

*An Amateur Wireless Magazine*

PRICE 10 CENTS

A decorative rectangular frame with a stippled interior, flanked by two torches with flames. The letters 'QST' are prominently displayed in the center of the frame.

**QST**

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**The American Radio  
Relay League**



**FOR THE MONTH OF APRIL  
NINETEEN HUNDRED AND SIXTEEN**

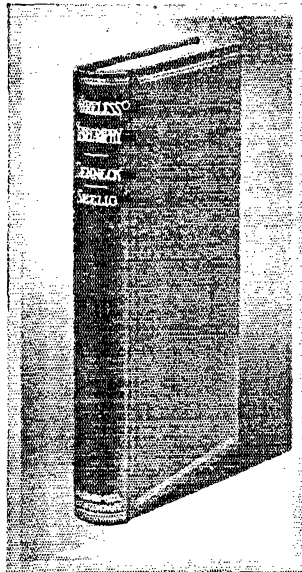
# ZENNECK'S Wireless Telegraphy

"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.



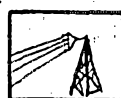
**E**VERY amateur operator and every student of wireless owes a debt to Mr. Seelig who has translated Dr. Zenneck's "Lehrbuch der drahtlosen Telegraphie." This book has been a standard in Germany and now it is brought to America and translated for us. The book carefully covers all phases of wireless 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



April, 1916

Number 5

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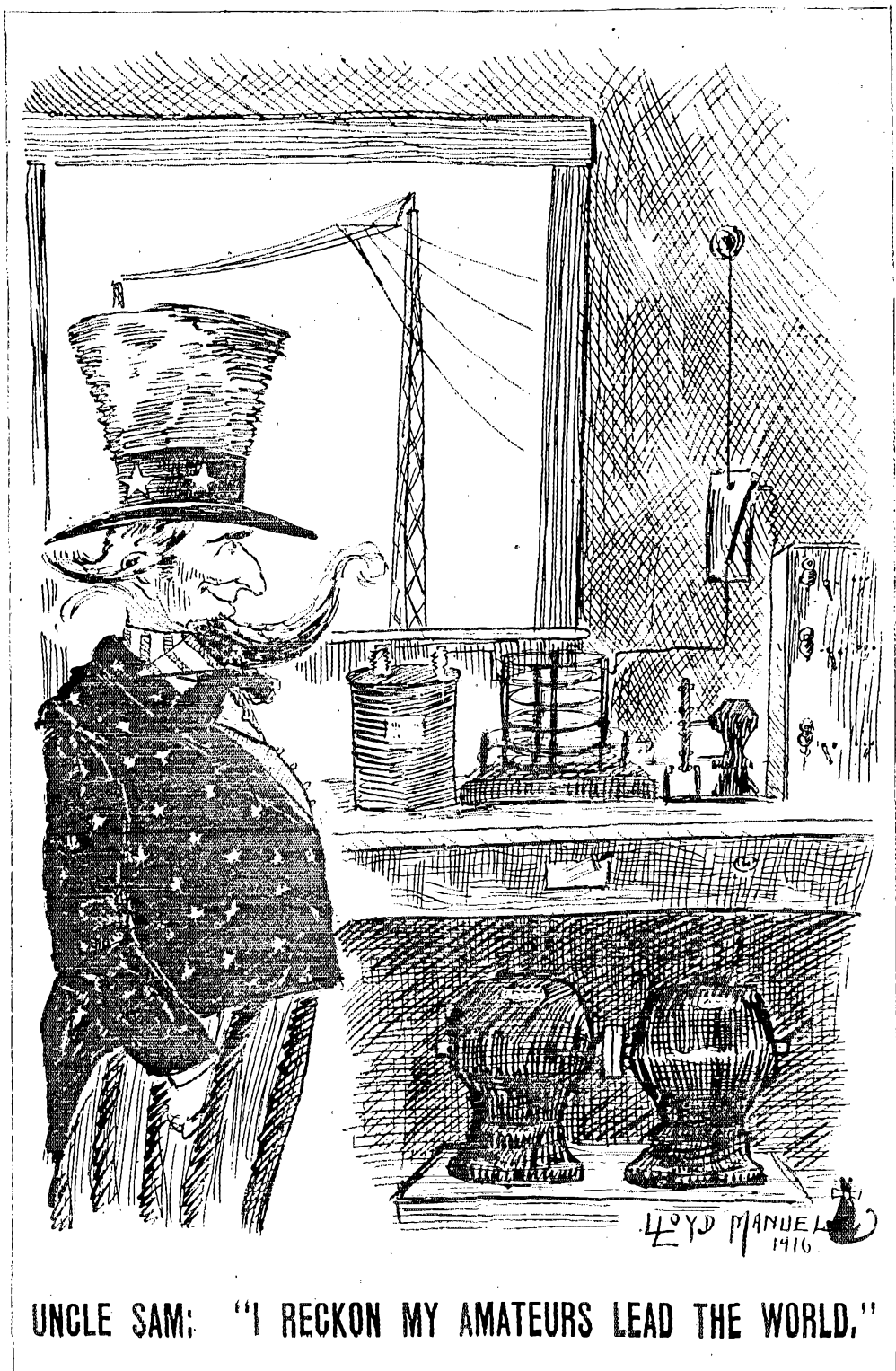
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UNCLE SAM: "I RECKON MY AMATEURS LEAD THE WORLD."

# April Radio Relay Bulletin

## WASHINGTON'S BIRTHDAY AMATEUR RELAY MESSAGE

By 9XE

Colonel W. P. Nicholson sends message  
from Rock Island Arsenal.

**E**VERY one remembers the story of a famous little George, and his hatchet; had this little George been living in the 20th Century and on the particular date of February 22nd, 1916, he would probably have told his Father he could not tell a lie and he had blown the fuses with his little key. Yes, we are quite sure little George would have reported thus, for every amateur tried his best on the memorable night. The important amateurs of the United States lent their aid to this relay about which we have heard so much. A few months before, the same amateurs had relayed a less important message which was a success. The first message of December 31st, 1915 inspired 9XE and his assistants to order the work on February 22nd, 1916.

The purpose of this test was to show the United States Government that the amateurs of the United States were in a position to co-operate in radio work. The United States authorities at the Rock Island Arsenal seemed rather skeptical about the results of such a relay, but promised to co-operate with 9XE. Never before had the amateurs been flattered by such co-operation. The Navy Department went so far as to have QRT and QRM signals sent out from Arlington on the night of the test. Many of the readers heard NAA give his warning.

