the surface of the wire only. The high frequency resistance of a wire may be decreased by increasing the amount of surface, and this may be done without necessarily increasing the diameter by the use of a stranded wire, or a strand of wires wherein each wire is insulated from its neighbors. Such a conductor consisting of fine enamelled wires is known as "Litzendraht" and may be used to advantage on waves above 700 or 800 meters but recent developments tend to show that stranded conductors are of questionable advantage in connection with the higher frequencies. "Litzendraht" may be purchased on the market, or those to whom the price seems prohibitive may do well to purchase D.C.C. magnet wire, say No. 36 or No. 38, and braid or twist it themselves. This may be done quite conveniently by stretching 30 or 40 wires between two supports, and twisting them by the use of an eye-bolt secured in the chuck of a small hand drill.

Resistance leakages are encountered in coils used for receivers due to the coloring matter used in insulations or to the presence of moisture in the insulation. Wire having colored insulation may be avoided to distinct advantages and every effort should be made to exclude all moisture from windings and their supports. When paper or cardboard tubes are used in the construction of inductances, they should be thoroughly dried out by placing them in a warm, dry room for several days or, baked in an oven at not too high a temperature. The tube should then be well shellaced. It is advisable to purchase shellac in bulk and mix with 95% alcohol as the lower grades of alcohol contain a great percentage of water. After the tube is thoroughly dried and wound, care should be taken that all the moisture which may possibly be in the insulation of the wire is expelled, after which the whole coil is covered with a thin coat of shellac; a second coat being added later if desired.

The natural wave length of any coil of wire may be determined by connecting as in Figure 6 and exciting the coil with a

wave meter. It will be found that the wave length at which the greatest response is obtained is quite sharply defined. Due to the distributed capacity of the coil it is in itself an oscillatory circuit and acts as such immediately upon its excitation by a circuit with which it is in resonance.

Take the coil mentioned in connection with the discussion of distributed capacity and utilize it in a receiver, as in Figure 7. It is desired to tune to an incoming signal at a wave length of 275 meters. It is possible to use less than half of the coil for this purpose and, as a result, two oscillatory circuits exist—the circuit comprised by the inductance b to s and the condenser C responding to 275 meters, and the circuit comprised by the entire inductance and the capacity Cd (distributed capacity) responding to 268 meters. Due to the slight difference between their periods of vibration a division of the energy between the two circuits is unavoidable, the energy loss to the detector being governed by the percentage of difference between the periods of the two circuits. It will also be quite apparent that, since circuits having two distinct periods of freedom are here dealt with, the damping of the receiver at a switching device so arranged as to connect or disconnect the sections automatically as required. (See Figure 4, page 160, July 1916 Number of "QST"). It should be remembered that the arrangement of these sections must be such that the natural periods of vibration of the coil or coils present are at all times well removed from the wave length being received regardless of the value of such wave length. In the construction of a receiving tuner of sufficient size to properly cover wave lengths between say 200 and 3000 meters, it is hardly practicable to divide the coils into small sections such that the natural wave length of each section is well below 200 meters. It is possible however to cut the number of divisions down to five or six with careful study and painstaking experimental work with the wave meter. It might be well to call attention to the fact that end-losses may occur in both the primary and secondary coils of the receiving tuner and that, where a series condenser is used in the primary circuit, it should always be placed between the antenna and the receiving transformer since otherwise the natural wave length of the primary inductance in conjunction with the



-FIG. 9-

will result. Short circuiting is however detrimental under certain conditions and for the best work should not be depended upon. In case it is desirable to utilize this method means should be provided for shortcircuiting the overhanging turns when their number is great, the "short" to be lifted as soon as their number falls below say one quarter of the total turns in the coil.

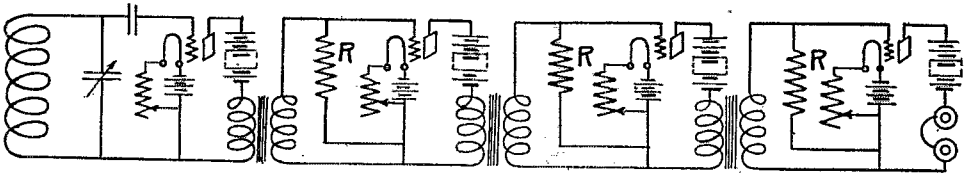
The simplest method of eliminating this "end-loss effect" is to short circuit the unused portions of the receiving coils. A marked improvement of signals in the neighborhood of the affected wave lengths certain wave lengths will be extremely great and hence, the selectivity of the system as a whole quite materially lessened.

A second method of eliminating the end-turn losses lies in the provision of means for a division of the coil into sections and antenna may easily exceed the safe limit.

A very simple method of preventing end-turn losses is one wherein separate inductances are employed for different ranges of wave length. The proper size of these coils may be very easily determined by means of a wave meter.

These inductances may take the form of variometers and to a decided advantage for, in this form, no necessity is found for tap off connections and since a continuously variable inductance is had the variable capacity element may also be eliminated from the circuit. For short wave reception the variometer, once used, will be found to be indispensible, inasmuch as capacity loss due to decreased voltage and end-turn losses have been eliminated as far as it is possible to do so in a practicable manner.

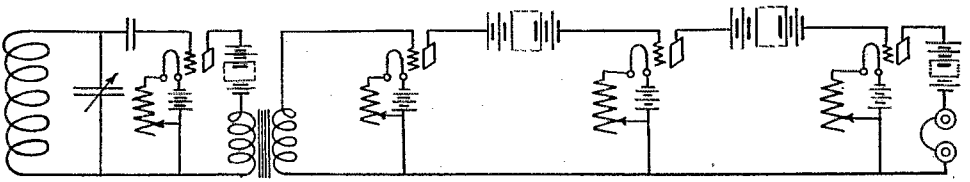
One very interesting application of the audion is found in the form of the Audion Amplifier (Figure 9) wherein the audion is used as a relay. A step-up transformer is provided, the primary of which is substituted for the telephones in the circuit of the first detector, the outside end of the secondary being connected directly to the grid of the amplifier audion. The filament of this audion is then connected to the primary of the transformer, or if two audions are being used and both lighted from the same battery, no connection at all need be provided at this point. It is possible to go further and use a second and third step (Figure 10) in the process of amplification. It will be found disadvantageous however to go further than a third step because of the interactions between the amplifier circuits resulting in a continuous whistling sound in the telephones. Resistances marked R in Figure 10 may consist of a few lead pencil marks on pieces of paper, the weight of the marks being varied as desired. This high resistance leak tends to prevent the whistling sound mentioned above.



-FIG. 10-

The construction of a very good step-up transformer for this purpose is described by Stanley and Camp in the 1916 Year Book of The Radio Club of America as follows. "Assemble in a fibre tube six inches long, one inch outside diameter and seven-eighths of an inch inside diameter, a bundle of number 22 or smaller, double annealed iron wire. If the wires are all cut the length of the fibre tube and packed in as tightly as possible a good core will be had upon which should be pressed two fibre heads, each 3¾" square and ½" thick. These heads must be so placed that there will remain a clear winding space of 4¾". In this space is wound a primary which will consist of 36 layers of No. 34 S.S.C. magnet wire, each layer being separated from the next by a layer of paper .005" thick. On top of the primary wind sufficient good quality paper to form a layer .025" thick. The secondary should consist of 50 layers of No. 38 S.S.C. magnet wire, each layer having the same separating paper as the primary layers. It is important that the leads from the two windings be brought out at the proper places. Care should be taken to connect the coil in properly as the primary of the coil can not be used as the secondary with any degree of success."

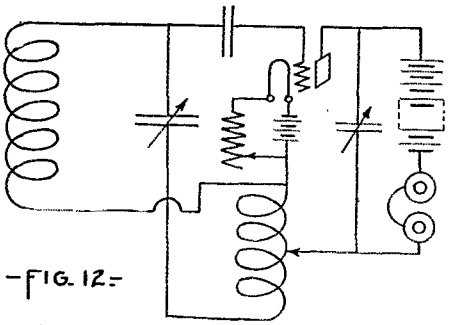
Figure 11 shows an arrangement of audion detectors originated by Professor G. W. Pierce of Harvard University. An audion amplifying transformer as described above is used between the detector and the first amplifier audion. The battery current in the wing circuits of the remaining audions is increased until ionization of the gases in the bulbs occurs, i.e., until the blue glow appears. A very careful adjustment of this arrangement will give wonderful amplification, probably somewhere in the neighborhood of 1,000 times. This adjustment is difficult however and the critical condition of the audions comparatively hard to maintain especially, when less than three steps are employed, although the writer has occasionally secured excellent results with but two steps.



-FIG. 11-

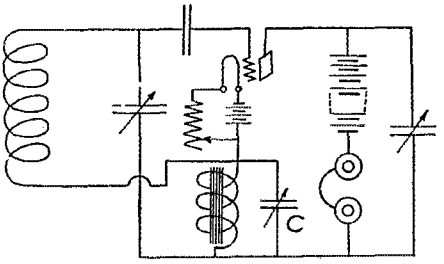
If the wing circuit of an audion is sufficiently coupled either electro-magnetically or electro-statically to the grid, or closed oscillatory circuit of the audion, and if a charge is placed on the grid thereby interrupting the existing flow between the filament and the plate, the resulting pulse of current in the wing circuit will be repeated by means of the coupling back into the grid circuit. The grid condenser will then again receive a charge, which it delivers to the grid and the phenomenon again takes place, and will, providing the adjustments

are proper, continue to do so indefinitely, and at a frequency usually dependent upon the time period of the closed oscillatory circuit. If the closed oscillatory circuit is tuned to an antenna, and this system placed in resonance with an incoming wave, it is readily seen that, inasmuch as the resultant pulse of current in the wing circuit is many times greater than the initial charge thrown on the grid, and since the wing circuit current may be repeated back into the grid circuit in exact phase with the incoming oscillations, a reinforcement or amplification of the received signal may result, the degree of amplification depending upon the radio frequency of the received wave. In this condition the audion is oscillating or generating a continuous oscillation.



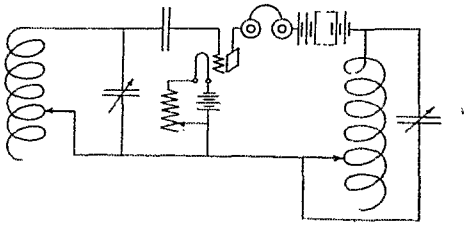
-FIG. 12-

It is impossible to receive a continuous oscillation with a plain rectifier due to the fact that the received currents are of such frequency as to be inaudible to the human ear. However, inasmuch as a generator of continuous oscillations is had at the receiving station advantage may be taken of the "heterodyne" method of reception for undamped waves. Reception by this method is accomplished by the production of beats at an audible frequency between the wave being received and the wave generated at the receiving station. For example, assume that an incoming wave has a frequency of 200,000 cycles per second. Now there is



-FIG. 13-

produced in the receiving circuit an alternating current with a frequency of, say, 199,000 cycles. The result is a "beat" frequency, dependent upon the difference between the two frequencies present, which in this case is 1,000 cycles per second, an audible note. Since the audion then acts as a generator, rectifier, and amplifier, by



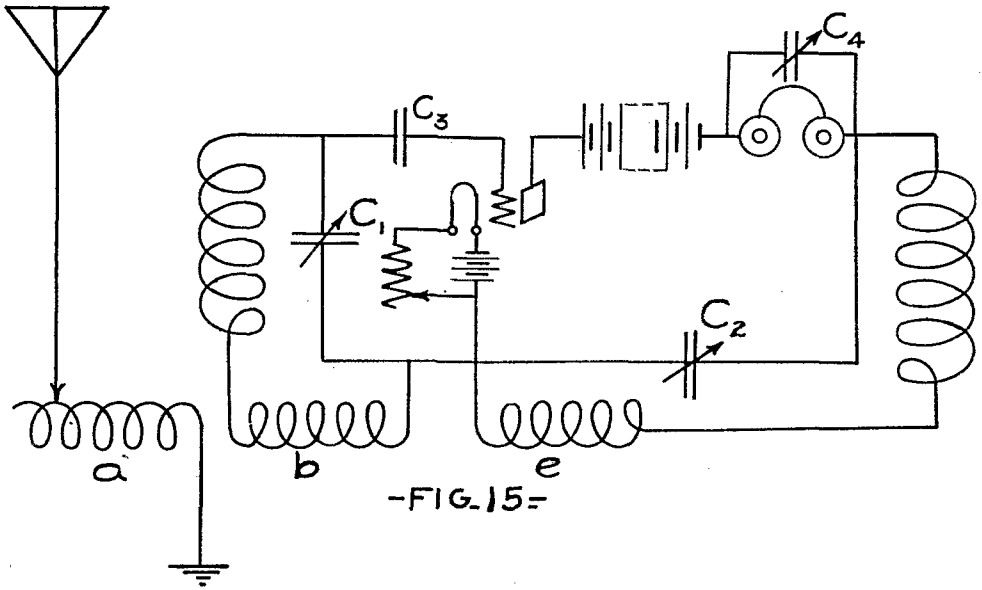
-FIG. 14-

its use, either damped or undamped waves may be received and amplified.

Figures 12 and 13, respectively, show electro-magnetic and electro-static coupling between the grid and wing circuits. In Figure 12 the coupling consists of an auto-transformer. It may consist of an **inductively** coupled transformer and, as is apparent, the proper degree of coupling between the two circuits may be obtained by variation. In Figure 13 the coupling consists of the condenser C, shunted by an iron core choke coil, which permits the passage of direct current only. This is the so-called "ultraudion." Figure 14 shows an oscillating system wherein no coupling is provided other than the small amount offered by the audion itself. Here the wing circuit is tuned to resonance with the grid circuit, the energy being transferred as above suggested through the coupling provided by the audion. This elimination of external coupling however often renders the circuit difficult of operation especially on the longer wave lengths. The writer prefers the method as shown in Figure 15. Coils **a**, **b**, and **c** are so arranged that **c** slides into **b**, and **b** into **a**. Their length may be of the order of 8" and their diameter about 4" or 5". They should be wound with No. 28 S.S.C. magnet wire. Taps are provided about every ¾" and a loading coil and suitable variometer should be used in conjunction with coil **a** for tuning the antenna. The loading coil (not shown) should consist of a tube 6" in diameter and 14" in length wound with No. 28 D S.C. magnet wire. The condensers C1, C2, and C4 should have a capacity of about .001 microfarads. C3 is comparatively very small, its maximum capacity being that of C1 with pointer on 10° scale mark.

A simple and very good method is shown in Figure 16. Here S may be a tube 7" in diameter and 14" in length wound with No. 28 D. S. C. magnet wire. P may be a coil 6" in diameter and 8" in length wound with No. 24 D.S.C. magnet wire. On coil S taps should be taken off every ¾" to accommodate switch No. 1, and about every ¼" for a distance of 3" from the lower end of the

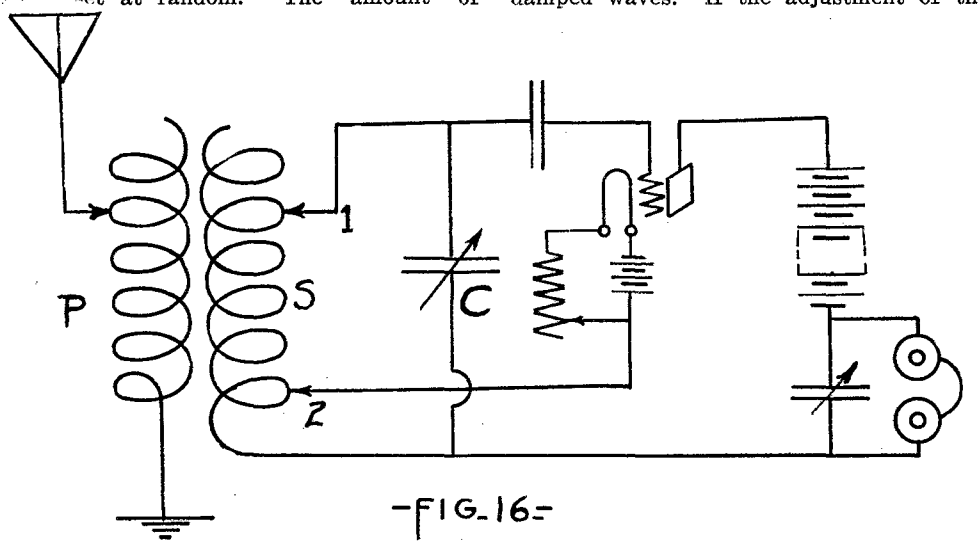
coil for the accommodation of switch No. 2. The range of this system will lie between approximately 2,000 and 15,000 meters



-FIG. 15-

where the capacity of C is of a maximum value of .001 microfarads.

Inasmuch as the peculiarities of operation of these arrangements are the same throughout, an outline of the procedure with reference to Figure 16 will suffice for all. The value of inductance and capacity in the grid or closed oscillatory circuit of Figure 16 is set at random. The amount of

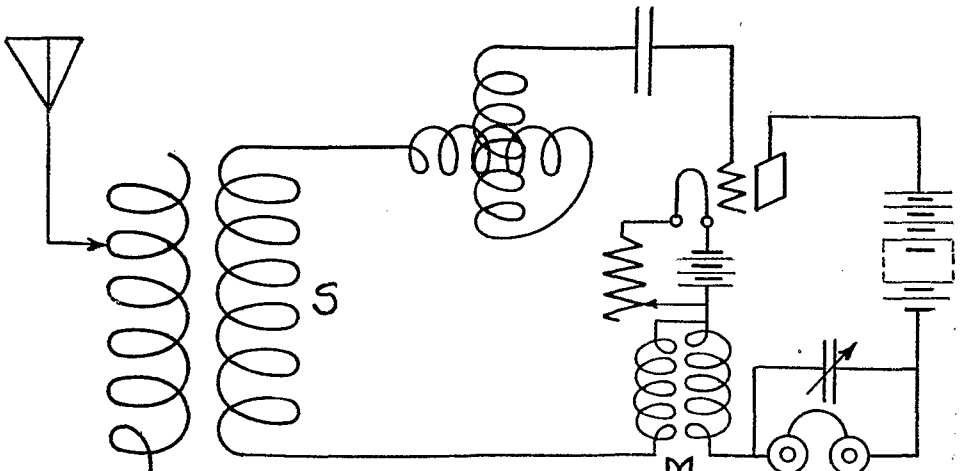


-FIG. 16-

inductance common to both the wing and grid circuits is increased at switch No. 2 until a howling noise is heard in the telephones. This sound may be quite loud and disagreeable. The common inductance should then be decreased until this sound ceases, at which time the audion should be oscillating. By adjusting the antenna inductances, a point will be found where a hiss is heard and reaches a maximum. At this point the entire system is in resonance. This hissing sound is due to the shock excitation of the system by infinitesimally small atmospheric disturbances or stray damped waves. If the adjustment of the secondary tuning condenser now be varied, it will be found that the oscillations of the audion may be stopped or started at will

and that their stoppage is accompanied by a rather muffled click in the telephones. The system as a whole may be gradually swung from 2,000 to 15,000 meters and kept at all times in resonance. Hence, any stations which happen to be working within range may be logged for future reference. Both damped and undamped waves may be received on these systems. The damped (spark) waves however, will come in with a click, that is, their natural spark tune will not be apparent. By decreasing the amount of wire common to the wing and grid circuits, a point will be reached where the audion ceases to generate, and at this point the natural spark tone of the station will be apparent. However, in this condition the audion still continues the repeating action and amplification results. Close adjustment of grid-wing circuit coupling is necessary for the best results.