Everything had been carefully arranged before the test. The desirable sending stations were listed according to wave lengths, power and other essential details. A large map of the United States was divided up into Districts and by means of circles showing the range of various high powered stations, it was readily determined that the

amateurs could cover every point in the United States except a few of the western desert Districts. Considerable diplomacy was necessary in handling the situation, as a certain amount of jealousy was found to exist between Special stations, First-class amateur stations, and the little fellow with the gas engine coil and a few dry batteries. Local jealousies came out, one certain amateur claimed that he was always jammed by another when a relay message came through. This was investigated and it was found that neither the interferer or the QRM'd man could receive a message well enough to read their own call-letters. Their sending was beyond all expression and the only thing their neighbors could read, were their call letters.

Some stations wanted a different night—others a different time, and still others wanted certain stations, friends of theirs, or second cousins, appointed in Squedunk. Every one had something to suggest. Some wanted a copy of the msg. before it was transmitted so they might check up what they received, another crew wanted each station to call another and receive o. k. for a msg. This idea would have worked out well had the message not been an emergency call, all stations trying to pick it up on a QST.

After considering with great care the hundreds of suggestions, final instructions were printed as complete in detail as was possible. A certain time was assigned to each relay station together with the particular wave length which was to be used. Five minutes were given for sending the message and this allowed very little time for tuning. All this backed up the one main purpose, the conditions were exactly as

planned; no one had any advantage over the fellow; it was an emergency message; and a case of receive it or not.

On Friday, February 18th at eleven p. m. a test was tried and on this particular occasion QRN was worse in 9XE's district than ever before during the winter. The results from the test were very poor and showed how extremely helpless the amateurs were in the face of such great difficulties.

#### Last Minute Changes.

The Harvard Wireless Club notified 9XE that 1ZD's station could not work, but Harvard University would take 1ZD's place, and use his wave length. Harvard certainly did its share.

University of Michigan, 8XN, at Ann Arbor, got in touch with the writer and asked for an assignment. Every one has heard of the striking efficiency of this station, and a special assignment was made for 8XN on the same time as 5BJ, and another assignment was granted at twelve o'clock to permit the stations over the eastern part of the United States to hear the message on the wave length of Miami and Key West stations. Those who claimed they were jammed by stations sending press, only had to adjust their variable condensers a little and 8XN could have been heard.

On the very night of the relay, Prof. Ford of 9YA called the writer and requested permission to send the message twice. This station of the State University of Iowa is well known throughout its District, so permission was granted for another sending time along with the regular assignment. The second sending occurred at 11:35 p. m. central time.

About this time 9XE was the busiest place in Davenport. The Associated Press succeeded in sending in a telegram asking for the msg. about every five minutes, and between these intervals, long distance phone calls kept the writer on the jump. At the same time the local reporters were busy explaining to the writer how nice it would be for the newspapers to have the Message at once. Needless to say, no one got it until it had been sent.

#### The Fatal Moment Arrives.

Eleven p. m. The first time in the history of wireless telegraphy, the air was clear with only an occasional QRN. Every amateur in the country was quiet—truly a remarkable thing. It is still eleven p. m. and out the message came:

QST, QST, QST, de 9XE -----

QST relay MSG.

A Democracy requires that a people who govern and educate themselves should be so armed and disciplined that they can protect themselves.

(Signed) Colonel Nicholson, U. S. A.

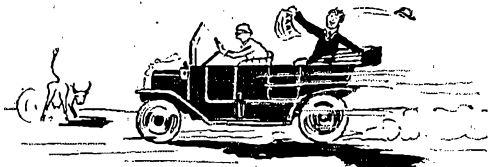
The readers need no further description as to just how each station received and relayed the message. Needless to say, the test was a complete success. Certain parts of the message became balled up in the transmission, and before it had gone far it had been signed by Colonel Nicholson, Colonel Nicholson, Colonel Michalson, Colonel Micholson, Colonel Nichols, Colonel Nick, Colonel Richards, Colonel Richardson, and several other Colonels amplified to the nth power. It was a common cause, rich men, poor men, young men, old men, two ladies, a host of boys, and several ministers. All the talk about preparedness shows that young America is on the job when aroused.

#### How the Message Travelled.

The Pacific Coast heard the news fifty-five minutes after it had left 9XE. The Atlantic Coast was just five minutes later than the Pacific. New Orleans boasts of receiving the message within twenty minutes of its first transmission, and the Canadian border reports having heard the message at 11:20 P. M. Central time. All along the coast of Texas, the message was received within thirty minutes after the original transmission. Every amateur may feel with pride that he is one of the efficient system which bounded the United States in one hour.

#### Incidents of the Relay.

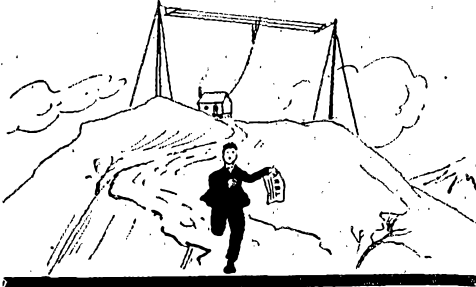
Kuna, Idaho. On his large ranch, H. E. Rawson received the message, and galloped across the prairies eighteen miles with his



one-lung Ford, and having made the distance in record time, delivered the message to the Governor, who was so surprised at this strange manuever that he was unable to express himself for several days. Mr. Rawson certainly showed the old time American spirit.

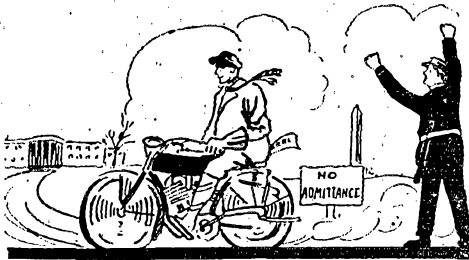
Peekskill, N. Y. J. W. Dain, 2CE, was sick in bed, but still had plenty of pep left in him. Against the Doctor's orders, he tried to receive the message, and with chattering teeth and trembling knees, he finally copied it. How's that for spirit?

Victor, Colo., William C. Colburn of the Colburn Ajax Mines and one of the prominent members of the American Radio Relay League, received the message at his Special



station which is located 10,300 ft. above the sea level. This was a nice high place for the message, where we hope it may stand upon the pinnacle of American fame.

Washington, D. C. W. A. Parks, 3DS, copied the message, jumped on a waiting motorcycle, opened the machine up; and after nearly frightening several policemen.



especially the one at the Executive Mansion, dashed up the steps of the White House with the msg. written on an A. R. R. L. blank for the President of the United States, whom we hope was peacefully sleeping as it was about 2:00 a. m. February 22nd. Mr. Parks is a "Minute-man."

Wheeling, W. Va. John C. Stroebel wrote his station down in the book of fame as 8ZW, which was heard from one end of the country to the other. While Mr. Stroebel was notifying hundreds of other amateurs by wireless, he was unable to resort to the wild and rugged roads of West Virginia, so he was compelled to fall back on the old time out-of-date system of telegraphy run by the Western Union, to notify the Governor of his State.

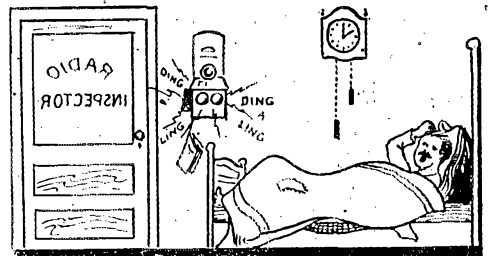
Lewiston, Mont. 7BD, was found to be the connecting link between the middle west and the Pacific Coast. A. C. Campbell, the operator, certainly did some quick work when he received the message from 9XN and relayed it to La Grande, Ore.

La Grande, Ore. O. M. Heacock, formerly 7OH, now 7ZH, came in to good advantage when his wonderful aerial handed the message to 7JD. See the picture of this famous pole in the Illustrated Section.

Hoquiam, Wash. This city came on the map when H. W. Blagen, received the message and handed it on to Lacey, in the same State.

Lacey, Wash. The Morning Olympian of Olympia, Wash. tells us how the Rev. Sebastian Ruth in charge of the radio outfit in St. Martin's College, received the message from 7JD and sent it out broadcast covering several hundred miles of western territory. Rev. Ruth, reports having encountered a great deal of interference from VAE, Point Estavan, Vancouver Island. VAE seemed to be calling imaginary warships of the Allies. All sorts of fictitious gunboats are dreamed to have been prowling around our coast so with even the Allies against us, we put the relay through in good shape. Walter A. Kleist, of Tacoma, Wash. delivered the message to Governor Lister of Washington.

Boston, Mass. Mr. S. W. Dean of the Harvard Wireless Club received the message from 2XW. Mr. Dean was so delighted that he hauled Mr. Gawler, the Radio Inspector of the First District out of bed at 2:00 A. M. The Governor of



Mass. was compelled to undergo the same surgical operation. Mr. Dean phoned him the message in the wee hours of the morning.

Marengo, Ia. The Mayor of this city received the Washington's Birthday message which was received by Peter A. Stover, who copied the message from 9XZ.

Jefferson City, Mo. The message reached this city at 11:45 P. M. and was received by Willis Corwin at his radio station 9ABD

Mr. Corwin is exceedingly proud of the letters of congratulation which he received from the Governor of his State and the Mayor of Jefferson City.

Muskogee, Okla. Colonel Nicholson's message was picked up here by Ernest Sams at 11:41 o'clock. Mr. Sams call is 9XN.

Waco, Texas. Hurrah for Waco! This place is about one thousand miles from 9XE and on the night in question the static was doing its worst. Paul M. Deeley of this city got the better of the static and so was able to copy the message a few minutes after it was sent. At first he was only able to copy about every third word of the famous relay but the checking up was so beautifully done and with such little loss of time that the A. P. wire was beaten by half an hour.

Shreveport, La. This place is about nine hundred miles from Davenport, Ohio, but Mr. W. Antony had no trouble in hearing the message all the way down the Mississippi river and first copied all but three words from the origin 9XE.

Worcester, Mass. The Worcester Telegram of February 22nd reports that William H. Allison received the message from 1ZL and delivered it to the Mayor according to schedule.

Nutley, N. J. The Nutley Sun states that Arthur A. Hebert of Highfield Lane, one of the important members and District Superintendent of The American Radio Relay League received the message thirteen minutes after its start from the Rock Island Arsenal.

#### List of Relay Points.

The writer could continue for several pages giving newspaper clippings and news items from every part of the country, but the space in "QST" must be devoted to more important things. Credit is due in many places which we have not mentioned and the list given is by no means complete. Many of the relay stations neglected to notify headquarters, so their names will fail to appear.

In conclusion, we wish to express our thanks to Captain Bullard of the Navy Radio Service. Through his co-operation, we can explain much of the success. Mr. Josephus Daniels, Secretary of the Navy also lent valuable assistance and recognizes the value of amateur relaying. Finally, we wish to thank all the members of The American Radio Relay League for their timely assistance.

#### ALABAMA

Birmingham H. S. Brownell  
Mobile B. W. Martin

#### ARKANSAS

Little Rock J. M. Clayton

#### COLORADO

Denver E. A. Smith  
Victor H. C. Colburn

#### CONNECTICUT

Hartford H. P. Maxim  
Hartford C. D. Tuska  
Hartford L. D. Fisk

#### DISTRICT OF COLUMBIA

Washington Nat. Radio School  
Washington W. A. Parks

#### GEORGIA

Athens W. B. Pope

#### IDAHO

Kuna H. E. Rawson

#### IOWA

Ames Iowa State College  
Cedar Falls E. F. Grossman  
Council Bluffs I. M. Kerney  
Des Moines G. J. Lorance  
Dubuque C. W. Bonson  
Dubuque J. D. Brennan  
Dubuque C. W. Patch  
Iowa City Prof. A. H. Ford  
Marengo P. A. Stover

#### ILLINOIS

Cairo K. B. Warner  
Galena L. M. LeBron  
Fort Wayne E. C. Young  
Louisville C. Bridges  
Magnolia A. C. Spencer  
Moline E. Wittich  
Quincy J. J. Sehott, Jr.  
Rockford R. Graf  
South Bend L. Fruit  
Valparaiso Dodges Institute  
Wishawaka R. I. Hootens

#### KANSAS

Wichita W. S. Ezell

#### KENTUCKY

Bellevue Thos. Tallentire

#### LOUISIANA

New Orleans W. J. King  
Shreveport D. R. Simmons

#### MARYLAND

Baltimore R. Dimling  
Baltimore R. S. Hall  
Baltimore C. R. Lamdin



**MASSACHUSETTS**

Cambridge S. W. Dean  
 Great Barrington R. F. St. James  
 Northampton G. Sabine  
 Worcester W. H. Allison  
 Worcester W. B. Burgess

**MICHIGAN**

Battle Creek E. E. House  
 Bay City Geo. McBride

**MISSOURI**

Cape Girardeau H. Deal  
 Columbia L. M. Stewart  
 Jefferson City W. P. Corwin  
 Kansas City R. R. Moore  
 St. Louis A. S. Blatterman  
 St. Louis W. H. Carroll