Figure 17 shows a circuit applicable to the shorter wave lengths, that is, below 2,000 meters. It will here be noticed that the secondary tuning condenser has been dispensed with, all the tuning of the secondary or closed oscillatory circuit being accomplished by the variometer. It will be necessary to provide at least three variometers, each wound with different sizes of wire, to cover the range from 200 to 2,000 meters. The secondary circuit is coupled to the antenna circuit by means of the coil which may consist of 50 turns of



-FIG. 17-

No. 22 magnet wire wound on a tube 4" in diameter. The two coils comprising the coupler M, for coupling the wing and grid circuits, may also be approximately this size, except that one should slide within the other. Direct coupling may be used at this point, but with a smaller measure of success due to the impossibility of getting as close an adjustment of the coupling, and it may also be found advantageous at certain wave lengths to resort to tuning the wing circuit by the insertion of variometers. Great pains should be taken in the assembly of apparatus for the reception of shorter wave lengths by these methods and care should be taken to eliminate all end-turn and similar effects, inasmuch as the presence of additional frequencies due to overhanging ends or nearby oscillators may make these circuits at the higher frequencies absolutely inoperative.

The Possibilities of A Spark Coil

By M. A. Herzog

The article on the "spark coil amateur" by Mr. Felix which appeared in the July issue of "QST" was interesting, and the writer heartily agrees with him that some space should be given in the magazine to assist those who use them.

Since the advent of the transformer the spark coil has been regarded by many amateurs as a toy incapable of serious work. This is a mistaken impression. The induction coil, while rather inefficient as an electrical instrument, is remarkably efficient in radio work, since greater distances per watt input can be covered with an induction coil, than with a transformer. Some personal experiences in this line may be of

interest.

The coil used at this station has a one inch core, eight inches long. The primary consists of two layers of No. 18 wire, insulated from the secondary by five layers of empire cloth. The secondary consists of three sections, each of which is three inches in diameter and two inches long. There are about two pounds of wire in the secondary.

The vibrator gave a great deal of trouble. The one first used was of the double spring type used in many of the coils on the market. This type will give a fairly high tone, but a very stringy spark. This gave very poor results.

A vibrator of the type used on the "Connecticut" automobile sections was then put on. This has a rather short, stiff spring, the tension of which can be adjusted, and a heavy armature.

This interrupter gives a very low tone, but a fine heavy spark at the secondary. The writer tried placing paper and rubber under the spring, extra bridges over the spring, and various other devices in order to raise the pitch, but without success, as every time that the speed of the vibrator was increased, the spark would become weak. So one of two conditions had to be chosen—either a low speed but good spark, or a high speed with a poor spark. The reason is of course that with only a few interruptions per second the secondary has time to charge to a much greater extent before discharging than when the interruptions are many. So for good work the low speed had to be chosen.

The coil gives about a five-eighths inch spark, but it is a heavy flame. The input can be regulated up to thirty watts by adjusting the vibrator, but at this power the spark is so rough that from eight to eighteen watts is generally used.

The maximum distance covered with this coil is thirty-five miles, using an input as low as four watts, which is rather more than eight miles per watt. When using eight watts the receiving operator at 4DD, Oxford, Ga. can hear the signals with the receivers six inches from his ears. A single audion is used. A one Kw. station here, radiating about four amperes, is sometimes not heard as loud.

A station five miles from here using a galena detector has also been worked with an input of just one watt — enough to operate the vibrator.

The aerial that gives these results is a two wire unsymmetrical "T" about seventy feet high at one end and forty at the other. The lead-in is taken one hundred feet from the lower end. The flat-top is two hundred and sixty feet long. The wires are spaced eight feet. The emitted wave is 315 meters.

Contrary to the opinion of many amateurs, a spark coil can be efficiently operated with a helix and condenser instead of the plain aerial connection. The helix used here has eleven turns, all of which are used for both primary and secondary. Strange to say, a fairly sharp wave is obtained. The condenser consists of eight 5x7 plates. The power is a six volt storage battery.

To conclude: A slow speed vibrator has its disadvantages, such as difficulty in reading through static, but for really efficient work with a coil, it is "all to the good."

WIRELESS STATIONS SUSPEND SERVICE

The Sayville and Tuckerton Trans-atlantic wireless stations have suspended all service to Europe until further notice. Messages are accepted subject to indefinite delay and at the sender's risk. No reason for this action has been officially given, but it was learned that the atmospheric conditions were very bad and this, coupled with an accumulation of business, had resulted in a congestion which was desirable to clear up.

GIRLS TO STUDY WIRELESS

Wireless telegraphy instruction, is to be a special feature of the work to be done in a new girls' camp to be opened at Rowayton-on-the-Sound, Conn., on Saturday of this week. Mrs. Josephine Craw, of Craw Avenue, Rowayton, has given the use of eighty-eight acres for the camp, which will be in charge of Mrs. M. E. Hamilton and is indorsed by the National Special Aid Society of 259 Fifth Avenue, where Mrs. Hamilton has headquarters.

There is a demand for women wireless operators, it is said, and twelve can obtain employment at once. Women particularly are preferred as wireless operators in department stores, where there is an increasing demand for them. The girls at the camp will be instructed first by communicating with motor boats on the Sound and as they become proficient there will be larger apparatus installed, and they will communicate with regular stations.

ERRATA

We are calling with much regret attention to the fact that an unfortunate error crept into the advertising space last month. In the advertisement of the Eastern Radio Institute the address should have been 899 E. Boylston Street instead of 399 as it was printed. We trust that the readers will bear this in mind should they try to locate the school.

Summer Working

By S. Kruse

THE tendency to stay and fight the summer static which has appeared for the first time this year, has brought to light a surprising difference in range between stations which have done winter work. With expectations that summer work will become general, this paper has been written. The statements made here are not mere personal opinions, but the essence of notes made throughout the last two springs, as well as the gist of letters received from operators of thirty of the better stations in the Missouri valley. In this connection especial credit is due the operators of 9LO, 9JW, and 9QV.

THE TRANSMITTING

By far the greater part of successful summer work depends upon the transmitting apparatus. In the main, the same points that make for good winter work will also result in an improved summer range. Requirements, however, are much more exacting in the summer. At the best, one cannot hope to work over even approximately the same distances as in winter.

SPARK TONE

There is a widespread opinion that a very high pitched note is desirable for summer working. From the data collected by the writer, this is emphatically wrong. The stock argument for the mosquito spark is the way some 500 cycle set comes in as compared with another set using a 240 cycle generator. That is granted without argument. Nevertheless, it proves nothing. The 500 cycle tone loses a vast part of its effectiveness as soon as it assumes the hissing quality that is characteristic of a very high pitch amateur rotary gap. The imitation 500 cycle note is very pretty to listen to and can be HEARD through no end of static—yet the least bit of static will make READING it at any distance absolutely hopeless. This statement is not idly made. For the past three winters, the writer has been carrying on tests with amateurs using various gap speeds and changing the condenser capacity to get the best radiation at each speed. When possible, the other station has done the same. The results were so uniform as to be monotonous; all tones above 700 sparks resulted in weak signals; tones from 700 down to 500 sparks gave normal results, while tones below 500 resulted in a great increase in loudness of signals. Naturally, the loudness at lower tones is obtained at the expense of using large capacity and operating with a long spark with the consequent noise. These considerations limit the lowering of tone to about 400 sparks.

One surprising result was that the lower tones are not only as easy but actually more easily read through static than the high note. That is for tones not below 500 sparks per second. Below this point the familiar confusion with the X's begins to appear.

Another point in regard to tone, that has not been explained to date, is, that at the same time that high tone signals are "swinging" so badly as to be unreadable, the low tones come in quite evenly and steadily.

I would advise the amateur who favors the high tone to make a series of tests using the best condenser capacity at each speed, and working with someone pretty well out for tip end of his range. It will go hard with the high tone.

SPARK GAP

At the present time there is only one substantial gap on the market and this one was only announced a couple of months ago. The amateur who wants a real rotary must construct it himself. A prime essential is that the gap must run true—within a couple of thousandths of an inch. This at once eliminates the baby series motor operating a brass rimmed rubber disc at a speed up toward 10,000 R.P.M. The only gap worthy of consideration is a massive metal rim milled into deep teeth and mounted on a thick disc of fibre or Bakelite. The insulating disc should be not less than ¾" thick and must be mounted on a metal bushing bored to fit the shaft. A still better construction is to make the gap wheel as a deep toothed gear which is mounted on a polished head or forced on a short length of drill rod and mounted in separate bearings. The drive may be by belt or rubber tube coupling and the rotative speed should be not above 3,000 R.P.M. in any case. Such a gap, if well balanced and used with chisel-shaped electrodes, may be set to about 1/200" and will give an even, useful tone which can be copied through static where the slightly ragged tone of a high speed gap will be hopeless. For a one Kw. set, a gap with a one-inch face and sixteen to twenty-two teeth operating at 1800 R.P.M. is recommended. The diameter may be six or seven inches and

the material brass or aluminum bronze.

GROUND CONNECTION

For some mysterious reason, the ground connection seems to have greater importance when working under adverse conditions. Probably the best ground—better than a water pipe—is a net work of No. 14 galvanized wires, buried in all directions from the station. Ten or a dozen lengths of 80 feet each will do very well. They need not be buried more than an inch or two.

THE RECEIVING STATION

As far as has been ascertained from the experiences of various amateurs, the audion detector is not desirable during static unless the bulb is one which can be brought into a sensitive condition without "spilling." *In general, if the bulb has to be worked with a magnet, it will be hard to operate in static as half the words will be drowned out by the hissing sound of the detector. Galena seems to be the only detector that is both rugged and sensitive enough but even this leaves much to be desired. Perikon will answer if the static is not severe. While the writer's experience has not been extensive with this combination, he believes galena with an audion as an amplifier will be sensitive and rugged to a very great degree.

COUPLING

The receiving tuner must be of such design as will permit loose coupling. This will certainly not eliminate static but will make it less vicious.

SENDING

There is a pretty general agreement that it is necessary to QSZ when the static becomes bad. The rate of transmission should be from eighteen to twenty words per minute, making an actual speed of from nine to ten words. It is well to send the words rather rapidly leaving more than normal space between the words. This enables the reception of complete words between "splashes." A jerky sending is very bad and must be avoided at all costs; it is usually caused by trying to send faster than one is able.

The other extreme is the machine-made, monotonous sending that comes from trying to think of something else while pounding the key. This is even worse than rapid sending as it is simply impossible to remain alert after having such sending droned into the receiver for ten or fifteen minutes.

The ideal sending is clear-cut, crisp, and yet not choppy, with distinct spaces between the letters and more than normal spacing between words. In transmitting long messages, it is a good plan to send them in sections of about twenty words, each section to be followed by "HW ? K." This is replied to by a request for the missing words, or else by "R K" (Received—go ahead). This may not be according to the International rules, but it saves time.

WORKING HOURS

It is a pure waste of time to try to work in the evening or day time. The only possible opportunity is in the morning before 7 A. M. At that time, the ether is often as clear as in winter and bad static is hardly ever encountered unless a storm is approaching.

RESULTS

So far this paper has dealt in generalities. Probably statements of actual performance will be of interest. First, as to the matter of tone. In the winter we hear any number of Ohio stations at Lawrence, Kansas. As spring approaches, these begin to fade out until the last one is the curious throbbing buzz of 8NH. 8NH is an exceptional station, to be sure, nevertheless, it is drowned out by several others with tired tones and more power as long as the winter lasts.

Coming closer home, the same statement in a lesser degree applies to 9NN, GC, (Graceland College at Lamoni, Iowa) and 9LM. In each case, there are other stations nearby which make more noise in the winter because of their superior power, but which are gone from hearing when the violets begin to bloom.

Again, as to the matter of using a good rigid rotary gap at present, practically every station within ninety miles of Lawrence is using some such gap as suggested and in every case with which I am familiar, an increase in radiation and a more readable tone have resulted when the high speed gap was discarded. As both these points are of supreme importance, they cannot be too strongly emphasized.

Now as to the importance of a good ground: At 9LQ, ranges of 300 to 350 miles were obtained last winter with a water pipe ground, but at the approach of spring, the range dropped badly. It was then that a net-work ground was installed, and at once letters from stations at 500 mile distances began to arrive. In most cases, these people were not heard here, although they used considerable greater power than the little 200 watt Packard at 9LQ.

*Have any of these experimenters tried the static leak suggested by Mr. Cole in the May QST?—Editor.

Another example is 9DM. At this station, a net-work of copper and iron wires was buried just under the sod. Up to that time, no greater range had been covered. After the installation of the net-work, steady communication with 8PP was established. Since then, the power has been increased to a kilowatt. It is not necessary to introduce 9DM to anyone within 900 miles. Here too, the range is very little affected by the summer. Then there is 9LO, which station has done a tremendous amount of relay work during the past winter. The range of this station has been little affected by summer weather and daily work was carried on with 5ZC until late in April. 9LO is located in a hollow where the ground is always damp, affording excellent connection.

During the last five years, we have found that the radial ground is very good for portable sets which we have taken into the field during the summer. Good results were obtained by using a "ground" consisting of a few hundred feet of loose wire or even a wire fence; whereas, a ground consisting of rods driven into the earth gave very poor results. This was all summer work.

Finally, a few illustrations as to the proper time to operate. Last summer and this spring, almost daily, conversations were carried on between 9LQ, 9JW, and 9QV. The distance is twenty-five miles and the power ¼ Kw. in each case. Not only was it impossible to work during the evening, but often the QRN was so bad that we could not even HEAR each other. At 7 A. M. we could work without a break or repeat going at about sixteen words per minute and often using only sixty watts at 9LQ. To do this, only one gap was used in the rotary and a lamp of sixteen candle power was placed in the primary lead of the transformer. The spark was hardly visible and would have been absolutely useless if we had tried to work through the evening static, yet 9JW reported QRK each morning.

SUMMER RELAY WORK

It is usually taken for granted that relaying is impossible during the summer. Let us take an illustration and test this assumption. Suppose we wish to work from Topeka, Kansas to Chicago. From a pool of the operators in the Central States, the following route has been compiled as being most reliable:

Topeka, Kansas, 9QV and 9JW.
Lawrence, (9XP), 9LQ, 9QD, (9DM).
Kansas City, 9LO (9XK) 9TP, 9EP, 9MQ.
Lamoni, Iowa, GC, 9WU.
Duquoin, Ill., 9FY.
Chicago, 9IK, 9EV.

Perhaps this does not seem to be a very good route as there are spaces of considerable length. That is because this route has been picked by experience, rather than by reference to the map. All the stations but those in brackets are reliable both as to class of work and working hours. The bracketed stations are good, but have irregular hours. As to the solidity of the route—the following pairs of stations can work in daylight in summer weather:

Topeka—Lawrence.
Lawrence—Kansas City.
Kansas City—Lamoni.
Lamoni—Duquoin.

It seems from this that the message can be gotten to Duquoin with no trouble, and as a matter of fact, Kansas City is not needed when 9DM or 9XP are on, as the work may be direct to Lamoni then. It does not seem unreasonable to expect a message to reach Chicago with not over one other station and the chances are very good that even this one extra station will not be needed. Certainly, the routing here will be workable in the morning.

From this illustration, it is seen that the supposedly impossible job of relaying in the summer is not hard at all, here in the Central States; while for the east it should be quite easy, especially in the Great Lakes region where one kilowatt stations are numbered by the dozen and score. It must be admitted for the Middle West, i.e., for the states of Montana, Wyoming, Colorado, Utah, and New Mexico, the matter is not quite so easy. Stations are scarce out there, and winter work is the best that can be expected at this time. The West seems to have enough good stations so that relaying there may be done at any time.

CONCLUSION

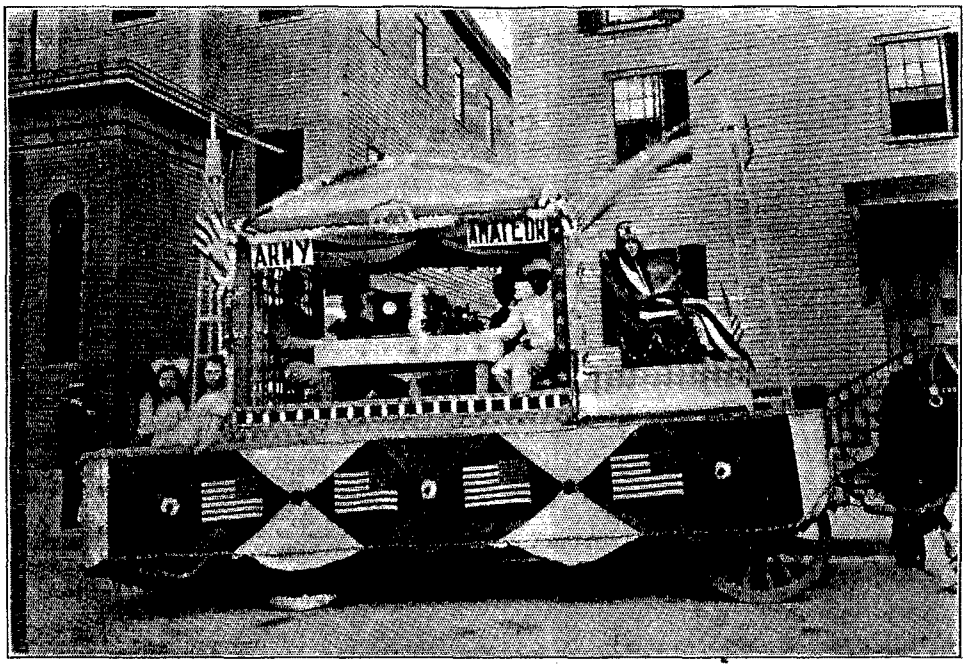
The general conclusion to be drawn seems to the writer to be: We have been losing a good portion of the year simply because the conditions of former years were such that summer work was difficult or impossible. Those conditions have passed or are passing; it is my sincere wish that a concerted effort be made to do summer work along the A. R. R. L. relay routes so that next summer, we will find them in such condition that Trans-continental relays will be as feasible on Independence Day as at New Year's.

LEAGUE HELPERS

Following the ideas suggested in the July issue of QST by Mr. Barrett, we have received the following contributions:

Don't mention My name $2.00
3AES 1.00

A Wireless Float



The photo shown herewith depicts a float which appeared in the Fourth of July Preparedness parade in Newport, R. I. The float was designed by Lloyd Manuel and was constructed by himself and his brother. It was suggested to the Committee in charge of the celebration who eagerly agreed to finance the display.