**MINNESOTA**

Hutchinson E. R. Dennis

**MONTANA**

Lewiston A. C. Campbell

**NEBRASKA**

Kearney S. L. Keller  
 Lincoln T. C. Rice

**NEVADA**

Reno W. Pressell

**NEW JERSEY**

Atlantic City Earl Godfrey  
 Bridgeton W. A. Fithian, Jr.  
 Camden W. A. Fyles  
 Highland Park F. K. Shield  
 Lake View L. Spangenberg  
 Morristown E. P. Gaty  
 Ocean City E. R. Burgeois  
 Nutley A. A. Hebert  
 Ridgewood T. C. Banto  
 Rutherford B. B. Jackson  
 Summit F. M. Waterman  
 Westfield H. B. Day

**NEW YORK**

Albany J. K. Hewitt  
 Freeport S. L. Raynor  
 New Rochelle G. C. Cannon  
 New York City A. Boeder  
 New York City P. T. Brown  
 Niagara Falls O. E. Dunlap  
 Nyack M. V. Bryant  
 Peekskill J. W. Dain  
 Port Chester J. W. Hubbard  
 Port Washington J. Weiss  
 Yonkers J. K. Noble

**NEW HAMPSHIRE**

Keene Reg. F. Hour

**NORTH CAROLINA**

Winston-Salem Sargeant Clodfelter

**OKLAHOMA**

Muskogee Earnest Sams

**OHIO**

Galion L. M. Berry  
 Hamilton Doron Brothers  
 Lakewood G. E. Grostick  
 Lima G. W. Hays  
 St. Marys Mrs. C. Candler

**Sandusky**

G. L. Beare

**OREGON**

La Grande O. M. Heacock

**PENNSYLVANIA**

Bala Chas. A. Service, Jr.  
 Philadelphia L. M. Knoll  
 Philadelphia F. B. Chambers Co.  
 Philadelphia J. A. Nassau  
 Pittsburgh A. J. Gilmore  
 St. Davids C. H. Stewart

**SOUTH CAROLINA**

Charleston W. F. Allston

**TEXAS**

Dallas F. M. Corlett  
 San Antonio J. C. Rodriguez  
 Waco T. Darwin  
 Waco P. M. Deeley

**UTAH**

Salt Lake City J. G. McCollom

**VIRGINIA**

Richmond R. R. Chappell

**WASHINGTON**

Lacey Rev. S. Ruth  
 Hoquiam H. W. Blagen  
 Tacoma W. A. Kleist

**WEST VIRGINIA**

Wheeling J. C. Stoebel

**WISCONSIN**

Superior F. W. Keeler

**H. C. GAWLER, RADIO INSPECTOR  
 OF THE FIRST DISTRICT**

To H. P. Maxim

I beg to inform you that the relay message sent out from Rock Island Arsenal was telephoned me at about 2:00 a. m. this morning by 1ZD. The text is as follows:

"A Democracy requires that a people who govern and educate themselves should be so armed and disciplined that they can protect themselves. Col. Nicholson."

This message was received by 1ZD at 1:45 A. M. and immediately telephoned to Governor McCall. He was unable to communicate with Mayor Curley of Boston, but delivered the message through other radio stations as outlined in the program.

Permit me to extend to you and the American Radio Relay League my heartiest congratulations for this notable achievement. You will recall when the formation of your league was under consideration, I emphasized the importance of having efficient and effective lanes of communication over extreme distances. It is indeed a most pleasant surprise that this ideal has been accomplished to such an extent in the short space of time the league has been in operation, and it seems to me the possibilities for even better results are most encouraging.

Respectfully,  
 (Sgd.) H. C. GAWLER,  
 Radio Inspector.

## THE SENDING SET

By Arthur A. Hebert

**T**HE average amateur thinks that because he has a coil or transformer, condenser, gap and a helix, it is only necessary to make the connections, and, if a big noise is made in the gap, he must be radiating powerful currents in the antenna. It is, therefore, my intention to say a few words in this article on the different pieces of apparatus used in the sending set in the order of their importance.

**THE CONDENSER:** Known to many amateurs as Leyden Jar. In my opinion it is one of the most important parts of the apparatus, but it is seldom taken into consideration, so long as a discharge can be obtained, at the gap. A simple way to tell if there is enough Capacity (condensers in the circuit) is to watch the discharge at the gap,—if it is red or yellow (flaming) there are not enough condensers; if on the other hand the discharge is stringy and blue, it is quite certain there are too many condensers in the circuit. For use with a properly rated  $\frac{1}{4}$  kilowatt transformer, which is a favorite with many, a condenser capacity of .0045 microfarads (three sections of Murdock's Moulded Condensers will give approximately this capacity) should be found very satisfactory, and with  $1\frac{1}{4}$  turns in the primary of the oscillation transformer of the "Pan Cake" type, which will be taken up later, will give a wave length of 200 meters in the closed circuit.

**THE GAP:** Be sure to keep the two electrodes clean in a plain gap, and in a rotary gap see that the teeth in the wheel are kept bright, as well as the electrodes (Emery Cloth or a fine file should be used for this work). In two cases which came to my knowledge the keeping of the gap clean increased the radiation by nearly  $\frac{1}{2}$  ampere. Do not be afraid to have the electrodes large enough—the less resistance in the path of the current the better the discharge—this is particularly so with a rotary gap. In connection with the rotary gap, bear in mind that the speed at which it revolves has a material effect on the oscillations radiated, and it is not the greatest speed that will give the best radiation. A simple method to determine the note or pitch of the wave emitted by a rotary gap is to hold lightly a piece of stiff paper over the revolving wheel touching it as though cleaning the teeth. If the speed of the

motor is varied, there will be different tones given out which can be compared to the frequency of the signals radiated and received by other stations. In making this test it will be found that better radiation takes place if the motor is so adjusted, that the number of revolutions is reduced just enough, so that the pitch of the note is two or three tones lower than when the motor runs at its highest speed. This applies particularly to motors whose speeds are two thousand revolutions or over, and having wheels not over six inches in diameters.