The float measured sixteen feet long by six feet broad and the towers were nine feet high. Between the supports was stretched a horizontal antenna. The receiving sets comprise the regular apparatus used in stations 1TD and 1TG. The two best amateur sets of which Newport can boast. For transmitting, an auto buzzer (vibrator) was used—also a one-inch spark coil across the gap of which was shunted a Murdock condenser. The spark could easily be heard a thousand feet in open air.

The young lady who took the part of Columbia was Miss Ruth F. Weaver. Remarks to the effect that she was the nicest Columbia in the procession have since been frequently heard. The children riding on the back were Misses Anna Pierce and Helen Brice. The part of the Army operator was impersonated by Arthur W. Manchester; the Navy was done by Harry Tilley; the Commercial by Charles G. Cook (which made him so proud that since he has been wandering forth with a cane); while the Amateur part was taken by the instigator of the outrage—Lloyd Manuel.

The better part of two weeks was spent in planning and building the float, but it was an effort well worth while if one is to judge by the very frequent applause which greeted it along the line of march.

(Photo courtesy Kershner).

Suggestions on Message Form and Transmission

By Lindley Winser, Western Correspondent

I believe a few words on these topics, to the end of standardizing the handling of relayed messages, would not be amiss. It is my intention to take the methods used in commercial work and adapt them to the needs of amateur work. My experience has been that each of us has either a favorite form, differing from everyone else's, or no form at all, for the transmission of his messages and this often confuses the receiving operator considerably, especially when trying to copy directly on the message

blank. The Navy and the different Commercial Wireless companies each have their own particular message formation, which is invariable. Why not an American Radio Relay League formation, also invariable? A proposed form follows, being written exactly as it is to be transmitted:

hr nr 1 ck 16 losangeles 820 pm 3rd via 6zw to mr john jones
1352 eddy st
sanfrancisco cal—...—
best regards will be with you soon—...—
harry

Expanded this is: Hear message number 1, check (number of words, including address, body and signature) 16, filed at Los Angeles at 8:20 P. M. on the 3rd day of the current month and sent via 6ZW (being the station from whom the message is being received whether it happens to be the only station who relayed it or not. If sent direct from filing point to destination the "via" will be omitted) To Mr. John Jones, 1352 Eddy St., San Francisco, Cal., double dash, Best regards. Will be with you soon, double dash, signed, Harry.

It will be noted that absolutely no punctuation other than the signal indicating "double dash" used to separate the body from the rest of the message, is indicated in the transmission, also that there are no such things as capital letters in the Continental Morse Code and that the proper names are run all together, indicating that they are to be counted as one word.

The word "date" may be used in place of the figure indicating the date if the message is being sent on the same day as it was filed. Both the word "date" and the figure should not be used, it wastes time. Of course, in copying the above message or any other, the necessary capital letters and punctuation will be put in except that no punctuation is ever needed in the body of the message.

A great many operators seem to fail to recognize the value of the "check" of a message in finding mistakes and as a result they are often careless in counting the words to begin with, also many may not understand the correct or "cable count" method of counting. Taking the above message, the count begins with the word "mr" and continues through the message, including the signature and counting the street number as one word and the name of the city as one word: In case any single word in the message contains more than thirteen letters it is counted as two words. A quick method of finding the trouble when the sending and receiving operators fail to agree on the check, is for the sending operator to transmit the first letter of every word counted and let the receiving operator compare.

Another point to remember is to be sure and send every message exactly the way the person filing it gave it to you, that is, if any words are misspelled, misspell them when you send the message and do not abbreviate any words in a message, cut them down all you wish when conversing but spell in full in every message unless given to you by the sender in abbreviated form.

OBITUARY

Mr. George E. Chamberlain, of Sawtelle, Cal., an American Radio Relay League member, was drowned when the steamer "Roanoke," of the North Pacific Steamship Company broke in two and sank off Port San Luis, Cal. during a storm on May 7th.

Absolutely no hint of the disaster was given until the day after its occurrence when a boat containing three survivors in a state of complete exhaustion, appeared off the San Luis breakwater.

Mr. Chamberlain was acting as wireless operator on the Roanoke and was making his first voyage. It was reported that the auxiliary dynamo on the vessel was out of commission when she left San Francisco, and that on the day of the accident, the main machine had been dismantled for repairs, thus accounting for the failure of the radio equipment. Mr. Chamberlain wrote the poem which appeared on Page 35 of the February QST.

MONTHLY REPORT OF TRUNK LINES "C" AND "D"

A. A. Hebert, Manager

The routing of Trunk Lines "C" and "D" has been completed, and it is believed that by September communication can be carried through to the most distant points. Below is the arrangement of the two routes:

LINE "C".

Boston. Mass. to Key West, Fla.

BOSTON, MASS.
1LE, C. A. Corney—1ZD, S. W. Dean.
MANSFIELD, MASS.
1IH, C. C. Fuller.
PROVIDENCE, R. I.
1ZP. Ralph C. Watrous—1UQ, K. E. Barth.
WESTERLY, R. I.
1TL, Carl O. Flint.
NEW LONDON, CONN.
1DD, Paul Robillard.
MIDDLETOWN, CONN.
1WW, Philip A. Bailey.
HARTFORD, CONN.
1ZM, Hiram Percy Maxim—1ZT, C. D. Tuska.
WATERBURY, CONN.
1DJ, Geo. E. Cole.
ANSONIA, CONN.
1VC, Joseph Zander.
PORT CHESTER, N. Y.
2ZP, John W. Hubbard—2AHN, L. H. Marshall.
NEW ROCHELLE, N. Y.
2SX, Geo. C. Cannon.
PORT WASHINGTON, L. I., N. Y.
2FH, Jacob Weiss.
YONKERS, N. Y.
2IB, Walter Feeney — 2IK, Martin Jensen.
NEW YORK, N. Y.
2JD, Arthur R. Boeder.
LEONIA, N. J.
2ZE, Paul F. Godley.
LAKEVIEW, N. J.
2IM, L. L. Spangenberg.
NUTLEY, N. J.
2ZH, A. A. Hebert.
NEWARK, N. J.
2AQ, D. N. Corson—2AAZ, V. F. Pennell.
ELIZABETH, N. J.
2ES, Robert Campbell, Jr. — 2WG, Harry C. Lemkie.
ROSELLE PARK, N. J.
20J, Robert H. Horning.
WESTFIELD, N. J.
2MM, Chas. E. Apgar.
NEW BRUNSWICK, N. J.
2CG, F. K. Shield, Nelson Dunham.
TRENTON, N. J.
3DH, Harry E. Stahl, Jr.—3DC, Donald M. Bergen.
BURLINGTON, N. J.
3OH, Lewis Levy.
ABINGTON, PA.
3AFA, Chas. W. Weber.
BALA, PA.
3QZ, Chas. A. Service, Jr.
PHILADELPHIA, PA.
3TQ, Edward C. Andrews—3XP, S. Delbert, Jr.—3JN, A. L. Frankenfield.
ST. DAVID'S, PA.
3ZS, Chas. H. Stewart.
PENN'S GROVE, N. J.
3FR, E. Craig Densten.
WILMINGTON, DEL.
3TN, Silas N. Venn—3FO, Dr. W. G. Hudson.
BALTIMORE, MD.
3RD, R. G. A. Dimling—3ME, Chas. A. Lamdin.
ARLINGTON, MD.
3QV, Robert S. Hall.
LAUREL, MD.
3KI, John S. Stanley.
HYATTSVILLE, MD.
3XR, J. Harris Rogers—3IG, Harry H. Lyon.
WASHINGTON, D. C.
3ZW, W. A. Parks — 3PR, E. Frank Ramsey.
?
?
?
RICHMOND, VA.
3ZK, Frank S. Splatt—3ST, Ralph R. Chappell—3SM, A. Elmo Burnett.
NEWPORT NEWS, VA.
3TY, Julian E. Krone.
PORTSMOUTH, VA.
3SZ, L. C. Herndon — 3TV, Irving Blanford.
SOUTH HILL, VA.
3KA, N. G. Smith.

TOWNSVILLE, N. C.
4CV, James E. Smith.
RALEIGH, N. C.
A. & M. College.
WILMINGTON, N. C.
4AF, Arthur L. Humphrey—4BA, Marion C. Avant.
SUMMERVILLE, S. C.
4BK, Mayrant Simons.
CHARLESTON, S. C.
4CB, Wm. F. Allston—4YC, S. C. Military Academy.
SAVANNAH, GA.
4XL, Manning White—4CG, J. A. Hussey.
WAYCROSS, GA.
4CN, Robert L. Falks.
JACKSONVILLE, FLA.
4AC, Elmer L. Rice—4AZ, Thos. R. Dunk.
GAINESVILLE, FLA.
4AK, Chas. T. Whiting.
TAMPA, FLA.
4AW, Patrick H. Wall—4CT, Victor C. McIlvaine.
ST. PETERSBURG, FLA.
4CE, Albert L. Conn—4CU, Glenn L. Allen.
MIAMI, FLA.
4BF, Seymour Dane — 4AQ, Wm. A. Marsh.
COCOANUT GROVE, FLA.
4AU, Hugh M. Matheson.
KEY BISCAYNE. FLA.
4BL, H. M. Matheson.
KEY WEST, FLA.
4XA, Geo. W. Almour — 4AB, Isador Meltzer.

Secondary Route Between Washington and Jacksonville, Fla.

WASHINGTON, D. C.
3ZW, W. A. Parks.
PROFFIT, VA.
3AHF, Clarence B. Lewis.
?
MINERAL, VA.
3KC, Thomas F. Flynn.
ROANOKE, VA.
3VF, E. R. Tompkins—3WE, John F. Wohlford.
DANVILLE, VA.
3RO, W. T. Gravely.
WINSTON-SALEM, N. C.
4CK, Chas. W. Clodfetter.
GASTONIA, N. C.
4CA, Kenneth Babington.
ATHENS, Ga.
4AA, Wilbur B. Pope.
OXFORD, GA.
DECATUR, GA.
4CO, Geo. A. Howald.
KIRKWOOD, GA.
4AL. Chas. E. Kruger.
ATLANTA, GA.
4CL, F. F. Merriam—4AM. R. A. DeVore — 4BY, Max A. Herzog — 4XG, Georgia School of Technology.
COLUMBUS, GA.
4CC, R. A. Bowles—4CH, Stephen G. Brannon.
OCILLA, GA.
4AX. Clarence M. Gordon.
WAYCROSS. GA.
4CN. Robt. L. Falks.
JACKSONVILLE, FLA.
4AC. Elmer L. Rice—4AZ, Thos. R. Dunk.

LINE "D"

Between New York City and New Orleans, La.

NEW YORK CITY
2JD, Arthur R. Boeder.
LEONIA, N. J.
2ZE, Paul F. Godley.
LAKEVIEW. N. J.
2IM, L. L. Spangenberg.
NUTLEY, N. J.
2ZH, A. A. Hebert.
CHATHAM, N. J.
2ARF, J. J. Allen.
MORRISTOWN, N. J.
3WN. John P. Gaty.
CLINTON. N. J.
3UC, S. Van S. Howell—3AHW. Walter S. Leigh.
BETHLEHEM, PA.
3SS, Emil B. Brany—3JK. Stanley E. Schnable.
READING. PA.
3QD. Frederick J. Andersen.
HARRISBURG. PA.
3PB, Daniel H. Zorger—3AGS. Alvin G. Michael—3KX, G. Webber Knight.
STATE COLLEGE, PA.
8XE, Pennsylvania State College.
?
?
PITTSBURGH, PA.
8YI, University of Pittsburgh—8RN, Allen Altman—8AKA, R. C. Bender—8AEK, L. G. Young.
WHEELING, W. VA.
8ZW, John C. Stroebel, Jr.—8BF, Roy B. Jarvis.
FAIRMONT, W. VA.
8AEY, Floyd D. Morrow.
ATHENS, OHIO
8YP, Ohio University.

GALLIPOLIS, OHIO
8YP, Ezra L. Saunders.
PORTSMOUTH, O.
8SR, B. C. Locke.
IRONTON, O.
8UM, Paul D. Flehr—8ZG, Henry W. Campbell.
HUNTINGTON, W. VA.
8ANA, D. S. Johnston — NNC, Guy Chambers.
ASHLAND, KY.
9SW, Frank E. Gammon.
LEXINGTON, KY.
9YL, Otto Holstein.
SOMERSET, KY.
9UC, Harry L. Loveless.
KNOXVILLE, TENN.
MY, May Powell.
CLEVELAND, TENN.
5ZH, W. O. Horner.
?
?
HUNTSVILLE, ALA.
5BS, Robert M. McLain.
BIRMINGHAM, ALA.
5AM, Harold S. Brownell.
BESSEMER, ALA.
5CR, Geo. D. Cockran.
AUBURN, ALA.
5YA, Alabama Polytechnic Institute.
MONTGOMERY, ALA.
5ZI, Wm. H. Amerine.
?
?
MOBILE, ALA.
5ZM, Ben W. Martin.
?
FRANKLINTON, LA.
5BB, P. E. Greenlaw.
COVINGTON, LA.
? St. Charles College.
NEW ORLEANS, LA.
5CI, W. J. King—5AT, Frank M. Stone.

Secondary Route, Between Pittsburgh and Lexington, Ky.

PITTSBURGH, PA, 8YI, etc.
STEUBENVILLE, OHIO.
8LM, B. F. Collins—8ABD, Walter L. Myers.
CANAL DOVER, OHIO.
8ZX, Harry S. Weber.
CAMBRIDGE, O.
8CL, Roy W. Waller.
NEWARK, O.
8AGF, Carl G. Howard.
COLUMBUS, O.
8ER, Louis W. Elias—8YO, Ohio State University.
SPRINGFIELD, O.
8FH, Wm. Haynes—8ZM, Ross McGregor.
DAYTON, O.
8LT, Stanley Copp
8LJ, Carl Linxweiler.
WAYNESFIELD, O.
8PI, James M. Day.
HAMILTON, O.
8ZU, Doran Bros. Elec. Co.
CINCINNATI, O.
8ZF, Henry M. Rubel, Jr.—8PO, J. M. Schaaf—8RY, Carl P. Goetz.
NEWPORT, KY.
9BN, John H. Flynn, Jr.
COVINGTON, KY.
9QJ, Kuper Hood, Jr.
BELLEVUE, KY.
9PZ, Thos. Tallentire.
IRONTON, O.
8UM, Paul D. Flehr—8ZG, Henry W. Campbell.
LEXINGTON, KY.
9YL, Otto Holstein.

As will be noted by the question marks, there are still several gaps which we desire to fill, and your manager would like very much to hear of any stations, which could be used to fill in the gaps.

Practically all of the stations mentioned are already members of the League — to those owners who see their appointments, but are not members we would very much like to hear from them—as we are anxious to increase our membership.

Now that the routes are completed it is to be hoped that every one will take interest in the development of our relay work, and all work with the end of increasing the efficiency of each other's stations.

I desire to thank all those who have written me in connection with Trunk Line work, and would like to hear from others who may know of something of interest to all.

Arthur A. Hebert,
246 Highfield Lane, Nutley, N. J.
July 8th, 1916.

MONTHLY REPORT OF TRUNK LINES "A" AND "E"

R. H. G. Mathews, Manager.

The manager of trunk lines A and E reports that he is busy lining up all stations on his routes, so that he may begin active relaying about the first of September. He requests that all amateurs on these two routes write to him and advise him as to the part they can take in the work. This refers both to members and non-members of the League. Any suggestions would be appreciated.

MONTHLY REPORT OF TRUNK LINES "B" AND "F."

H. C. and L. F. Seefred, Managers.

The managers of lines B and F are very busy working up their trunk lines so they may have their relay stations assigned by September 1st of this year.

TRUNK LINE F

San Diego, Calif.
Los Angeles
Bakersfield
Centerville
Richmond
Ione
Reno, Nev.
?
La Grande, Ore.
? Wash.
Vancouver, B. C.

TRUNK LINE B

San Francisco, Calif.
Ione
Reno, Nev.
?
Salt Lake City, Utah
?
Denver, Colo.
? Neb.
? Kans.
? Mo.
? Ill.
Chicago, 9IK

It begins to look encouraging, as we have received letters from the following, who wish to take active parts in relaying: 6SC of San Francisco, 6SL of Salt Lake City, Utah, 9EP of Kansas City, Mo., and KDP of Portland, Ore.

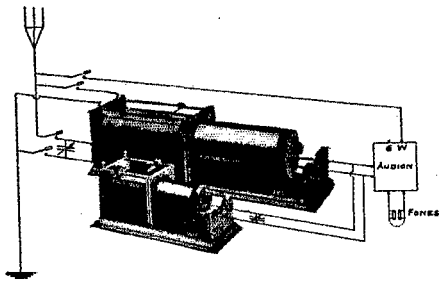
We should like to hear from all readers of "QST" who can work on either of these lines, whether they are League members or not. Write soon so we may be able to make a test as soon as conditions will permit.

The Chambers Aerial Circuit for Undamped Waves

By E. C. Andrews

It was my privilege to witness a demonstration before the Wireless Association of Pennsylvania at one of its recent meetings and later at my own station. It occurred to me that possibly a description in QST would interest its readers especially as it pertains to something that every experimenter has wished to accomplish, i. e., to receive undamped waves on the loose coupler. A certain amount of success has been achieved by a few enthusiasts, but not without considerable expense for large and cumbersome oscillating coils and several extra variable condensers. Even then, the results have not been satisfactory at all times.

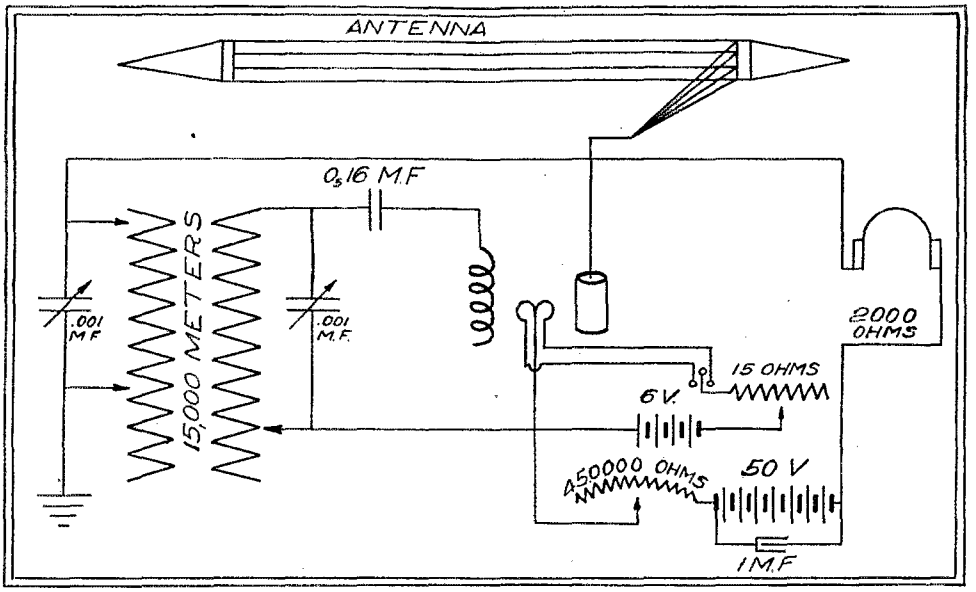
The demonstrations mentioned were given by Mr. F. B. Chambers, a member of the Technical Committee of the W. A.