**HELIX OR OSCILLATION TRANSFORMER:** On account of the law, in order to obtain a pure wave, it is almost a necessity to use an oscillation transformer, although a plain helix can be used, but it requires very careful adjustment and very seldom can be made to radiate efficiently by the average experimenter and have a pure wave. One of the most satisfactory Oscillation Transformer for small sets, is the flat spiral type, commonly known as the "Pan Cake." It can be constructed as follows: The primary winding is made of ten turns of flat brass or copper ribbon (copper preferably) placed edgewise on a Bakelite or Hard Rubber insulating support, spaced one-half inch. The ribbon is  $\frac{5}{8}$  of an inch wide by about 1-64 of an inch thick. When wound spirally, the inside diameter should be about  $4\frac{1}{2}$  inches, the outside diameter  $14\frac{1}{2}$  inches. For the Secondary winding use the same size ribbon and spacing, but have about 20 turns, which will enable one to experiment with waves of from 200 to 600 meters. The set will be more efficient, of course, if this Oscillation Transformer is constructed with just one-half the turns given above to work on the 200 meter wave. Either the primary or secondary winding should be so arranged that it can be drawn away from the other, so that a certain amount of coupling can be obtained.

**THE ANTENNA:** Efficient radiation cannot be obtained if the antenna has a normal wave length of 300 to 400 meters, as great many have, and the gap circuit 200 meters. If such a condition exists the circuits are out of balance, and it is certain that no radiation will take place. The only remedy is to shorten the Antenna; for even though a condenser should be put in series with the ground, it is doubtful if the natural

period of the Antenna could be reduced enough to work properly,—so that if one expects to obtain good results and keep within the law, it would be better to shorten the Antenna. In the event of shortening the Antenna, it becomes necessary to add more wires to give an effective capacity to take care of the current to be radiated. For instance: Supposing the Antenna to be 100 feet long, 4 wires spaced 2 feet apart and it is to be shortened to 50 feet. Good results in sending will be obtained if there are 8 wires spaced 18 inches apart. The Antenna must be considered in the light of a Condenser, similarly to the condenser charged by the transformer, good work can-

not be expected if it does not take care of the charge imposed upon it.

**TUNING:** There is only one thing to say:—Bunch all of the apparatus together, being sure that the leads in the closed circuit (condenser and gap circuit) are short, of large wire, and be sure that the wires of the low voltage side (house current) of the transformer do not parallel the high voltage wires of the secondary side of the transformer, which will cause more trouble to the transformer and the house meter; and often set the house on fire.



## TAKING AN EXAMINATION

By Little Willie

**L**ISTEN, while I tell you how they made me buck the goat the other day, when I went up against it for a First Grade Comm.

There were three of us. We borrowed a semi-broken down omnigraph, and we listened to this running at anywhere from twenty-five to fifty-five words a minute, running frontward and backward until we had it all down pat, and could write it left handed whether the machine was running or not. I think it was successful in one particular only. It taught me the exclamation mark. I never knew it before.

There were not enough records for this omnigraph, but nevertheless we thought we ought to use it because they told us the Radio Inspector would pull one on us when we went up for our exams. As an omnigraph sounds altogether different from the phones, we thought we ought to get used to the 'graf.

With the phones, and nobody around, and if the pencil is sharp and nice and soft, we

can handle twenty easy, especially if we know what is coming. The latter makes a lot of difference. But when a half dozen disinterested and wholly unsympathetic critics stand around and watch you, and you have no idea as to what the stuff is that is going to come, and you also have a feeling down in your midst that you are almighty likely to flunk anyway, it is some job getting twenty, or even eighteen. At least that is the way the writer of these lines feels about it.

When the awful day came and we found the office of the Radio Inspector in the Custom house, we were just a little bit shaky. I wondered if I had overtrained. They say that you can do this in football and boat racing, and I don't see why one could not also do it in wireless.

The office, when we timidly edged in the door, had a lot of other goats with scared looks on their faces sitting down at tables

engaged in chewing the ends off of lead pencils. Some of them had their hair all mussed up where they had scratched it too hard, and others were just staring straight ahead into vacancy. The instrument of torture we recognized at once. It lay on the table over at the other end of the office, and had plenty of room to itself. No one wanted to get anywhere near it. The first look at its brass gears gave me a chill.

We mistook the Radio Inspector. I saw a man at a table and he looked sort of like the boss, so I asked him if he was the Radio Inspector. He said "No," and I saw at once that he was nothing but a goat himself. He was struggling through a First Grade Amateur and was having quite a time with a diagram.

Finally a keen looking, quick spoken youngish man came up and guessed the first time who we were and what we wanted. He was without any doubt, the real thing, and before our numbed intellects had quite mastered what was going on, he had us herded around the instrument of torture, and was hooking up the dry cells and fixing up those darned records: We each had plenty of paper given us, and knew that the awful moment had come.

The first thing was starting the machine up at nothing less than fifty-five words a minute. I gave up my goat on the spot. If he expected me to get anything at that speed, he was booked for a disappointment. The machine buzzed around so fast that you could not tell an H from an S to save your life. A J. and a figure 1 were absolutely alike, and what all the rest of the stuff was, was Greek to me. Then he pulled out his watch. I thought this was the sign to get ready, and I got, but noticing me, he said to wait a minute he was not ready yet. Then he screwed the business down and to my intense joy, the speed came down to something human. Finally he said to go ahead and we jumped in.

I got the first two letters O. K. Then something came and when I was trying to make up my mind whether it was an X or a space sig., I lost half a dozen letters. I grabbed hold with a jerk again, realizing that I was losing my grip. A lot of mixed up stuff about tugs and docks and fires came in about one-half of which I got straight. I was just getting control of myself when he stopped the shebang and told us to correct it and write it out neatly. I don't blame him, for the neat business. My copy looked like somebody had used the paper to sharpen a pencil on left-handed.

When I finished my copy and handed it in, I was dead sure I was not cut out for a First Grade Commercial. I might squeeze up some day to a cargo, and I ought to be satisfied with a First Grade Amateur. But, a First Grade Commercial—well, nothing

doing for little Willie, I feared.

Then we had handed up a lot of papers with questions on them which Mr. Radio Inspector sliced up with a pair of scissors and told us to paste each part onto the top of our blank paper and go ahead. The first question suggested that we might draw a complete diagram of a ship's radio equipment, showing the complete transmitting equipment, receiving equipment, auxiliary emergency equipment, explain the object of all parts, give their names, and use symbols to your heart's content. We had heard of this question, and we had crammed up on motor generators and storage batteries and wave meters, and decrement dingbobs, but when we came face to face with this diagram business, it seemed like quite a contract. After two hours and a half of drawing in and rubbing out, I had mine finished. Then I looked it over and found I had connected my DC ship mains up direct to my AC generator, and had forgotten all about my DC motor. This took another half hour to correct.