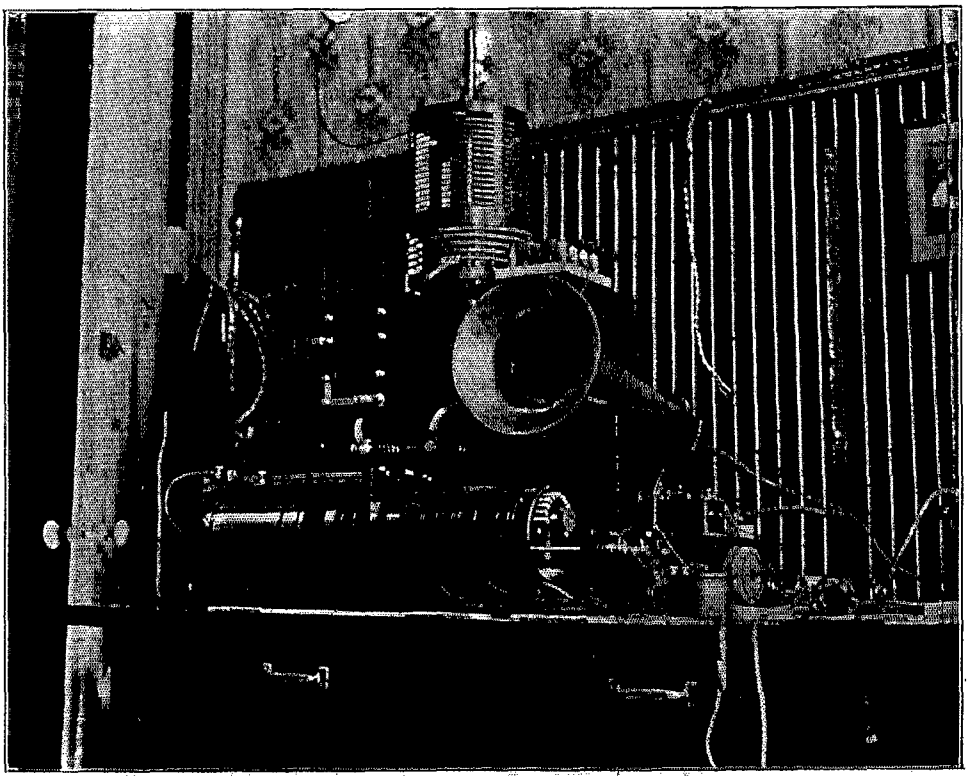
of P. of which the writer is also a member. By the courtesy of Mr. Chambers, the following data of the construction and hook-up is given.

First, the following pieces of apparatus were used during the demonstrations: A large inductive tuner, an audion detector, one pair of 2,000 ohm phones and two variable condensers, making in all five pieces. The antenna at the first demonstration was 75 feet long and 85 feet high with ten wires on 24 foot spreaders. The second antenna was 75 feet long, 50 feet high and had six wires.

The most important part of the experiments was the dimensions of the large tuner. Still, the tuner would have been of little use had not Mr. Chambers discovered the new circuit which he has called "Chambers Double Connected Aerial Circuit." The use of this hook-up causes the audion to have the same characteristics as it has when used with oscillating coils, etc. One feature of the oscillating audion when using the large inductances is the ease with which the body throws the circuit out of tune. This is not so with the new hook-up. It is not vitally effected by the approach of the body and can be used very satisfactorily during heavy static. All who have had experience with the other methods know how easily static upsets the resonance in the coils used. They must be adjusted all over again. With the Chambers circuit, there are no coils and only the usual number of variable condensers are required. This does away with coils and windings which give a large amount of resistance to the feeble impulses and consequently, stronger signals may be received.



The dimensions of the tuner are as follows: Primary tube, 14 inches long, 7 inches in diameter, wound with the No. 24 enameled wire. Secondary tube, 13½ inches long, 6 inches in diameter, and wound with No. 30 enameled wire. Sliding



contacts are used on the primary and the secondary has ten taps to a switch. Neither silk nor cotton covered wire should be used as it is a well-known fact that both absorb moisture which would be detrimental to weak signals. A fireat many feel that enameled wire has some kind of a false capacity, but some experimental work suggests this a great mistake. Do not use taps in place of the sliding contact on the primary as the capacity losses in taps greatly diminishes the strength of weak signals. For strong signals, it makes very little difference what kind of wire is used or whether taps or sliders are used.

Where it is desirable to use a small coupler at times for the smaller wave lengths of spark signals, the accompanying hook-up will facilitate this; and with a little practice with the S. P. S. T. switches quite as efficient results will be obtained without the necessity of changing the connections from one coupler to the other.

The adoption of this new Chambers circuit in connection with the large tuner will no doubt be a means of developing the reception of undamped waves to a phenomenal extent. The Technical Committee of the W. A. of P. will be pleased to learn the results of any experimenters who use this circuit, and further data the writer would be pleased to give. His address is 22nd and Morris Streets, Philadelphia, Pa.

Arc Light Troubles and Their Correction

A Method of Getting Rid of Induction

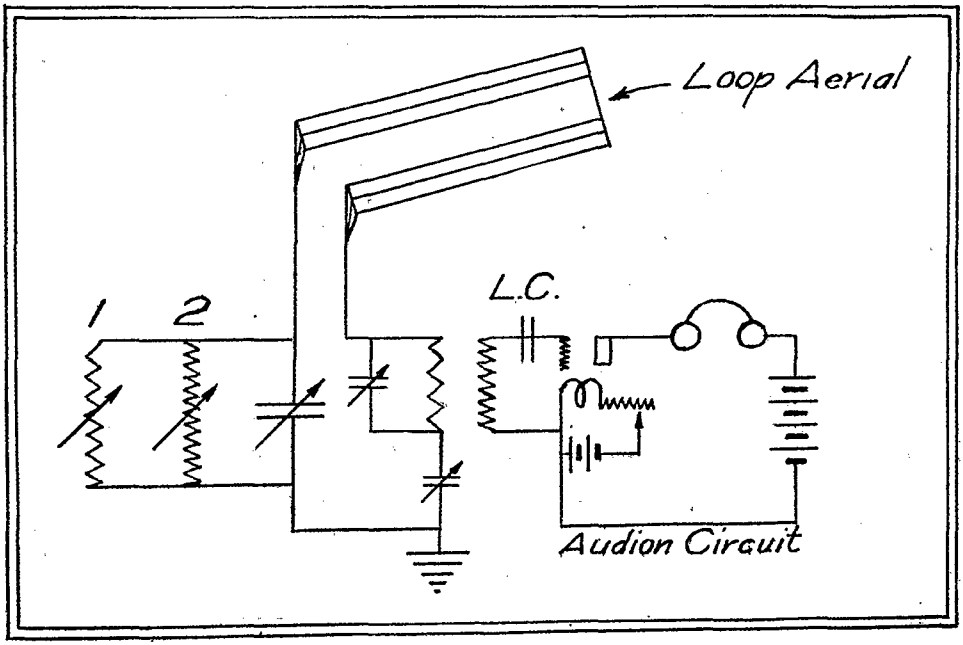
By Carl Linxweiler

Up to a few weeks ago, I had never been able to do any receiving in the night time. This was because of the unmerciful arc light interference. At some time or other, the majority of readers have probably been troubled in the same manner as I, but my interference was continual. It was not a hum which I heard, but a sound of a generator starting up. I could hear it start before any arc was lit. I had almost abandoned hope because I had tried nearly every remedy known to the trade. I had run one wire aerials in every direction without results. Finally I came across this hook-up in an old magazine.

Inductance 1 is a single slide tuner wound with No. 22.

Inductance 2 is a loose coupler secondary 8"x4¾" in diameter, or any other high inductance.

On trying this out with galena, I found the arc was hardly noticeable. With the audion, it was a little more pronounced. I believe it would repay anyone who has trouble of this kind to try out this hook-up.



UNCLE SAM'S WIRELESS

Since our last issue, the President of the United States has called out the National Guard of all the States in the Union. This means the Signal Corps of each state, and this in turn means the portable wireless sets. Here in Connecticut, we had a good Company of the latter made up from members of the local radio club. Mr. David Moore, one of the original Governors of the American Radio Relay League, is a member, and we had the honor of telling him good-bye before he swung onto his troop train and started for the Mexican border with his mates and their outfit.

Before 1ZZ, by which Mr. Moore is better known in the East, left, he told us several things about the Government army wireless organization. The attitude of the Government, particularly the Army, is that we amateurs are all right as far as we go, but the trouble is we are all located in the big cities where the machinery of civilization is fully developed and at hand. The telephone and the telegraph are at hand, and only in extraordinary emergencies could they see where we could be of use. If, however, we amateurs were out on the deserts and in other inaccessible places where there are no telephones nor telegraph lines, we would be exactly what they are looking for.

The portable sets in use seem to be very well worked out indeed. There are two kinds, at least here in Connecticut. One is one-quarter k.w., the power being generated by two men grinding a crank. A fixed and quenched gap is used. In the other set, there is two k.w., generated by a gasoline engine, and is the real thing. The masts are of course telescopic. The whole business can be set up and operating in less than five minutes from the time the wagon arrives.

An interesting suggestion from one of the officers, was that we urge the amateurs of the country to arrange their transmitting and receiving sets so that they can be picked up and loaded onto a motor truck. It is thought that many cases will arise where this would help if it could be done. It is a new idea, and a good many of us will no doubt keep it in mind in making sets in the future.

We are told that the Army wants radio operators badly. Anybody who is a pretty good operator would be grabbed at. The demand exceeds the supply at this writing. A government license is not necessary. If a fellow can operate, he will do. Any of us in the various states who want some experience, could not do better than communicate with the War Department at Washington, and offer their services in the Radio Department of the Signal Corps. When the disturbance is over, they will be veterans from the regular service, and they will have experiences which will be invaluable all the rest of their lives.

OURSELVES

The attention of the fraternity is respectfully directed to the ornamental heading at the top of this page. When this cut was prepared we were very busy. We confess we ordered the cut and we also confess we approved the drawing from which the cut was made. But. honest and true, fellows, we did not realize fully what we were doing. If the figure on the right is a picture of us, and the figure on the left

is a picture of our helper, we are guilty of chucking the biggest bluff yet chucked on the North American continent.

First of all, we never had such a good looking coat as the chap in the cut. Next, we don't look so much like a distinguished statesman. Next, we have no phone on our desk. There is not room. But, if the filing pin and the papers impaled upon it are unpaid bills, it is us. When it comes to the other side of the cut, we have thought long and seriously. To the best of our knowledge we do not remember having met the lady. The table looks something like what we call "our desk." The filing case suggests one in the President's office, where he keeps some of his important American Radio Relay League papers. It suggests nothing we own. By no stretch of the editorial imagination can we see similarity between the pile of second hand transfer cases which we call "our filing case," and the natty looking outfit shown in the picture. And as for the vase with the two flowers, we know the whole business must be some pipe dream.

When the end of the month comes around, and we have a wagon load of magazines to wrap and address, we are favored by the presence of a certain radio lady. She is a good looker all right, but honest boys, she does not present the effect given above. Some day, when QST gets to be what we hope to make it, we may have an office that looks like the cut, and we may look like the handsome gent with the graceful attitude and the good looking coat, and we may have a peach like the one shown, and a bunch of roses in a vase and a waste paper basket which will stand up straight; but this day has not yet come.

CONTENTS OF QST

Have you fellows noticed the way we are growing? As we write this, after a square meal, and the consciousness that our belt is comfortably tight, and after a contemplative review of our July issue, which we feel was a cracker jack, even if we do say it ourselves, we cannot but think that we are really coming along, and are some stuff after all, a certain District Radio Inspector to the contrary notwithstanding.

Things are beginning to come our way, and if the QRM is not too bad, we are going to amount to something. The technical articles that are being sent in to us are really the best we have ever seen from the standpoint of a high grade amateur. They are not ultra-highbrow, and yet they are not of the "How to make it" variety. They really help understand the theories we amateurs are interested in. They are not prejudiced in favor of or against any particular make of apparatus or any particular company. They are helpful, in other words, and without any strings attached. We seem to be able to attract the delightfully humorous and practical writer also. Some of the humorous yarns which we have printed during the past six months, are not to be found in any other magazine. They are written by the fellow who has actually been there. You can tell it from his knowledge of details. It seems to us it beats the fiction business all to pieces.

And have you noticed our advertising? Just cast your eye over it and note that the stuff is all of the better class, and that there are no cheap imitation outfits built to sell to the school boy and not built to relay a msg. A lot of the latter has tried to break into the columns of QST, but we are old birds at this game and we know that our membership is not the one to take any interest in bits of tin and wire, nickel plated and mounted upon a piece of polished birch, all of which we take to be facts notwithstanding that that dinner was a good one and our belt feels very comfortable.

SUMMER WORK

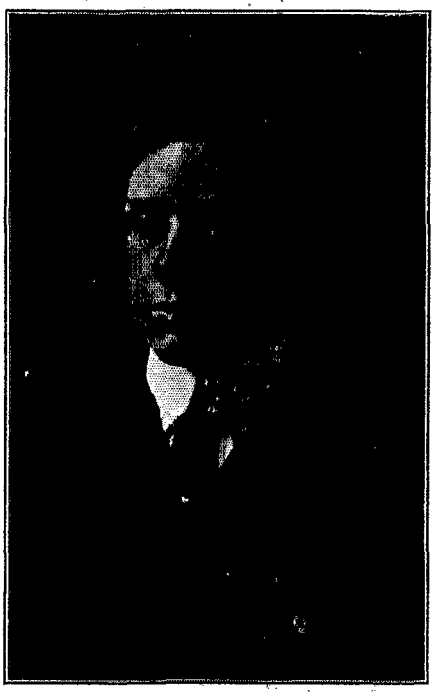
Summer certainly has a quenching effect upon the quantity of relay work. When we get so tired we cannot pound the typewriter any longer, nor answer another letter from the fellow who wants to know how to join the League, nor think of another argument why Smith and Jones should advertise in QST, we go upstairs and put on the phones and listen in. On the occasions, it is very apparent that the amount of traffic being handled is away below what it is during the winter. We hear plenty of the local stations going, even on the hottest nights, which surprises us. There is much less long distance work going through however.

It by no means has ceased, because frequently we have heard our call with a QSR, and we have been able to handle several msgs. bound for points both east and west. As static is unquestionably worse this summer than for some summers past, it is not easy to work such long distances as is customary, but relay work does not die even in the summer. When Fall comes, our District Managers will begin again on the regular test messages Monday and Thursday nights, and they promise us big things. Many of the gaps have been already filled, and Trans-continental relay work will undoubtedly be a regular thing twice a week.

Who's Who in Amateur Wireless

Beginning with this issue we hope to publish each month two pictures of amateurs who have become known by call letters. This will draw us all closer together. We often are curious as to just what the other fellow looks like; here's a chance to see.

Editor.



DEAN A. LEWIS

We are very fortunate to begin this department with a picture of Dean A. Lewis. Mr. Lewis lives in Northampton, Mass. and his station 12L is the most heard of one in all the U. S.

Mr. Lewis is 21 years of age and for the past year has been attending the University of Michigan. While he was there other operators were in charge of 1ZL. Mr. Lewis operated 8XA and had no trouble in communicating with his own station in Northampton. He has been a holder of a First Grade Commercial License for two years and has been interested in radio work for about five.

An operator on ship a little south of Key West heard 1ZL, some Record! Mr. Lewis has been in the League since its organization and last winter over 400 messages were handled through 1ZL. Aren't you glad to know him?

C. D. TUSKA

When the Editor suggested this Department to one amateur, he was told: "Put your own in first, then ask for mine!" There was little left to do, so here he is: Your Editor, C. D. Tuska lives in Hartford, Connecticut and operates 1ZT when he isn't working nights on QST.

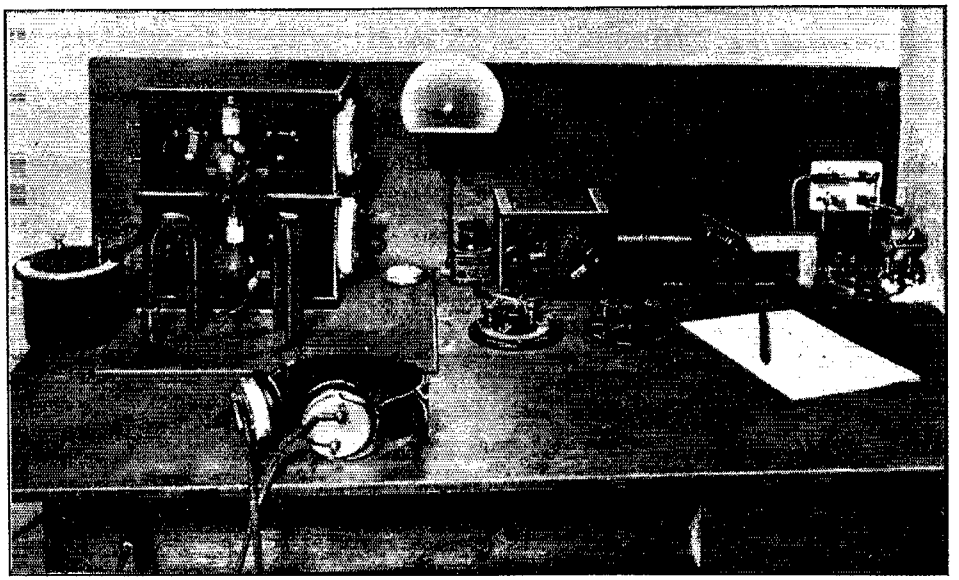
The Editor is a student at Trinity College and certainly has to hustle to keep up his work as Secretary of The American Radio Relay League and QST. He is an Associate Member of The Institute of Radio Engineers, and last year was Instructor in Radio Telegraphy at the Y. M. C. A. in Hartford. He hopes you will pardon his irregular operating hours and remember he is a busy individual. Wireless has held his interest for nine years and for the past three he has held a First Grade Commercial License. The Editor feels he is getting to know all the readers and hopes you are becoming acquainted with him.

Radio Station 8AEZ

M. B. West, Lima, Ohio.

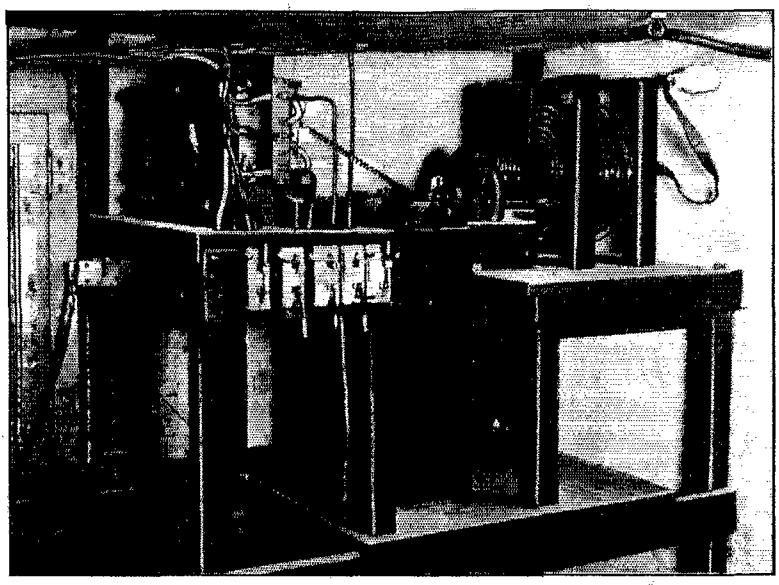
Antenna.