Then I tackled my questions. I knew how many kinds of condensers there were and I also knew what inductance does to my wave length, and also what happens when I put a condenser in series in my ground lead. But what in time was the reason for using high resistance phones with a crystal detector got me. I had to give this one up, although I supposed a lot of the wise guys who read this will know all about it. I confess I did not then, but I do now, and let's see some of you chaps guess on the subject.

I got snarled up trying to tell what I would do to prove that I had a pure wave. My goat got to slipping also when it came to proving whether or not my antenna was radiating, although I think I got by on this after a while. I made a fool of myself on what the law says about superfluous signalling. I allowed as how the law advises not to engage in this to pass time any more than was necessary. The correct answer is PROHIBITED. No half way business at all. Just simply cut it out.

Finally after four and one-half hours, I was wringing wet and the job was finished. I waited around with my other fellow victims about an hour and found I had got away with 86 out of a possible 95. They cross five points off of experience in the case of an amateur because he has never worked a ship's station. This figure nearly made me drunk. I expected about 56. I walked home with the other fellows, who also got good figures, and my little certificate in my pocket showing I was a licensed First Grade Commercial operator, felt mighty good. I took it out fourteen times on the way home, to take a look at it.

Well, QRU nil, cul gn gn SK.

## UNLICENSED AMATEURS! QRT QRT

**L**OOK out for yourself if you are sending and are not the holder of a Government license for both yourself and your station. In last month's issue, we reported the bringing into Court of a lot of amateurs on the Pacific Coast for violation of the radio laws regarding sending without licenses. This month a case has been brought in the East. The First District is the battleground. The conditions surrounding the case are very instructive, and we have taken pains to get the details for the benefit of the readers of QST. The Government is evidently going to insist upon the observance of the radio laws, and any amateur lacking in respect for our Federal Laws should get out his chart right away and look up the meaning of QRT.

Mr. W. T. Scofield of Stamford, Conn., 42 years of age, and an old telegrapher by profession, decided to get into the wireless game at his home. He bought a spark coil and rigged up an antennae and the rest of the stuff, and began sending. Somehow or other it got around that he had no license. He was using unauthorized call letters, which in itself is a dead giveaway. In the course of events, the Radio Inspector of the First District warned him, and suggested that he apply for a license. He would be granted a Second Grade Amateur License, merely for the asking, and when it was convenient, he could be examined and if he knew the rudiments of wireless, he would be given a First Grade Amateur License.

His station would be given a temporary license until the Inspector could call upon him. In other words, it was made perfectly easy for Mr. Scofield, the same as it has been for all of us.

Mr. Scofield somehow or other did not take the kindly advice of the District Radio Inspector, and in the course of events it is alleged that his attention was again directed to the matter. After a while, the Government seems to have lost its patience. They called upon Mr. Scofield and read an important document to him, which advised him that under severe penalty for failure he must present himself before the Federal Grand Jury. He did this, and was indicted. On March 7th his case came up in the Federal Court at New Haven, and a very serious outlook presented itself to Mr. Scofield. The machinery of the Government had been set in motion, and it is

no fool job to "get out from under" when these gears begin to clank and the machine starts in your direction. If we had been in Mr. Scofield's boots, we would have worn these aforesaid boots out at the toes kicking ourselves. It was such an easy job to have applied for a Second Grade License, and saved all this trouble.

It was a jury case and several witnesses had been brought into court to testify. All manner of evidence was given which showed conclusively that Mr. Scofield had operated an unlicensed station and had no operator's license himself. The United States District Attorney had no mercy and bore down hard, stating that the laws of the United States of America were made for a purpose and that these laws must be observed. Mr. Scofield had to hire a lawyer and this gentleman urged that Mr. Scofield could not have been doing much harm and that he ought not be punished. The case was very weak from Mr. Scofield's side because he had to admit that he was unlicensed and that he had operated an unlicensed station. His only grain of comfort was that a dispute arose between the highbrow counsel over the interpretation of the statute. It seems that Mr. Scofield's lawyer tried to make it appear that the law says regarding interference, that an example of actual interference had to be proven before a case could be made out against any one. The United States through its counsel maintained that the law said an actual example did not have to be proven, but that if the apparatus of the defendant COULD cause interference, then it was enough. The judge gave this his study, and announced that the United States counsel was right, and that it was not necessary to show an actual case of interference. A small spark coil with the proper accessories could produce interference and that the operator of this coil was liable under the law if he worked without a license.

The jury brought in a verdict in favor of the Government. The Judge made the fine only \$5.00, but saddled all the costs upon Mr. Scofield, and this must have amounted to enough money to buy the best kind of a transmitting and receiving set. Mr. Scofield made the mistake of his life in not applying for a license in the beginning. Every amateur ought to remember this case for the first time he sends out a message and signs calls letters which he has selected himself either from his initials or something else, he is guilty of not only

operating an unlicensed station, but operating without an operator's license and also sending unauthorized call letters. Every letter in the alphabet has been assigned by the International Convention to some country or other, and no one can select his own call letters without committing what amounts to radio forgery.

In this connection, it might be said that the officers of the American Radio Relay League, propose to accept no one for membership whose call letters are unauthorized. Once in a while an application for membership is received in which unauthorized call letters are given. It is so easy to secure properly authorized call letters, that there is no excuse for using unauthorized ones. All that has to be done is to write a letter to the District Radio Inspector whose addresses are as follows, and ask for application blanks for Second Grade Amateur License, and fill these out and return them when they are received:—

1st Dist., all New England States, Custom house, Boston, Mass.

2nd Dist., Eastern New York and Eastern New Jersey, Custom house, New York City.

3rd Dist., Western New Jersey, Eastern Pennsylvania, Delaware, Maryland, Virginia, and District of Columbia, Custom house, Baltimore, Md.

4th Dist., North Carolina, South Carolina, Georgia, Florida, and Porto Rico, Custom house, Savannah, Ga.

5th Dist., Alabama, Mississippi, Louisiana, Texas, Tennessee, Arkansas, Oklahoma and New Mexico, Custom house, New Orleans, La.

6th Dist., California, Nevada, Utah, Arizona and Territory of Hawaii, Custom house, San Francisco, Cal.

7th Dist., Oregon, Washington, Idaho, Montana, Wyoming, Alaska. Federal Bldg., Seattle, Wash.

8th Dist., Western New York, Western Pennsylvania, West Virginia, Ohio, and Lower Michigan. Custom house, Cleveland, Ohio.

9th Dist., Indiana, Illinois, Wisconsin, Upper Michigan, Minnesota, Kentucky, Missouri, Kansas, Colorado, Iowa, Nebraska, South Dakota, and North Dakota. Custom house, Chicago, Ills.