The antenna of this outfit is of the "T" type made of six No. 12 copper wires, 76 feet high and 78 feet long. The lead is made by twisting together all six wires and running directly to the sending set. All joints are made with copper sleeves. Iron pipe masts set in the top of Telephone Company's poles form the support. The ground connection is six feet long and consists of six No. 12 copper wires soldered to the water pipe.



SENDING SET

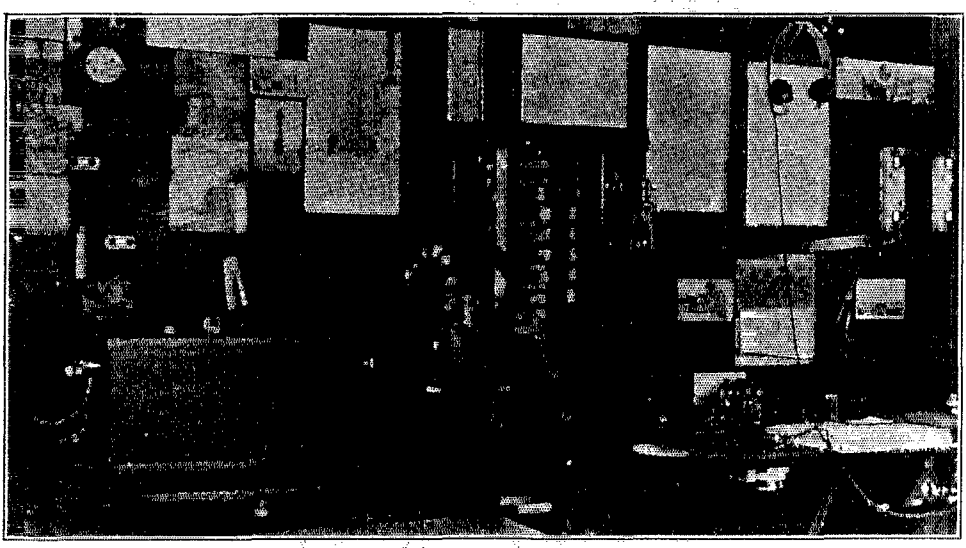
A three quarter Kw. transformer, eighteen 10"x14" plates of windshield glass 3-16" thick coated with 8x12 tinfoil with well-made connections immersed in oil forms the sending condenser; a rotary gap consists of an 8" Bakelite disc mounted on a short shaft and driven by a belt from a small motor at 4,000 R.P.M., four studs and four stationary electros, two on each side of the disc connecting to the condenser terminals, the rest of the set consists of a pancake type oscillation transformer as shown. This novel rotary connection gives four breaks or sparks in series and is very efficient as the call 8AEZ testifies.



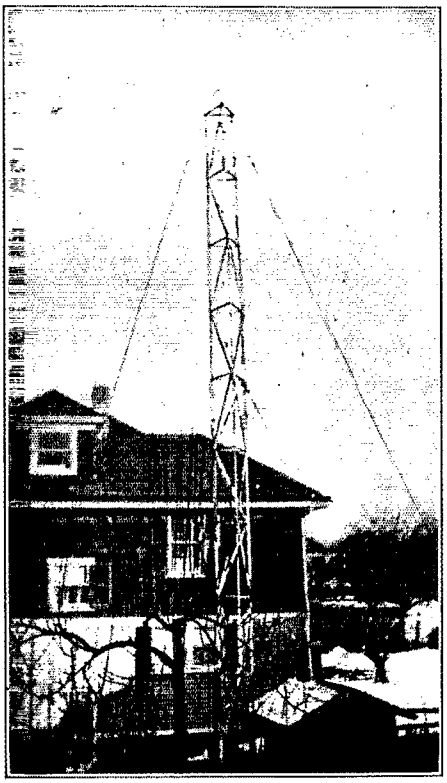
RECEIVING SET

In the room above the sending set, the receiving outfit is located which consists of a small loose coupler, series condenser, a small secondary condenser and one-step audion amplifier. Switches on the operating table control the starting of the motor and the power circuit as well as changes in power.

The Radio Outfit of W. A. Nash

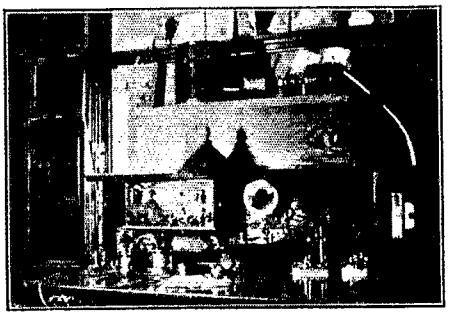


W. A. Nash of Biddeford, Maine, has sent us this photograph of his outfit. The sending set comprises a Blitzen ½ Kw. transformer, glass plate condenser in oil, twelve point rotary gap which is run at 2800 R.P.M. and follows designs suggested in QST. The geographical location of this set has prohibited as much relay work as the owner would like to do.



A League Set in New Brunswick, N. J.

Mr. Dunham is the owner of this outfit which has given very satisfactory results. The sending set is ½ Kw. Hytone of Clapp-Eastham make. After using the set in the position shown, it was moved to the floor as the noise there became less noticeable than when overhead. By fall, the owner expects to revise all the apparatus and have a first-class equipment for long distance relay work. The antenna support is somewhat novel and a complete description is published in this number.

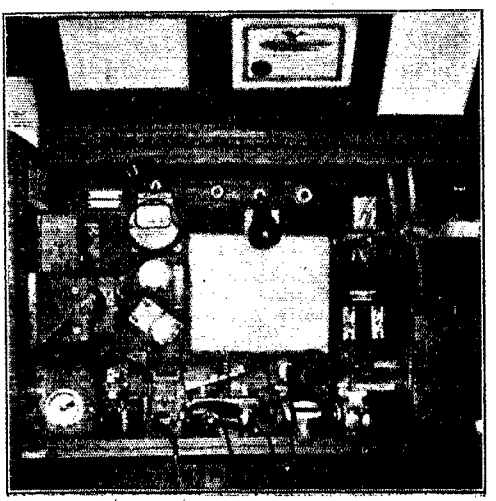


S. W. Piper's Station in Hagerstown, Maryland

This whole outfit is mounted in a large cabinet which can be closed and moved around. It really follows the suggestions offered in Editorials and could readily be put on a motor truck provided it were near some source of power.

The transmitter, which is at the right, consists of a Chelco ½ Kw. transformer, a Clapp-Eastham glass plate condenser and an oscillation transformer of familiar design. The rotary gap has a high tone spark and the set has been heard 100 miles. A series condenser is cut in to give various wave lengths.

The receiving instruments on the left consist of a large loose coupler with a loading coil tuning up to 20,000 meters and a small loose coupler for boats and amateurs. A Crystaloi detector and audion are used. With Brandes 3200 and 2000 Ohm phones, signals can be heard from NAA a hundred feet from the receivers. The antenna is 132 feet long, four seven strand copper wires spaced two feet apart with a 64 foot lead fifty feet high.



Radio Communications by the Amateurs

Portable Radio Sets

New York City, June 23, 1916.

My dear Mr. Tuska:

Knowing your interest in national defense which has been expressed through the columns of QST, I am sure you could make practical use of the following suggestion: A census of all the permanent stations has recently been taken by the Naval Radio Department for the purposes of arranging a system of communication in case of war. But the greater need is for portable transmitters, which can be mounted on carts or motor cars. The expedition into Mexico has been greatly hampered by the unreliability of the wireless communication and most of us know that this is not the fault of wireless telegraphy in general, but a matter of apparatus and operators.

Perhaps this weakness in our national defense could be partially overcome by the four nations of a corps of portable transmitters under the auspices of The American Radio Relay League. The one weakness of an amateur corps would be to secure a portable power plant. No doubt, a good number of portable sets could be secured and organized which are complete from power line to antenna with a good number of reserve operators gathered from amateurs of the neighborhood or local club. But even this much would be of great value to our national defense. It appears that the fault with the Mexican communications via radio were not a matter of generators but of that portion which our amateurs might organize and operate. Look over your stations, and see if you can so mount it that it is easily transported, and easily made into a portable unit, without impairing its efficiency.

Cordially yours,
(Sgd.) Edgar Felix.

This suggestion by Mr. Felix opens up a problem which should be brought before the Radio Clubs throughout the country. The members of each club are in a position to discuss the question and if possible, we should have one portable set built by each club. If the club has apparatus of its own, it could easily be arranged for portable use. If the question cannot be handled by a club, we must always remember that we each, individually, owe the country something and it should be a part of national preparedness for each one to consider how he might aid with his set.

As has been suggested, the greatest difficulty lies in the question of the power plant. Certain of us have spark coils and here is our chance. A good big spark coil set mounted in a man-size way could be placed on electric truck and in certain places could be used. This of course will limit it to a comparatively short range near cities which have current to charge the truck with. In other cases, the arrangement must consider a portable generator to be driven by hand or by a gasoline engine. Let us hear from someone who has done something, with pictures and description.—Editor.

On the Editorial "QST and the American Radio Relay League"

Danville, Va., July 2, 1916.

C. D. Tuska, Sec.,
Hartford, Conn.

Dear Mr. Tuska:

QST is getting better with each issue and I am thoroughly enjoying the matter contained therein. Especially was I interested in your affair with the "Experimenter" and I must say that I am utterly surprised at their attitude relating to the advertisement you desired them to insert. To my mind, it always pays to be "big" and "broad," and complete harmony is essential for the success of any venture. I do not mean a half way success, but a "whole" success.

Well, so be it, there are other avenues for the extension of QST and it is going to come forward I know. Have a heart—a strong one. Had a letter from Rothrock at Winston, N. C. saying he had (at last) sent in his subscription. Am writing to get others to subscribe also.

When an amateur springs up here, if one ever does, I will see that he has QST, if I have to give it to him myself. Am writing another fellow in Illinois to come across for QST.

Here's best wish — more power — and glory.

Yours truly,
(Sgd.) W. T. Gravely.

The Pacific Coast

Portland, Ore.

Regarding the work of The American Radio Relay League, I have been very much interested in the results that are being obtained by various amateur stations throughout the United States, but up to this time I have been unable to participate in this work as I have been employed as instructor in radio telegraphy at the Portland Y. M. C. A. Practically all of my evenings were spent in the class room and laboratories. The classes are now closed for the summer and I shall have more time to devote to radio work. I believe I can be of some assistance to the League in getting communications through this district.

At present I own and operate a radio station in Portland, Ore. The power input ranges from ¼ to 4 Kw. and the wave lengths which I use at present are 200. 300, 550. and 600 meters. My station is listed as KDP. For the last nine years I have handled practically all the commercial service out of Portland, having had working contracts with the Massie Wireless Telegraph Company and Marconi. At present I am handling considerable ships' business for several companies as there is no other commercial station in Portland outside of the Federal Telegraph Company which has only a continuous wave set.

In the past, I have been able to communicate with amateurs as far south as Los Angeles, Cal. and Commercial stations in Alaska, using a wave length of 550 meters and a 2½ Kw. input. Using the 200 meter wave, I have communicated with amateurs in the southern part of Oregan and Idaho. The receiving apparatus is up-to-date and I believe capable of getting about all that is passing this way.

Hoping that I may be of service to The American Radio Relay League, I am,

Yours very truly,

(Sgd.) Charles L. Austin,

Associate I. R. E.

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Good Work

Cleveland, Ohio.

Editor and QST Friends:

Recently made a trip to Wheeling, W. Va., and saw a friend 8ZW while there. We all know of his excellent work. Now a word of encouragement to our fellows who think that because 8-it (ate it) or 8-u no who has an aerial which appears to be somewhat higher or longer than their own, they can do nil.

I certainly was surprised when I saw the antenna at 8ZW. Although the poles and aerial were first-class construction, the far end was only about twenty to thirty feet high with the neighboring hills towering five hundred feet above it. This outfit is located in the Ohio River valley. Now our readers will say: "But OM he is using 5 Kw." He has 5 Kw., but uses two and in certain instances he has worked greater distances on only ½ Kw. and comes in stronger than on the full five, strange as it may seem.

There is no reason to doubt his word. The writer, himself, has frequently covered eighty-five miles on 330 watts. This was in good broad daylight and with ½ inch coil, 22 miles at noon in the summer months was done. The above are positive ranges: I have "freaked" with my set to the tune of one mile per watt input, sometimes greater, but not often. My outfit has been heard from Hendersonville, North Carolina to St. Louis, Mo., Grand Forks, North Dakota, Superior, Wisconsin, Detroit, Mich., Northampton, Mass., Bright Waters, N. Y., and back to Hendersonville. This was with an 880 watt input, not a stretch of imagination, but pure facts. Cheer up, fellows, I hear many of you in Ohio who do not know it.

On visiting owners of sets, I find that the lack of knowledge and not apparatus hinders the majority. The city amateur, on the average, does not get results due to QRN and other noises equally as bad. Despite the locational disadvantages, the city hands have certain things to their credit and should do, everything considered, as well as the hams in a one horse town.

Improve your knowledge — follow QST and let's see what can be done. The writer has been an amateur for several years. Perhaps some in Ohio can remember Wm, MV, CX, etc. We 8 fellows were doing this long distance work three or four seasons ago when the Government Call Book contained only about two or three pages of Eighth District calls. My wife says I must go to bed now so GN 73, boys, CUL.

A Newlywed.

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QST

Shreveport, La.

Editor:

The more I see of QST, the higher my opinion of it is. While reading over articles by the amateurs, I find very many interesting things. An article by A. J. Manning in the June number suggests that the amateurs with successful sets ought to send in a description of their apparatus. This appeals to me as an excellent idea as we with the successful sets would like to know what the other fellow has and the unsuccessful would gain information from this source.

An amateur who gets from five hundred to one thousand miles out of his sending set

is doing remarkable work and a description of this set would be to the advantage of every amateur who is not doing such wonderful work.

In the same issue, a suggestion made by E. C. Andrews that amateurs hearing long distance stations should write to the senders, is an excellent suggestion, but it can be overdone or is not appreciated. I have an exceptionally good receiving set and upon hearing amateurs from five hundred to one thousand miles, I wrote about thirty letters telling them how they came in and only received acknowledgements from five. The remainder must have been awfully busy. Let us hear from more amateurs.

(Sgd.) D. R. Simmons.

A Trunk Line Criticism

The proposed relay trunk lines have evidently been drawn from a purely geographical point of view; that is, between the larger cities in the different states that lay in the approximate route desired. I suppose it is the intent to then see what stations can be located in these cities to do the work. Why not construct points at which stations are already located that are doing good work? You will find in most cases this will involve the smallest towns rather than the big cities. Interference in the cities is notorious, but there are many stations in the smaller towns throughout the Central States that I receive regularly and for the most part they are located singularly in small towns. It is the absence of local QRN that enables these stations to work good distances regularly. To get down to cases that will more clearly illustrate my point, refer to east end of Trunk Line B which routes from St. Louis to Chicago, via Peoria. 9FY, DuQuoin, Ill., probably has a greater range than any other one Kw. station in Illinois. He is an excellent operator. This winter he has worked Denver, Colo., a vessel at anchor off Sandy Hook, another gulf vessel, and several stations in the First and Second districts. Being in a small town, his is the only station in that immediate vicinity and consequently he is able to work without being jammed every other minute, as is the case with amateurs, say in St. Louis. Also, he is a League member. 8AEZ, Lima, Ohio, has a wonderful range for one Kw. There are several other high powered stations in that town but owing to a division of working hours, they have no local QRM. I couldn't regard a trunk line through Ohio complete without taking in Lima or St. Mary's at which latter point is located 8NH, a station which this past winter I have copied louder and more regularly than any amateur over 100 miles distant from Cairo. I make these specific references only to illustrate the idea that in my opinion the trunk lines would be better laid out between League stations already in successful operation in smaller towns than on the geographical basis shown in the Trunk Line map. Another feature is the presence, in cities, of continuous interference from street car systems, flashing electric signs, etc., which often prevent reading of extremely weak signals and which interference would be at a minimum in smaller places. I offer this for what it may be worth. The three stations I have cited have done excellent work this past winter relaying, and are generally regarded as clearing houses for east and west bound relay messages.

Referring to the suggestion that amateurs located on or near a trunk line send in their names, count me in on this. I expect to operate a one Kw. station next season in Cairo, which is mid-way between St. Louis and Memphis on Trunk Line E. I am much interested in relay work and expect to be "among those present" next winter.

K. B. Warner, Cairo, Ill.

Nobody Home

When the first few twitterings of QRN commence, the majority lay down on the job and place in its summer sheet the particular assortment of ding-bats which only a few weeks before they displayed with pride to the admiring visitor.

A man wouldn't use his old Ford in like manner in off seasons. He would at least go out to the cow barn, shoo off the old Shanghai rooster who made his perch on the windshield and give the old boat the double O for old times sake.

Now perchance if you, after a strenuous days work ??, or just before retiring, sit in for about five minutes and see what the wild winds are saying—you may hear something. The game as it stands today is about on a par with the shy summer maiden who works her conquests at the seashore.

If you're simply going to flirt with the A. R. R. L., stop because you shouldn't give the impression that you mean business during the "jammy" period. If, on the other hand, you are a died in wool, sure enough A. R. R. L. guy, don't "lay down on your arm" when the patter of QRN agitates you, but stick around, as once in awhile we get one of those old-fashioned freak nights, when even the grinders are asleep, and possibly you may connect with some kindred spirit 'steen who will be surprised as you.

GN, OM, CUL.

From one of our readers as a reminder.

This new department has been opened up for the benefit of the readers of "QST", Letters should be addressed, "QST", care of The American Radio Relay League. The Queries Department, Hartford, Conn. The questions will be answered free of charge and as promptly as possible. The answers will in each case, appear in "QST", provided however, they are of interest to the average reader. We are not in a position to answer questions requiring a long, mathematical solution.

The Editor hopes to receive a large number of interesting questions for the next issue. He trusts that you will make your questions of general interest and will refrain from asking questions which you can answer by consulting the Radio Laws and the Call Letter Books. "QST" does not wish to pad this department out with a series of uninteresting, foolish, questions.

ARNO A. KLUGE, Ravenna, Neb.

Question 1. Please describe a set suitable for receiving noon time signals from Arlington with an aerial about 90 feet high and 200 feet long. How sensitive a detector will be necessary and could you name some factory instruments which will do the work?

Answer 1. A set which will receive noon time signals from Arlington would consist of some first-class loose coupler, variable for the secondary audion detector, and a good pair of phones. We would suggest that any of the advertisers in QST make reliable apparatus and can furnish you with the instruments required.

Question 2. How many turns of wire are used and what is the diameter of the coil on the usual tuner of 3,000 meter range?

Answer 2. There are about 300 turns of No. 22 copper wire and the primary of the coil 4½" in diameter and a secondary is wound with No. 26 wire, 3¾" in diameter and about 16" long.

RICHARD HITCHCOCK, Chester, Mass.

Question 1. I have a 13,200 volt transformer and a glass plate condenser, ⅛" thick by 24" by 36". Is my condenser too large? What should be its size?

Answer 1. Your condenser, we find, is too small. The usual size would be between ten and fifteen 8"x10" glass photograph plates covered with 6"x8" tinfoil.

Question 2. When I use a straight gap with above condenser, I get 1¼ amperes into the aerial. Using a rotary, I get less than one ampere. Does this indicate that I use too much condenser for the rotary?

Answer 2. The fall in radiation which you experience when using the rotary is probably due to too little condenser, rather than too much, although either might be the case. Your rotary speed enters into the question since it determines the time during which this condenser can charge. If your condenser is large and your rotary running fast, it cannot charge to full capacity. Similarly, if the condenser is small the rotary may discharge it oftener than a fixed gap would and this means lower radiation.

Question 3. My condenser could be immersed in oil if that would help it. Do you think the improvement worth the change?

Answer 3. The efficiency of a condenser is always improved when immersed in oil. The results would probably be worth while, but you will find the oil a rather nasty article unless you can make a jar to hold the condenser in.

Question 4. What do you think I should get in radiation on 100-foot antenna, 30 feet high, with a 30-foot ground lead?

Answer 4. We cannot answer the radiation question since you do not mention your power. If it is a half Kw. the radiation

should be in the neighborhood of 2½ amperes.

A. O. PARMELEE, Reading, Mass.

Question 1. If a hot wire ammeter is short circuited by a S. P. S. T. switch as shown on page 89 in the April QST, does this not throw the open circuit out of resonance when the switch is closed?

Answer 1. The inductance and capacity of a hot wire ammeter are so slight compared with the rest of the circuit that they are negligible. They would not throw the circuit out of tune.

Question 2. Should a D. P. switch be used with the meter connected to one side and a compensating inductance to the other as shown in enclosed diagram for maximum results?

Answer 2. The diagram you enclose shows the ammeter in the antenna circuit. It should be in the ground and it is unnecessary to use a D. P. D. T. switch as explained in Answer 1.

Answer 3. Your diagram showing the hook-up for short leads is very efficient and the Editor can see no change which would help it any.

E. E. HOUSE, Battle Creek, Mich.

Question 1. Can you give me any reason for an audion bulb of the DeForest type increasing its vacuum?

Answer 1. One explanation might be that a certain amount of air is left in the bulb after it is first exhausted and this air unites with the metal in the filament at the very high temperature. In this manner the vacuum is changed. Experimenters who have worked with the discharge of electrons through tubes inform us that there are very many variable quantities connected with the same. The kind of glass is one of the most important and similar to the audion, the results are apt to vary in a new tube. One case which the Editor has in mind is that of an X-ray bulb manufacturer who had been obtaining his glass from Germany but due to present conditions, was obliged to use some of American manufacture. He could make the tubes alright, but everyone would split upon sending the current through it.

Question 2. Can you suggest any better way to get around making a terrific noise in the neighboring telephones than by cutting the telephone ground wire?

Answer 2. This means is used by a great many amateurs. One of the arguments against it is that this ground wire is the telephone company's protection against lightning. The telephone company would probably object strenuously if they knew of it. Nevertheless, it is done by many amateurs and at present is the only remedy we have heard of.

H. E. G.

Question 1. I would like to hear your opinion as to which type of detector is the more sensitive, the round type of audion bulb, or the gas filled tubular bulbs operating on the "electron" principle?

Answer 1. Through advices from the various manufacturers, and technical papers, the Editor must confess that he is still doubtful as to whether there is or is not a distinct difference in the operating principle of these detectors. The question of sensitiveness seems to be this: The globular type appears to be much more sensitive for long distance work. The tubular bulb produces much louder signals from near-by stations, but is not quite as sensitive as the round type for long distance work. The tubular type operates much more efficiently over short distances. By long distances, the Editor means over 2,000 miles.

Question 2. Which of the two would you consider to be the more reliable in operation?

Answer 2. Here, again, the Editor is in doubt, but believes there is very little, if any, choice. It is perhaps a little in favor of the tubular bulb which does not seem to cause as much trouble as the other type. The Technical Editor has a great deal of personal interest in this question and he would be pleased to hear from the readers their opinions.

CECIL BRIDGES, Louisville, Ill.

Question 1. Is it possible with proper tuning apparatus in connection with a Poulsen tikker, to hear Sayville, Arlington, and Tuckerton, when their undamped sets are in operation?

Answer 1. Yes. The Poulsen tikker should work on the station mentioned but you will find the oscillating audion more up-to-date.

Question 2. Please give information on a transmitting condenser to be used with a one Kw. Thordarson transformer in connection with a rotary gap giving a 500 cycle note, the waves employed being 200 and 425 meters.

Answer 2. A glass plate condenser con-

structed to give approximately .0125 mfd. will work well on the set in question. This condenser may be made of ten glass photograph plates 8"x10" connected in parallel, but the strain would probably be too great for maximum efficiency and it would be well to connect two banks of twenty each in series and immerse in oil. The size of the tinfoil is 6"x8". Seven Murdock sections would be about the equivalent of this condenser. The same condenser can be used for both the 200 and 425 meter waves by increasing the inductance when the set is used on 425 meters.

HERBERT L. LAUBE, Dubuque, Ia.

Question 1. I contemplate getting a one Kw. transformer. Which would be better, one of about 10,000 volt secondary or one of 20,000 volts and why?

Answer 1. The question of a high or low voltage secondary seems to be one of personal nature rather than something which can be settled on a purely technical basis. The arguments seem to point toward the lower voltage of about 10,000 volts. In this case, the losses are lower and the insulation does not have to be as great as in the case of 20,000 volts. The 20,000 volt transformer, on the other hand, can use a smaller condenser (smaller capacity) and consequently has an advantage considering the question of wave length. By smaller condenser, smaller capacity is meant since it might take several sections in series parallel to protect the condenser against losses. Putting the arguments before you, we are leaving you to decide which would be the better in your particular case.

Question 2. What is the reason for using a low voltage about 8,000 with a rotary quenched gap?

Answer 2. A low voltage transformer (about 2,000 volts) is used with a rotary quenched gap as the idea is to make the spark short and of short duration since this gives the beautiful quenching properties which we all try for. If the spark were about twenty thousand volts, it would jump before the electrodes where opposite each other and as they approached nearer and nearer, the decrement of the oscillation would have a chance to get in some deadly work. You have probably noticed the spark jumping to meet on an open rotary. This is what we mean and if you have some notion of decrement, you probably can answer your own question. If our answers do not straighten you out, we would advise you to consult some text book to clear up these questions.

CARL LINXWEILER, Dayton, Ohio.

Question 1. How many photograph plates, 8"x10" covered with 6"x8" tinfoil each plate spaced ¼" from its neighbor as they are to be placed in oil, are needed to form a condenser of a ¾ Kw. Thordarson with rotary of twelve studs running at 3500 R.P.M.?

Answer 1. See Mr. Bridges question in this issue which covers what you ask. Your rotary will be about equivalent to his 500 spark frequency and the same condenser will work equally well in your case.

Question 2. Is a loop antenna as efficient as an inverted L when the loops are connected together for transmitting?

Answer 2. By connecting the loops together as shown on your paper, the antenna will prove just as efficient as an inverted L.

POLICEMEN PASS RADIO TESTS

Receive Certificates Entitling Them to Become Commercial Wireless Operators

It was announced yesterday that three police lieutenants and five policemen have received certificates entitling them to become commercial wireless operators of the first class. There is a wireless apparatus installed on the roof of Police Headquarters, and it is assumed that the men will take charge of it as soon as Commissioner Woods returns from his vacation.

Those who received certificates are Lieutenants John A. Altenbach, George H. Quackenbos and William H. Van Keuren and Policeman George Wolf, Emil Kopko, George T. Valentine, Michael C. Morney and John F. Murphy. They passed examinations at the Training School for Radio Instruction at the New York Navy Yard and received the certificates from the Department of Commerce. All are eligible for assignment at any police station.

FOR SALE AND EXCHANGE

Now that our circulation is growing so rapidly, we receive hundreds of ads. for the Exchange Department. It is impossible at present to give the necessary space to these ads. and we hope the readers will have patience as their ads. will be published in turn. The Editor might also add that he inserted a small notice for himself and was swamped with replies from a large number of readers who wanted to purchase the same motor. It is no more than courtesy to answer each of these and he hopes everyone does this.

FOR SALE & EXCHANGE

FOR EXCHANGE — Edison mimeograph, No. 75, complete with all supplies and attachments, value $35.00; also, large list of electrical apparatus and violins to exchange for wireless apparatus. Ralph Batcher, Toledo, Ohio.

FOR EXCHANGE—I have an excellent unmounted 2 Kw. transformer which I will trade for a small marine engine, (gasoline) not less than 1½ H. P. in good condition. Paul D. Flehr, 510 South 7th St., Ironton, Ohio.

WANTED—One rotary gap—parts or motor. One antenna switch and an audion; also fifty 8"x10" photograph plates. Address all communications to C. King Sam, 17 No. Elm St., Waterbury, Conn.

EXCHANGE—Thordarson step-down transformer, 110 volts, delivering 3, 6, and 9 volts at secondary, used about one hour. One inch Bull dog spark coil; good condition, small Bunnell key, Duck's small glass plate condenser in case. Want good pair of phones, Holtzer-Cabot or Brandes and Navy tunes. W. T. Gravely, Box 245, Danville, Va.

WANTED—Five sections Murdock moulded condenser, and a one Kw. rotary gap. State tone, make, and condition. A. O. Parmelee, 155 Main St., Reading, Mass.

FOR SALE—Large glass plate condenser, $2.00; large motor starting rheostat $3.00; large fan motor, $3.00. Small loading coils, $1.00 each. Also lots of small pieces of apparatus and material. Seefred Bros., 343 So. Fremont Ave., Los Angeles, Cal.

FOR SALE—A chambers 2" coil for $5.00; a Chambers loose coupler for $6.00; a $12.00 2½ Kw. oscillation transformer, $4.00. Charles A. Roethlinger, 401 West Susquehanna Ave., Philadelphia, Pa.

FOR SALE OR EXCHANGE — Two good twenty-two rifles, fountain pen flashlight; one small nickel-plated flashlight; also a good motor with a four-inch fan. Initial cost of motor, $2.00; will sell for $1.50. Want wireless goods. Veryl Ebert, Box 389, Alden, Minn.

FOR SALE OR EXCHANGE — 1 Weston voltammeter (Duplex type) list $70.00; one General Electric Co. AC 7" Ammeter, cost $25.00; one cutter hammer starting box, cost $12.00; ½ Kw. Curtis transformer, cost $25.00; one RJ4 Audion, sell for $6.00; audion bulbs, cameras, etc. Want good metal turning lathe, gas engine or electric motor and an efficient transmitting equipment. What have you? R. G. Devaney, 196 Murray St., Binghamton, N. Y.

FOR SALE — Halcun rotary gap, 1 Kw. straight gap, new Ferron detector stand. L. A. Kern, 3208 Western Ave., Mattoon, Ill.

FOR SALE OR EXCHANGE — E. I. Co. $1.25 condenser, $0.50—E. I. $0.60 rheostat, $0.30. An excellent home-made pancake type oscillation transformer, suitable for all powers up to 1 Kw., $1.40. Brand new auto switchboard lamp (nickelled) holder and reflector with 6v. 2 candlepower Mazda lamp, $0.45. Cedric F. Hart, 718 6th Ave., Salt Lake City, Utah.

CHEAP FOR CASH—½ Kw. transformer; gaps, key, condensers, receiving instruments, coils, phones, etc. Low prices. Write for list. Everything guaranteed. J. A. Evans, 3208 Broad St., Richmond, Va.

FOR SALE—One ¼" Bull Dog spark coil; price $1.30. One "Radioson" ultra sensitive electrolitic detector, never been used. $4.00. One 75 ohm telephone receiver, $0.30. One buzzer, $0.20. One three slide tuning coil, length 13", $1.50. R. J. Perry, Jr., Lisle, N. Y.

FOR EXCHANGE—A 12 volt 50 watt dynamo in good condition (Carlisle-Finch make) excellent for charging storage batteries or lighting, for a pair of Brandes Transatlantic phones or a good two inch coil of any make, or will sell cheap. Edward G. Raser, 931 Edgewood Ave., Trenton, N. J.

FOR SALE—Brand new Tel-Radion, $4.50. Also have Audio Tron. Want transformer, audion, and typewriter. Paul J. McGee, Mattoon, Ill.

FOR SALE OR EXCHANGE—One 'searchlight' gas bicycle light, $1.00; Little hustler motor, $.50; 20 ohm key and sounder, $1.00; Pony relay, 100 ohm, $1.00; two electric door bells, 10c. each; potentiometer, $.50; Electrolytic detector without knob acid or wire, 10c.; four turns edgewise wound copper strip, 5/16" wide by 5" inside diameter 1/16" thick. $.40; 2 japaned metal battery cases for No. 6 dry cell, 10 c. each; Knapp type A1 motor (new) $1.50; 2 TEMPCO auto washers (new) $1.50 each; One Delat buggy light, $1.00; one spark plug brush, $.25; one inch MESCO spark coil, $2.50; Brandes 2000 ohm head set leather headband, $2.00. Phones or variable condensers, or will sell any of above for cash. Lester M. Smith, Salem, Wis.

WANTED—Articles, photographs, anything that interests the amateurs. For "QST." The Editors, AMERICAN RADIO RELAY LEAGUE, Hartford, Conn.

FOR SALE—½ Kw. Thordarson transformer, excellent condition, including oil immersed condenser, $10.00. Rotary spark gap, used only a few weeks, alloy disc, marble base, speed 8,000 R. P. M., $9.50. One pair Brandes 2000 ohm receivers, excellent condition, $3.00. What am I offered for a double filament Audiotron bulb, almost brand new, will throw in fibre panel and 12 flashlight batteries for same? Also have four 90 ft. lengths of six strand No. 21 copper wire, slightly oxidized, $2.00. Thomas Hood, 124 East 32nd St., Indianapolis, Ind.

WANTED—Subscription agents for "QST." Help yourself, help the LEAGUE, help everybody. Address, AMERICAN RADIO RELAY LEAGUE, Circulation Agent, Hartford, Conn.

FOR SALE—One inch and a half spark coil. $4.00; one pair Brandes' trans-atlantic phones, $6 00. Vibrator on coil slightly worn; otherwise everything is in good condition. Wm. H. Rocheleau, 71 Church St., Westbrook, Me.

FOR SALE—Four sections of hollow wooden pole (same as used by U. S. Signal Corps), capable of being made into one mast twenty-six feet, eight inches high; also steel connecting tubes, top plate and guy plate. Purchased new from the inventor and never used. Price $10 00. Edwin L. Powell, 216 Spruce Ave., Takoma Park, Md.

WANTED—Second hand audion, Multi-Audi-Fone, half Kw. Hytone rotary quenched gap sets, also other auxiliary apparatus. Must be cheap for cash, describe fully and give price in first letter. F. B. Hanes, Lakeville, Ind.

FOR SALE — Three-inch spark coil, 150 watt step-down transformer, superior head set, Crystaloi detector, Universal detector stand, Galena detector, three fixed condensers, $18.00. National automatic transmitter and a quarter Kw. condenser. All are in excellent condition. Cecil Bridges, Louisville, Ill.

FOR SALE—Have four Pittsfield half inch coils to sell at $1.25 each. No. 6 American model builder, $7.50. Want: Good "T" audion or Audio Tron bulb, or telephone transmitter, or a manufactured loose coupler built by a reliable firm and intended for use with an audion. All letters answered. Carl Linxweiler, 140 Eagle St., Dayton, Ohio.

WANTED—Motorcycle or Ford roadster chassis and engine. Have to offer a complete wireless station. Send for photograph and particulars. Henry Weaver, 1.002 Bellaire Ave., Pittsburgh, Pa.

FOR SALE—The one Kw. Clapp-Eatham transmitter illustrated in picture of my station, June issue, QST for $125. In perfect condition, nearly new, and has been heard 800 miles. Am selling to buy a five Kw. set. W. O. Horner, Cleveland, Tenn.

WANTED—Speed motor, cheap. Must be in perfect condition and be capable of a speed ranging from 2000 to 7000, ⅛ H. P. preferred. C. R. Pardridge, 521 Nimons St., Saginaw, Mich.

WANTED—A 1 K. W. transformer of the Thordarson, Packard, or Clapp Eastham make. Will pay cash. H. D. Norviel, 521 Jackson St., Anderson, Ind.

WANTED—A ¼ or ½ K. W. transformer of Thordarson or Packard type. Walter Belsky. 1134 Findlay Ave., Bronx, New York, N. Y.

WANTED—Variable condensers. Must be in good condition and of standard make. Will pay cash or trade. State price or wants in first letter. Cedric E. Hart, 718 Sixth Ave., Salt Lake City, Utah.

WANTED—¼ or ½ K. W. transformer. State make, condition, and lowest cash price. Clarence Gunderson, Albert Lea, Minn.

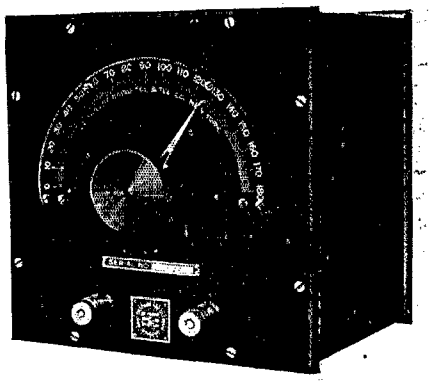
FOR SALE—One Blitzen ¼ K. W. transformer with special magnetic leakage tongue; also one Murdock oscillation transformer, both in excellent condition. Price, $12.00. Roy C. Ehrhardt, 820 Monroe Ave., Scranton, Pa.

BARGAIN—E. I. Co. load coil, fixed variable condenser, galena detector, marble base key, strap key, buzzer, tuning coil,

New DeForest Instruments

It has been said that "he who stands still is going backwards." This is especially true in the radio field which is rapidly advancing, and we believe that our readers will be interested in new instruments and apparatus which make for better results and increased efficiency.