## We Are Coming On All Right

Our American Radio Relay League is coming on all right, all right. When the Federal Government decided to bring a test case into court early in March at New Haven, Conn., they selected our President as their expert witness. Every member has reason to be proud of this. We have had something to say in the past about those mushroom wireless associations which are formed while you wait, and sell you a two-cent button for twenty-five cents, or something else of equal value. Our own League is quite different from these organizations, as we have pointed out in language possibly somewhat more emphatic than polite. When the Government selects our President as its expert witness, it sort of makes us feel that somebody else thinks the American Radio Relay League is the real thing, when it comes to amateur wireless organizations.

Read what the government's attorney wrote Mr. Maxim:

March 8, 1916.

Hiram Percy Maxim, Esq.,  
Hartford, Conn.

My Dear Mr. Maxim:

Permit me to thank you on behalf of the United States for the service which you so generously rendered the Government in testifying in the United States District Court at New Haven yesterday at the trial of the case of United States vs. William T. Scofield, the defendant being charged with a violation of the so-called Radio Communication Act.

In agreeing to testify as an expert without receiving the fees to which you would be entitled as an expert, I feel that the Government owes you, at least, a debt of gratitude. You will, of course, understand that I am personally as well as officially appreciative.

Respectfully yours,

THOMAS J. SPELLACY,  
U. S. Attorney.

## AMPLIFYING RECEIVERS WITH MICA DIAPHRAGMS

By Thomas Appleby.

**O**VER a year ago the writer introduced into the amateur field a new type of Radio receiver many times more sensitive than those of the ordinary type. The theory or principle of operation of the new receiver appears to be generally unknown among the amateurs.

Reference to Sketch 1 will assist in a better understanding of its operation. If we arrange a permanent magnet with double pole pieces NN and SS opposite the ends of an armature AB, rocking on pivot C, and wind a coil on the armature a slight current through this coil will magnetize the armature and one of its ends will become North and the other South polarity. The North pole of the armature will be attracted by the South and repelled by the North pole of the permanent magnet, and the South pole of the armature attracted by the North and repelled by the South pole of the permanent magnet. Thus we have four magnets acting on the polarized armature. Lever E serves to connect the armature with the diaphragm D and a small wire spring on the end B of the armature balances the tension of the diaphragm.

In the actual construction the coil is not wound on the armature but merely surrounds it with a very small clearance. The armature and lever are very small and lightly constructed and the diaphragm is made of Mica to reduce its weight and period. The mica diaphragm and lever arrangement is somewhat similar to the reproducer used on a graphophone.

The resistance of the winding surrounding the armature is generally 1000 ohms and the resistance of the complete set 2000 ohms, there being only one coil in each receiver. The cord connections are inside of the receiver case in the center of the

circular permanent magnet.

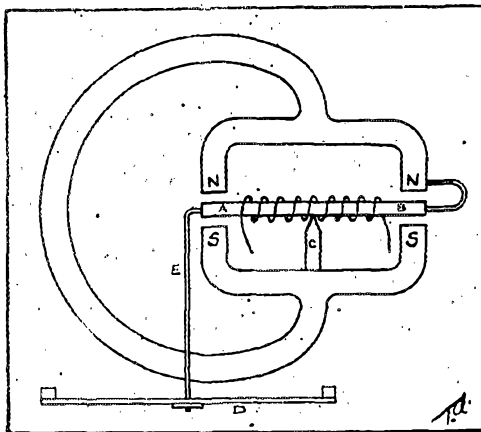
The exterior appearance of the Amplifying receivers is much the same as that of the ordinary type. The headband however, is of entirely new construction and has been found to be very easily adjusted, very comfortable, fits any head regardless of size, and does not pull the hair. There are no screws or nuts to set and simplicity rules throughout. See photograph cut No. 2.

Tests made in the Research Laboratory of one of the large commercial companies resulted in finding that the Amplifying receivers required only one-ninth the energy necessary with the best grades of the ordinary wireless receivers to produce an audible signal.

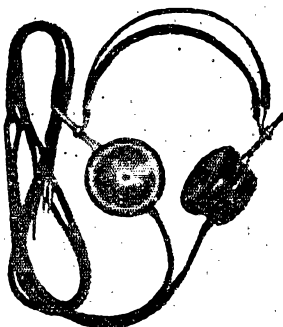
This means that the Amplifying Receivers are nine times as sensitive as those of the regular construction:

The type of detector used has nothing whatever to do with the sensitive qualities of these receivers. Whether used with an Audion, crystal or any other form of detector the results will always be far better than with ordinary receivers. Signals that cannot be heard with ordinary receivers can be read with the Amplifying receivers. If a pair of ordinary 2000 ohm receivers are connected in series with a pair of 2000 ohm Amplifying receivers and a faint station tuned in while listening on the Amplifying receivers and then the regular receivers placed over the ears nothing will be heard. If, however, a faint station is heard in the ordinary receivers and then the Amplifying receivers used strong signals will be heard.

In conclusion the writer will quote from one of many letters received almost daily. Mr. A. L. Groves, Brook, Va., is getting some excellent results. He writes as fol-



Amplifying Receiver Sketch 1.



Amplifying Receiver Cut 2.

lows:—

"I have been getting such fine results with your Amplifying receiver for the past few months that I cannot help telling you about it. Using your Amplifying receiver, crystaloi detector and all other instruments of my own make I can hear several of the high power stations in Europe and on the Pacific Coast and the Marconi Station KIE in the Hawaiian Islands, which gives me a range of over 5,000 miles. On the morning of December 19th, 1915 I heard two low power stations in Alaska on the 600 meter tune a distance of about 3,800 miles. This was of course freak work but from the strength of their signals I am pretty sure

that if I had been using anything but your Amplifying receiver and the Crystaloi detector I would not have heard them. Many people seem to think that I cannot hear 5,000 miles with a crystal detector, but it is true never-the-less, for I very often hear stations in Europe and have no trouble at all hearing KIE, Koko Head Hawaii, in the early morning. Sometimes their signals die out shortly after sunrise here but can hear them again after the sun gets about 1½ hours high. The same may be said of KET, Bolonis, Cal., but in addition I can hear their signals in the early evening, a long time before sun-set over there."

## Special Licenses

The relay of February 22nd has had a lot of influence upon the matter of Special Licenses. We succeeded in opening the eyes of the authorities and our ability through our relay stations to get a message broadcast over the entire country, puts us on a much higher plane than we ever enjoyed before. This has brought up the question of issuing Special Licenses.