Several new instruments being brought out by the DeForest Radio Telephone and Telegraph Company are illustrated herewith. A new variable condenser has been developed, similar to their large commer-

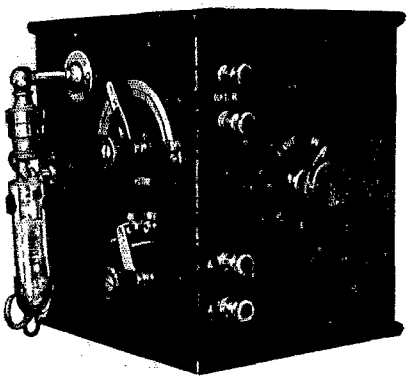


De Forest Variable Condenser.

cial type but enclosed in an oak case with either an oak top or one of hard rubber. This condenser has a maximum capacity of .0025 M. F. It has 35 large plates of aluminum—17 stationary and 18 movable. On account of the considerable spacing between plates, dielectric losses are reduced to a minimum and as the variation of capacity per degree of rotation is small, much closer tuning can be accomplished than is possible with a condenser having less spacing and smaller plates. This is of especial advantage in receiving continuous waves.

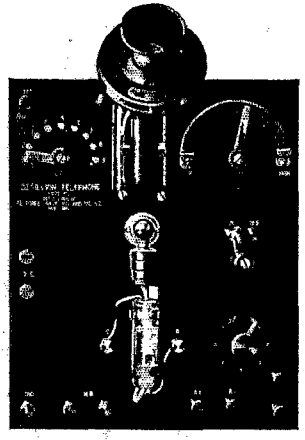
The Ultraudion Detector shown is a new type for amateur use. It will be immensely popular because of its simplicity and reliability. No wing circuit inductances are required, eliminating the expense of same. The tuner need be only a single coil of proper wave length and two variable condensers. As the various coils generally employed in receiving undamped waves are an item of considerable expense, this detector will be of much interest.

A short distance radio telephone transmitter is illustrated below. This set employs the Oscillion, a form of Audion for generating high frequency currents. The transmission of speech is at least as clear as that of a wire telephone, and the Oscillion is, of course, as reliable and constant as the Audion.



Ultraudion Detector.

The range is from one to five miles. The lighting circuit is to operate on six volts and the "B" or high voltage circuit requires 250 to 350 volts, depending on the distance to be covered. This circuit is controlled by the usual potentiometer employed in all the latest Audion instruments. The set is mounted on a panel measuring 11 by 13 inches.



Radio Telephone Transmitter

This set may be used also as a transmitter of undamped waves as a telegraph and then has a radius of about twice the telephone range.

Q S T SUBSCRIPTION CONTEST

Many of the most promising amateurs are held back for the want of money to buy first class apparatus. We have worked out a plan for helping these fellows. We have arranged for twenty different pieces of the latest wireless equipment and all of it is to be distributed among those amateurs who are willing to put in a little work for QST.

The one who sends in the most subscriptions to QST before November 18, 1916, receives the first prize, a $25 DeForest Audion Detector of the latest type.

The one who sends in the second highest number of subscriptions to QST receives a second prize, a pair of Brandes Navy Telephones.

The third, fourth and so on up to the twentieth, receives apparatus as stated in the list below.

The conditions governing the contest are simple. They are:—

1. You must send in your name and address, and we will send you a quantity of subscription blanks. Your subscriptions must be made out on these blanks, and sent in to Contest Department, American Radio Relay League, Hartford, Conn.
2. Any one interested in wireless is eligible.
3. *To be entitled to any of the first five prizes one must send in a minimum of 20 yearly subscriptions or their equivalent. To be entitled to any of the last 15 prizes one must send in a minimum of 10 yearly subscriptions or their equivalent.*
4. Weekly reports must be sent in beginning August 12th. The score will be printed in QST each month, so you can see how you stand with the other fellows.
5. Part time subscriptions are counted proportionately. For example, a full year subscription counts 12. Six months subscription counts 6, a three months counts 3. If you buy copies and sell them, they also count as one each.

Remember, the most unexpected people are interested in amateur wireless, and will gladly subscribe if you ask them. Your family doctor, sometimes is crazy to know about the extent to which wireless is practiced. We know one ourselves. The grown-ups are the best kind of material, because not only are they interested themselves, but their children might be made to take an interest from reading QST, and moreover, the grown-ups always have the cash.

THE AMERICAN RADIO RELAY LEAGUE, INC.
Subscription Contest Department.

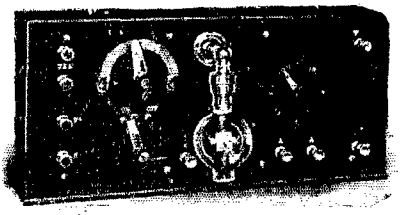
PRIZES

Anyone of these may become yours, if you are willing to do a little work in your spare time: QST subscriptions may be secured for the asking. Try and see.

FIRST PRIZE. VALUE, $25.00

DeForest Audion Detector. Type RJ8

Licensed for Amateur or Private Use Only



This NEW instrument excels every previous amateur type Audion Detector, thus placing it far above any other detector of any kind ever manufactured. It is provided with a POTENTIOMETER CONTROL for the "B" battery potential by means of a SPECIAL potentiometer designed especially for the Audion, thereby giving a closer regulation than ever before possible, resulting in greater efficiency and more service from the instrument and renewal bulbs.

The Type RJ8 Audion Detector has a hard rubber panel on which all the controls and potentiometer are mounted. The panel is set into a well finished oak cabinet measuring 13¾ inches long by 6¼ inches high by 8 inches deep. All of the metal parts are heavily nickel plated. The switch is of our well-known four-ply construction. It cuts the "B" BATTERY off from the potentiometer when the bulb is turned "off" preventing this battery from discharging slowly through the potentiometer.

The rheostat for regulating the intensity of the filament is on the rear of the panel and controlled by the "OUT" and "IN" bulb.

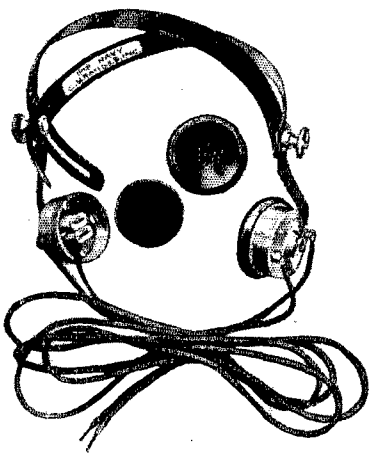
If the operator desires to incorporate this detector in a receiving cabinet, this can readily be done by removing the panel without disturbing any of the interior parts.

SECOND PRIZE. VALUE, $14.00

Brandes Navy Type Receivers

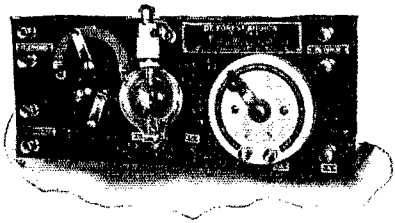
This type possesses a peculiar, soft, clear tone—a great advantage for long distance reading. It possesses both extreme lightness and rigid construction. The case is made of hard drawn aluminum, through which the advantages of absolute permanency, lightness and handsome appearance are gained. The ear caps are of hard rubber and, instead of having one large hole in the center, are perforated by many small holes. This is done in order to protect the diaphragm from being damaged should the receivers be accidentally laid on some protruding object.

The wire used in the windings is of the best quality, pure enameled copper, .002 inch in diameter, covered with pure, uncolored silk. The receivers are wound to the fixed number of turns required for best results, giving an approximate resistance of 3,200 ohms to the set.



THIRD PRIZE. VALUE, $14.00

DeForest Audion Detector Type RJ9



Licensed for Amateur or Private Use Only

This NEW panel type instrument is the lowest priced Audion Detector. All the controls are mounted on the front of the mahogany panel, which measures 5 by 13 inches.

The control for the "B" battery is a POTENTIOMETER CONTROL giving very close regulation of the "B" battery potential. The switch controlling the filament brilliancy automatically cuts the "B" battery off from the potentiometer when the filament is turned off."

The Type RJ9 Audion Detector is provided with brackets so that it can be screwed to a table. If the operator desires to incorporate it in a receiving cabinet, this can be done readily without disturbing the wiring and parts.

The metal parts of this detector are of lacquered brass.

FOURTH PRIZE. VALUE, $10.00

A Rotary Quenched Gap

This gap is an instrument which will be a valuable addition to any station. It is a special piece of apparatus which was designed by the Technical Editor. Several were made and gave wonderful results. It is completely enclosed in a bronze casting; this eliminates the noisy spark and at the same time it is built for rapid quenching. It is similar to the gap described in the July QST. There are twelve fixed and twelve moving electrodes. Only needs a motor. The motor is not given with it.

FIFTH PRIZE. VALUE, $10.00

Brandes Transatlantic, 2,800 ohms

These Brandes' would prove a nice addition to your set; either as an extra pair or as an improvement over your present phones. They are all that is claimed.

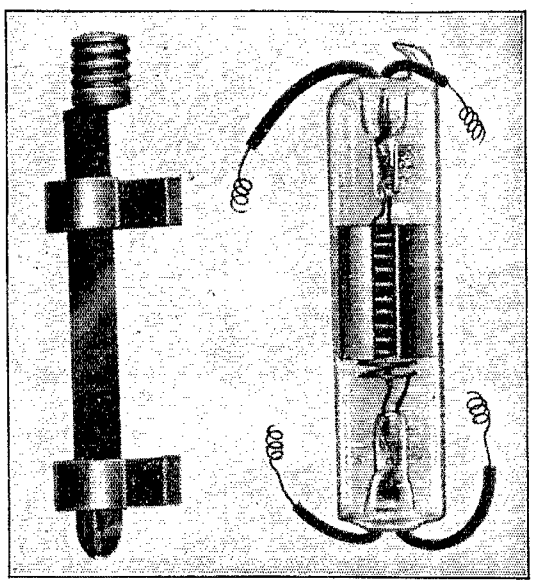
The receivers are a trifle larger than the Navy type. Are very sensitive and have the same soft, clear tone that facilitates the reading of long distance signals.

Transatlantic receivers are fitted with diaphragms .006 inch thick, tin plated. The caps are of hard rubber and shaped in such a manner that they fit very closely and feel quite comfortable to the ears. They are wound with silk insulated, pure copper wire .002 inch in diameter, to the required number of turns for the best results; the resistance being approximately 2,800 ohms to the set.

PRIZES 6 TO 15. VALUE, $5.50 EACH

DeForest Tubular Audion Bulbs

These bulbs are so useful and popular that we are offering ten. This gives you plenty of chance to get one. Show a little pep; it's worth it.



The Audion Detector is the most sensitive detector in existence. The Bulletin of the U. S. Bureau of Standards, Vol. 6, No. 4, Page 540, states that it is fully 50 per cent. more sensitive than any other known form of detector. It is the only reliable sensitive detector.

For the benefit of those amateurs who desire to experiment, and do not wish to buy complete Audion Detectors with the necessary accessories, and for those whose limited means will not permit the complete instruments to be purchased, we have brought out the Type T Tubular Audion Bulb.

Commencing March 15th, 1916, this type of Audion will be sold separately, without the other parts necessary for a complete Audion Detector. It is licensed for amateur use only and is NOT interchangeable with the regular round Audion Bulbs.

This type of Audion Bulb gives very loud response to signals. Every bulb passes two tests by our experts and is thoroughly up to our standard of sensitive qualities. It is finished in only one grade—the best.

The life of the Type T. Tubular Bulb is exceptionally long on account of the fact that the single straightline filament has no loops, and as there is no second filament, the Edison discharge to same is completely eliminated.

The plate or wing is in contact with the glass, preventing overheating. The filament is surrounded by a spiral grid.

This type of bulb is an excellent oscillator for the reception of continuous waves, being different in this respect than round Audion Detector Bulbs.

The grid is the spiral inside the tube and is connected to the green covered wire. The plate is connected to the red covered wire. The filament terminals are the white covered wires.

PRIZES 16, 17 AND 18. VALUE. $5.50

Brandes Superior Phones

How often have you had visitors in your station and only one pair of telephones? It's inconvenient to say the least. You really should have an extra pair for your friends and this is the chance to get them.

Continued on following page

These receivers are without doubt among the best that can be bought on the market today for very little money. The case is made of aluminum, insuring rigid construction and lightness. All the interior parts are nickel plated and polished giving them a handsome appearance. The bobbins are wound with No. 40 pure copper enameled wire to the proper number of turns which register a resistance of one thousand ohms per receiver. The diaphragms are .006 thick, tin plated, and the receivers are fitted with hard rubber caps. None of the material is substituted by a cheaper grade such as, for instance in the cap and diaphragm which could be easily made of much less suitable materials and considerable money saved in the manufacture of these receivers. There is no question that these receivers are very substantially built and will do wonderful work for receivers sold at this price. In fact, we have reports from people who claim that they are better than receivers which cost as much as eight dollars per set.

PRIZES 19 AND 20. VALUE, $3.50

Crystaloi Detector

Do you need a stand by detector? Here is a reliable one which is a prize well worth owning.

Start after it today!

The Crystaloi is a radical departure from any of the well-known types of detectors which depend on a metallic point in contact with an extremely minute portion of a sensitive mineral, which is subject to burn-outs, going dead, and the disadvantage of having to hunt around on the surface of the mineral for a sensitive point.

The principle of the Crystaloi is exactly opposite from that of any other detector, inasmuch as instead of a fine point of metal coming in contact with a minute portion of a sensitive mineral, the Crystaloi is constructed in such a way that a comparatively large surface of a very sensitive mineral is brought in contact with a great many points of a very light, finely divided alloy which becomes a conductor only when traversed by high-frequency oscillations. This arrangement renders the receiving apparatus remarkably free from static and other interferences, and is wonderfully sensitive.

It is only necessary to put the Crystaloi in circuit with a buzzer and while holding the key down, rotate the cylinder until the signals are loudest in the ear phones, at which time you are ready to receive anything that is in the air. The Crystaloi requires no battery or potentiometer and is ever ready to serve you under all conditions.

The Crystaloi is wonderfully sensitive, owing to the fact that the alloy is very light in weight and makes a very delicate contact.

Every Crystaloi detector is actually tested by putting it in service at our station and is guaranteed to do exactly what we claim for it or we will take it back and refund your money.

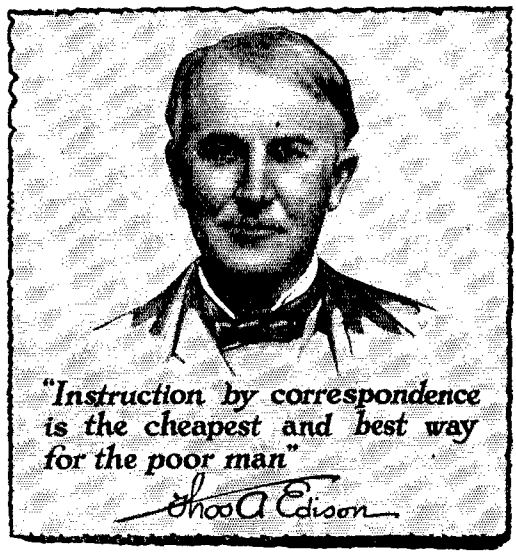
Rotten Luck—continued from page 191

would show if the current was getting up to the transformer. So, I snapped the terminals. There was a flash of fire that made me jump and I knew that the juice was there all right, WHEN I SNAPPED HER, but it certainly must have blown the fuses to pull such a flash as I got. Here I was, with two perfectly good fuses down in the cellar and I had blown them, just when I wanted them most. And, I remembered, with a sickening feeling, that I had loaned the only other fuses I had.

There was nothing for it, but to go back into the cellar, get another nasty shock, pulling those darned fuses out, take them back up to the attic, solder some copper wire across them and take them back into the cellar and get one more nice little jolt. I had got about half way through the soldering job, when the biggest fracas busted loose down stairs we have had in our family for many a long day. The good wife began screaming, the boy opened up with hoarse yells, the little girl squealed, there were hurried steps, and I was sure the house was afire. I dropped the soldering job, and went down the sairs three at a lick, to find our little library and hall the scene of the finest mix-up you could imagine. My wife had a book she was reading clamped down over her head like a hat. The boy was swiping the air with a broom, the little girl was clinging to her mother, and trying to dodge the broom, and the cook was running around in circles. A little dark object was fluttering around the room through the air, and it was apparent that a bat had gotten into the house. Thinking that this was no place for a perfectly respectable radio operator, I returned to the attic after making half a dozen fruitless passes at Mr. Bat with my hand.

When the fuses were fixed up, not strictly according to the underwriter's code, I put them back in and was sure I would find the trouble in the little choke coil which I used to get reduced power. I cut this choke out completely, and grabbed the phones, and put them on, threw on the switch and pressed the key. Absolutely nothing doing. Things were just as dead as ever. This was getting to be mysterious. Here was the juice, and here was a perfectly good looking transformer, and a perfectly clear key circuit, and yet the circuit was open somewhere. I reached in to the compartment where I keep my transformer, and gave a little tug on the primary leads. One was all right, but when I pulled the other IT CAME AWAY IN MY HAND. The wire had burned off.

If the break were now only at the outside and not the inside, I might get going. I pulled off some of the covering and there she was on the outside. I quickly unrolled two or three turns, scraped the insulation off, and connected to the terminal. Putting the phones on again, I grabbed the key, knowing that I would get it this time. Nothing doing, and the fellows at the State



Edison is Right!!!

You admit the International Correspondence Schools are a good thing. You'd take a course right now "if"—"except"—

"If" what? If you weren't so "overworked," with such "long hours," or had more strength and energy?

Wasn't it Edison who stayed up half the night educating himself in spite of every handicap you could ever have?

All big men who have made their mark in the world had the *ambition*—the *determination*—to improve their spare time, to train themselves for big work. You, too, can possess power, money and happiness if you'll only make the effort. The reward is great—it's worth it.

Here's all we ask: Merely mail this coupon. Put it up to us without paying or promising. Let us send you the details of others' success through the I. C. S., and then decide. Mark and mail this coupon now.

I. C. S., Box 6126, Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6126, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER	☐ CHEMICAL ENGINEER
☐ Electrician	☐ SALESMANSHIP
☐ Electric Wiring	☐ ADVERTISING MAN
☐ Electric Lighting	☐ Window Trimmer
☐ Electric Car Running	☐ Show Card Writer
☐ Heavy Electric Traction	☐ Outdoor Sign Painter
☐ Electrical Draftsman	☐ RAILROADER
☐ Electric Machine Designer	☐ ILLUSTRATOR
☐ Telegraph Expert	☐ DESIGNER
☐ Practical Telephony	☐ BOOKKEEPER
☐ MECHANICAL ENGINEER	☐ Stenographer and Typist
☐ Mechanical Draftsman	☐ Cert. Public Accountant
☐ Machine Shop Practice	☐ Railway Accountant
☐ Gas Engineer	☐ Commercial Law
☐ CIVIL ENGINEER	☐ GOOD ENGLISH
☐ Surveying and Mapping	☐ Common School Subjects
☐ MINE FOREMAN OR ENGINEER	☐ CIVIL SERVICE
☐ Metallurgist or Prospector	☐ Railway Mail Clerk
☐ STATIONARY ENGINEER	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ AGRICULTURE ☐ Spanish
☐ Architectural Draftsman	☐ Navigator ☐ German
☐ PLUMBING AND HEATING	☐ Poultry Raising ☐ French
☐ Sheet Metal Worker	☐ Automobiles ☐ Italian

Name _____

Present Occupation _____

Street and No. _____

City _____ State _____

If name of Course you want is not in this list, write it below.

Camp waiting patiently and the fellows within a radius of fifty miles, all enjoying a quiet smile.

My luck was getting the best of me. Where should I look now for trouble. I dove again into the transformer compartment and for no especial reason, ran my hand around under the primary windings. A sharp piece of wire pricked me. I dug in and discovered loose wire. This of course meant, the burn had gone down another layer. I unraveled some more wire and thought quick as to which end must lead down into the main winding, and which ran back into the dead winding. The right one was quickly scraped and run over to the terminal and the key pressed once more. Mind you, I had cut out my choke coil. When I touched the key, my condensers spurted blue flame from every point. I could hear my spark through my rotary case. Of course I had cut down my primary windings just two entire layers, and this made quite some difference in the performance of that transformer. I put the choke coil back in and got pretty good results, and then started on the test once more. I was a good hour late, but I knew the boys would be waiting for NAA anyway, and were probably still on. I called them. Then I listened. Nothing doing. I fooled with my flash light batteries, and my lighting batteries on my audion, and then I discovered that the lighting battery was on its last legs. It would hold up the brilliancy of the filament for a minute, but it quickly slumped down into a hopeless red.

My flashlight batteries were also shaky and as I had nothing else available, I was finally absolutely stuck and down and out. I had worked like a dog for an hour, had exercised every bit of knowledge and experience a First Grade Commercial is supposed to have, had pulled my whole set to pieces, and rebuilt it, had burned the tin off my soldering copper, which I always regard as the most serious of all calamities, and I had advanced not one peg. The fellows at the State Camp unquestionably put me down as a piker, and the young things around town of course know that I am a much overrated has been.

Can any one match this case of Rotten Luck?

CONSTRUCTION OF A LONG LIFE DRY CELL

By Nelson Maguire

In the construction of dry cells, it is very hard to give any good data or information on this special subject as there are many designs and patents for the same. After considerable experimenting, the writer made a cell similar to the one described here and found it to last much longer than the ordinary kind which may be purchased for about thirty-five cents.

The first step is to procure a glass jar about three inches in diameter and about six inches high. Place a zinc cylinder within about 2⅛ inches in diameter and 5⅛ inches long; then line the inside of the zinc tube with thick blotting paper and place the carbon in the center. The carbon from an old dry cell will do. The paste is made as follows: Mix three parts of water and one part of muriatic acid, by adding ACID to the WATER, not vice versa. Thoroughly mix four parts of crushed charcoal, two parts of flour, and one part of plaster of Paris. These are measured by volume and not by weight. Now mix the powder and the liquid together into a thick paste and fill the jar up even with the top of the zinc. The cell is then completed by covering the top with a good sealing compound which may be taken off old dry cells. After the cell has stood two hours, it is ready for actual work.

The ordinary dry cell does not last as long as this type because the acid eats through the zinc and causes evaporation. A salt is formed on the outside and in this manner, the cell becomes weakened. The glass coating protects the zinc for a longer time.

MARCONI WIRELESS TELEPHONE

The first public demonstration of the Marconi Wireless Telephone took place Monday evening, June 12th, when the experimental station at Aldine, N. J. talked to David Sarnoff on the steamship Bunkerhill which was taking the members of the New York Technology Club to Boston to attend the dedication of the new buildings of the Massachusetts Institute of Technology.

Conversation was begun at eight o'clock and lasted until ten when the steamer was sixty miles up Long Island Sound. The Bunkerhill was not equipped with a wireless telephone so the results of the demonstration were announced by radio telegraphy. The clearness of the signals amazed the listeners on board the Bunkerhill and among those who heard the test were, Mr. Sarnoff, Orville Wright, A. R. Hawley, Rear Admiral Capps and Alexander Graham Bell. After the conversation had been carried on for a time, Mr. Weagant played a phonograph and the strains of "The Star Spangled Banner" greeted the listeners. Then came the "Marseillaise" and in response to an encore, Mr. Weagant played "Tipperary." The test was a complete success.

Has an Illustration of Your Station Appeared in QST ? ? ?

If it has, you are in luck. You can buy the half-tone and do what a great many amateurs have begun. The scheme is to print a photo on your stationery from the engraving. Then, when you write to a fellow-amateur, he can see just what your station looks like and all about it. It is a fine scheme and to help it we shall place on sale—for the owners—half-tones of stations which appear in QST.

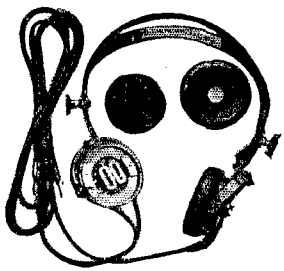
These cost us from a minimum of $1.25 up to $2.50. We shall sell each one, regardless of size, for $1.00. This gives you a chance to save some money and get in on a dandy idea. If your station has enjoyed the honor write today; just enclose a dollar, ask for your half-tone, and it will be sent post-paid by return mail.

ADDRESS: ILLUSTRATION DEPARTMENT

American Radio Relay League, Hartford, Connecticut

BRANDES RADIO HEADSETS

Superior Type, $5.50



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Fall classes both Day and Evening start September 18th. Send stamp for our prospectus which contains detailed information also free call list and other useful data.

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"RADIO" QUALITY

RECEIVING SPECIALTIES

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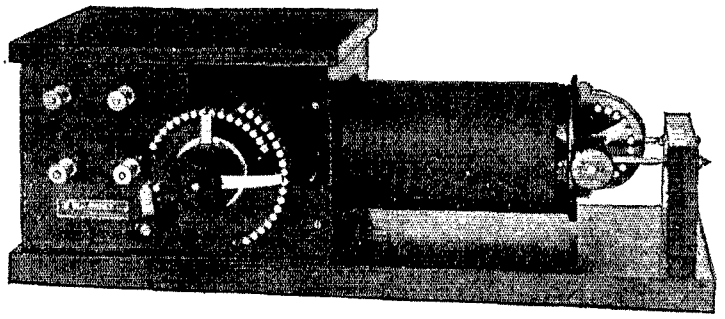
THE COUPLER YOU WILL EVENTUALLY BUY



YES—IT'S "The Original" Navy Type Transformer.
Without a competitor, ask a friend who owns one. BETTER ORDER NOW.
The market is very uncertain, be wise. We have a large supply
of all models ready for immediate shipment

Is it of any value to you to know that the Model 5A and 6S are finding their way into the most elaborately equipped stations in the country?

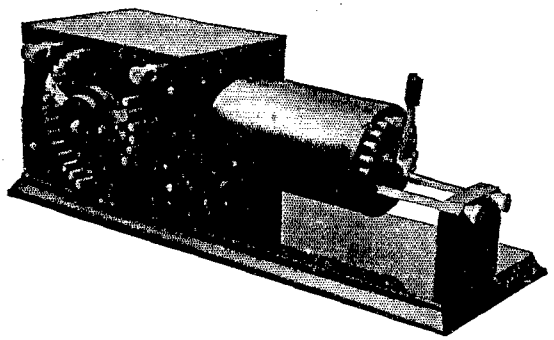
THERE'S A REASON

EXPERIMENTERS—You are aware of the wonderful results being obtained with the Electron Audio Detector and Oscillator. We have a supply on hand awaiting your order—Price, $6.50 double filament, single, $5.50

OUR CATALOGUE FOR 5c

The Radio Apparatus Co.
Pottstown, Pa.

Arnold Navy Type Loose Coupler Price, $15.00



Perhaps you have noticed I specialize and *this instrument is my specialty.* One must excel when efforts are concentrated on a single instrument. These instruments are not and never were ground out in quantities and the personality of the maker lost. I make every instrument myself, test it and know just what enters into its construction.

With suitable inductance in conjunction with an Audion Detector, this instrument has proven very efficient for receiving undamped waves. This Hook-up will be furnished to prospective purchasers. I also carry the finest line of Switch Points, Rubber Knobs Cabinets and Accessories on the market.

SEND 2c STAMP FOR BULLETIN No. 1

J. F. ARNOLD, 135 East 119th St., New York City

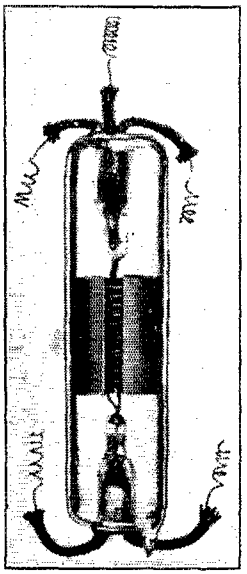
SUPER-SENSITIVE

DOUBLE FILAMENT

OSCILAUDION

$5.25 POSTPAID

DETECTOR—AMPLIFIER—OSCILLATOR



The Oscilaudion has established a new World's long distance record of 9,000 miles. The Oscilaudion is used at Harvard University and by advanced experimenters throughout the country. Most of the larger universities are now using the Oscilaudion in their experimental laboratories.

WARNING — The success of the Oscilaudion has caused unguaranteed, inferior, single filament imitations to appear on the market.

GUARANTEE—Every OSCILAUDION is guaranteed supersensitive as detector. amplifier or oscillator, and is further guaranteed to reach the user in perfect condition.

DEALERS AND JOBBERS—Here is your chance to cash in on the enormous demand for the OSCILAUDION. The pure electron discharge OSCILAUDION has created a sensation.

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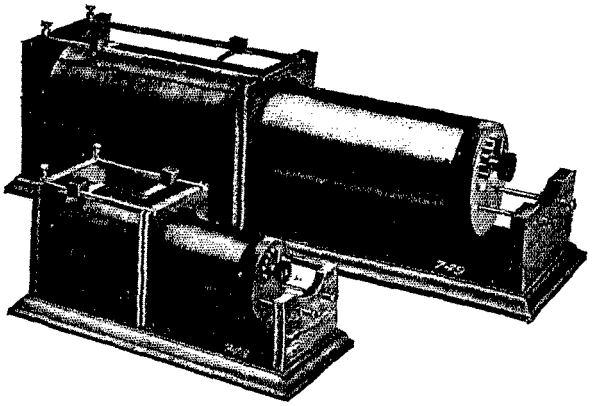
fitting you for positions paying good salaries with wonderful chance to travel the world over. It's the most interesting profession known and the demand for skilled operators is increasing. Send stamp for catalog, which gives full information.

NATIONAL RADIO SCHOOL, 1405 U St. Washington, D. C.

Have you entered your name for the QST Subscription Contest? Give a little of your spare time and try for one of the valuable prizes. See the announcement in this issue.

New Undamped Wave Coupler, No. 749

Special Introductory Price, $18.00



Our new Coupler No. 749 is 32 in. long, 9 in. wide and 10 in. high over all, and on the average sized antenna tunes up to 15,000 meters. This Coupler, used with the new CHAMBERS' SYSTEM OR CIRCUIT will bring in signals from domestic and foreign Arc Stations surprisingly loud and clear. Note the difference in size of our No. 748 and the new No. 749.

We claim to be the original inventors of a SYSTEM or CIRCUIT, for the reeeption of the undamped waves without the use of Loading Coils or Oscillating Coils, as they are sometimes called; as with our system or circuit only two inductively coupled coils are necessary. Circuit supplied with each coupler.

This CHAMBERS' CIRCUIT saves you money. Think of it! No eatra coils to pay for, and price of coupler only $18.00.

Place order now so as to be in on the introductory price. Orders filled in rotation. Send for descriptive matter.

F. B. CHAMBERS & CO.

2046 Arch Street
Philadelphia, Pennsylvania

Announcing the Tubular De Forest Audion Bulb

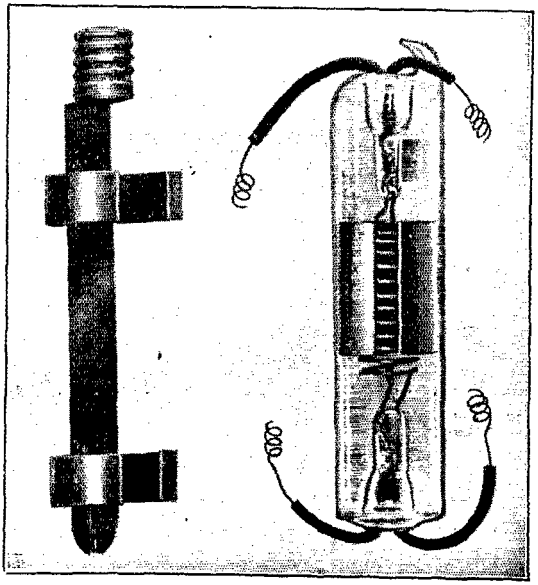
"There is only one Audion-the De Forest"

The New Type T Tubular Audion Bulb gives very loud signals from powerful stations. It has a large cylindrical plate, a spiral grid and only one filament of tungsten. As this is a long, straight-line filament, it has a long life. Edison effects are completely eliminated. The plate is in contact with the heavy glass tube, preventing overheating.

Sold Separately, $5.50 each

The special adapter fits this type to the screw base receptacles of De Forest apparatus, and is furnished at 40 cents extra.

Send stamp for Bulletins D16 and B16

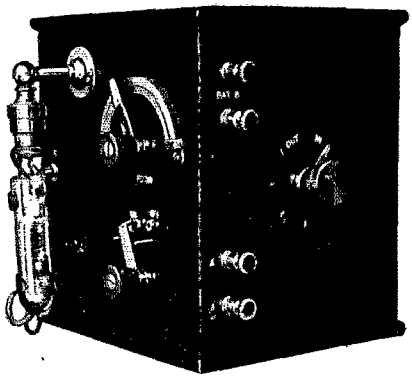


The Wireless Mfg. Co.
Canton, Ohio

"THERE IS ONLY ONE AUDION, THE DE FOREST"

DE FOREST ULTRAUDION DETECTOR

FOR DAMPED AND UNDAMPED WAVES



TYPE UJI
DeForest Ultraudion Detector
Price, $27.50

The new DeForest Ultraudion Detector enables every operator to receive both spark and arc signals at minimum expense. This instrument is made for private or amateur use only, and is within the means of all. Heretofore the lowest priced genuine Ultraudion cost $110.00.

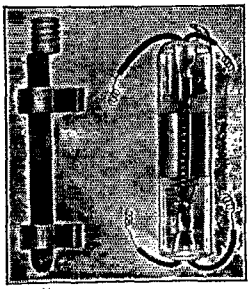
We now offer the new amateur type at $27.50. It is equipped with potentiometer control for the "B" or high voltage circuit, arranged for external batteries to be furnished by the purchaser, has an internal rheostat like our higher priced instruments, and is equipped with the genuine DeForest Tubular Audion with adapter.

No complicated circuits for tuning are necessary or desirable. Simply a regular tuner of proper size is used. No need of spending money on large, expensive coils to receive Darien, Nauen, Eilvese and all the undamped stations.

The genuine DeForest Tubular Audion illustrated herewith is now within the means of all amateur operators. It is sold to anyone in any quantity without the return of the old one.

Fully 50 percent. more sensitive than any other known form of detector and thoroughly reliable. Tests show an operating life of at least 800 burning hours when properly used, equal to at least a year's service.

With it the maximum receiving range can be covered. Suitable for receiving arc and spark signals and also for amplifying. Each equipped with a static shunt to prevent paralyzing from static and loud signals. Guaranteed to be delivered to you in perfect condition.



Genuine DeForest Tubular Audion
Price, $5.50, delivered
Adapter, 40c extra

ACCEPT NO INFRINGING IMITATIONS. INSIST ON THE GENUINE ARTICLE

Send stamp for Bulletins R16 on the Audion Detectors, Audion Receiving Sets the Tubular Audion and the Ultraudion

"WARNING—You are entitled to the genuine Audion, guaranteed by the owners of the Audion patents, when making an investment of this kind. Any evacuated detector having a filament, a grid and a plate, as well as other types, are covered by our patents, and several irresponsible infringers are being prosecuted. To be safe and get full value for your money, insist on the genuine DeForest Audion."

DeForest Radio Telephone & Telegraph Company

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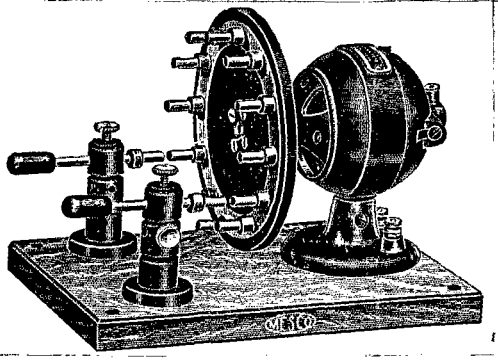
Makers of the Highest Grade Receiving Equipment in the World

New Mesco Radio Apparatus

ROTARY SPARK GAP

A Rotary Spark Gap is required in every transmitting station by the Federal authorities, for the reason that this type of gap produces a pure wave of low damping decrement. It also increases the efficiency of any transmitting station from 20 to 30 per cent.



This Rotary Spark Gap emits a high musical note, more audible to the human ear, can be heard at greater distances than the note from the stationary type, and cannot be mistaken for static or other atmospheric disturbances, a fault common with the stationary gap due to its low frequency note.

The rotating member has twelve sparking points mounted on a hard rubber disk and is carried on the motor shaft.

Also fitted with two stationary electrodes with special adjusting devices.

The Gap can be successfully used on any of our spark coils or transformers up to and including 1 K. W. capacity.

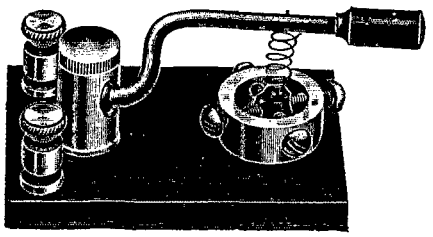
Our standard Globe Motor is used, which will operate on 110 A. C. or D. C. circuits and attains a speed of 4,500 R.P.M. Also made with our Globe Battery Motor, which can be operated on a six-volt circuit.

List. No.		Price
222	Mesco Rotary Spark Gap, 6 volt	$12.00
223	Mesco Rotary Spark Gap, 110 v., A. C. or D. C.	13.00
216	Rotary Unit only, with two Stationary Electrodes, 1 3/16 in. shaft	5.00

UNIVERSAL DETECTOR STAND

This Stand has a heavy brass cup, with four binding screws, capable of holding crystals up to and including ¾ in. diameter.

A hollow standard encloses a brass ball. Through an opening in the wall, a brass arm with hard rubber handle is secured fast to the ball, making a ball and socket joint, allowing it to be adjusted at any angle or used in any position.



A hole for the introduction of different size wires extends through the arm. A set screw in the side of the arm binds the wire.

Supplied with two binding posts. All mounted on a heavy genuine hard rubber base 2¼x 4¼x⅝ in. All metal parts nickel plated. A spring rests on the ball in the hollow standard and sets into a cup under the adjusting screw, so that varying pressures can be had as circumstances require. Remains permanently in adjustment under jars and vibrations of every description.

List. No.		Price
248	Universal Detector Stand	$3.00

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It is pocket size, 8x4½ inches, contains 248 pages, with over 1,100 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, Etc.

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