Every one who knows anything about wireless, knows that we could not handle any long distance relay work on 200 meters wave length. Every one knows that many of the relay stations who assisted in the February 22nd relay from Rock Island Arsenal used wave lengths nearer 500 than 200. This is contrary to the law unless the station has a Special License.

The law must be observed. Nothing ever succeeded for any length of time or ever will succeed if it violates the law. The ability to relay messages all over the country, has proven that there should be more Special Licenses distributed among the League stations. This was a hard thing to preach before the February 22nd relay. The ears of the authority were deaf to entreaty to a large extent unless it could be shown absolutely essential that a Station have a Special License. We think we have noticed a little change in this particular. If a station is in the interior, away

from the seacoast, and in the hands of a person who will be on the job regularly, and who has a First Grade Commercial License, and is so located geographically that he can handle through relay traffic to advantage, it is very likely that his chances of securing a Special License are better than they have ever been before. Our League stations should bear this in mind. We are the better class of stations and it has come to be understood that we are not all in the game for a few weeks and for a little temporary amusement. We really can be depended upon, and members of the League who think they ought to have Special Licenses, and who can meet the requirements mentioned above, ought to communicate with their District Radio Inspector and secure application blanks for Special Licenses. These should be filled in carefully and exactly, preferably in typewriter, and sent in to Headquarters at Hartford. If a favorable recommendation is to the interests of the League, it will be given and the applicant then stands a pretty good chance of favorable action from Washington.

But, remember OM, there is nothing doing, absolutely nothing doing unless you are on the job regularly, are away from the seaboard, and hold a First Grade Commercial License.



## TRUNK LINE MANAGERS APPOINTED

**J**UST as we close the forms this month, and go to press, we have the pleasure of being able to announce the Managers for two of the Trunk Lines.

Mr. A. A. Hebert, 27 Maple Place, Nutley, N. J., call letters, 2ZH, has been appointed Manager of Trunk Lines C and D.

Mr. R. H. G. Matthews, 5030 Kenmore Ave., Chicago, Ills., call letters 9IK, has been appointed Manager of Trunk Lines A and E.

The Pacific Coast Manager is not decided up to this moment and therefore cannot be announced.

All amateurs wishing to be an active part in the relay system of the country, should now communicate directly with the Manager of the Lines which they would like to be a part of. Test-messages are to be sent out every Monday night, and every Thursday night, and receipted back. Each week, the Managers will report to Headquarters how far out on each Line their test message got and how long was required to get the receipt back. These reports will be published each month in QST, and we will all be able to see just how the other fellow is handling his end of the game.

From now on, or as soon as the different Managers can get their Lines organized, Monday night and Thursday night will be big nights in amateur wireless. We will know that all the other good amateurs are at their instruments on these nights, and that test messages are going through and that we will be able to check up how well we can receive.

The Managers of the Trunk Lines will have full control and responsibility for their Lines. They will organize them and decide all matters which come up. They will report their results every week to Headquarters, and the Officers of the League will thereby be in constant touch with the successes and the failures and be in a position

to take any important steps which may be necessary.

A very important matter for the different Trunk Line Managers, will be the different routes for their Lines. Headquarters has received a large number of letters from the various parts of the country suggesting changes in the cities through which the different Trunk Lines are supposed to pass. Many of the suggestions made are distinct improvements over the original layout made by Mr. Maxim, when he originally planned the Trunk Line system. The Managers will have the benefit of these suggestions, and all amateurs throughout the country who have anything else to suggest regarding the different cities through which the different Trunk Lines ought to pass, should write a letter to whichever Manager controls their territory.

In many cases there will have to be alternative routes. This will be necessary because it will occur continually that somebody wants to be off on the relay nights. When this happens, an alternative station, is of course necessary.

Big things will now be happening in the American Radio Relay League, and everybody who has a real wireless set and who is a real American, will see that he is identified in this linking up of our entire country. No one can afford to be out of it if he has any wireless pretensions whatsoever. There will be lots doing in long distance records, because Monday night and Thursday night will see every amateur at his instruments and test messages will be in the air. New records for receiving and sending will be surely made. All of those with poor insulating, unsoldered joints, and doubtful tuners want to get busy and fix things up PDQ, which by the way, is an abbreviation which seems to have been left out of the International Radiotelegraphic Conventions List.

## RADIO COMMUNICATIONS BY THE AMATEURS

OF VITAL INTEREST TO ALL OF US

By 9XE

In nearly all our largest cities, those who contemplate self-destruction are arrested until they can prove that they have changed their minds. More plainly, those of us who cannot protect ourselves are protected by law.

This same argument should hold good in the wireless field and every wireless man should be protected from the consequences of a rash act. All of us have been very badly deceived at some time or other in the various products manufactured by various wireless concerns and advertised as reliable wireless goods.

It is un-American to sit still while someone robs you, and it is also un-American for any one to permit it. The writer's aim and ambition in this life is to so corral these unreliable wireless concerns and so instruct all of our wireless men that their wonderful claims for their apparatus will be accepted, if at all, with a grain of salt.

Every magazine devoted to the art of wireless telegraphy should be more than willing to assist the amateurs in this respect.

The writer would suggest that an experimental laboratory be installed at the various headquarters for the wireless magazines and that all amateurs be instructed before buying anything whatever, to consult the headquarters for their opinion, not only as to the merits of the article, but as to the reliability of the concern advertising it.

The writer has no axes to grind, as he is in a position to be bit occasionally and not feel it, but some of the smaller brothers, to whom a dollar represents weeks of saving, would probably not feel so well about the matter. The writer has been working along these lines for years and believes now that he has enough evidence in hand to convince the most skeptical that the sole aim of some of these wireless concerns is to unload a great amount of worthless wireless hardware or junk on the unsuspecting amateur.

Various devices have been tried out at the writer's laboratory and wonderful claims made about lots of the apparatus have been found to be without the slightest foundation whatever.

The writer is open to suggestions from any one and believes that if we get the boys started, some concerns will be obliged to sit up and take notice.

This will be submitted to all the magazines and if you read it in one magazine and do not see it in another, you may rest assured that that magazine does not have your interests at heart.

### HOOSIER RADIO CLUB

The Hoosier Radio Club has been re-organized and the following officers have been elected: R. C. Kenna, Pres., N. Hilgenberg, Vice President, N. Watson, Sec'y, B. K. Elliott, Treasurer. All the amateurs in Indiana are requested to send their names and addresses to the Secretary, N. Watson, 204 N. Hamilton Ave., Indianapolis, Ind. before May 1, 1916. The Hoosier Radio Relay Chain is to be formed throughout the State and all amateurs, regardless of equipment are needed.

Special attention is called to the fact that any amateur having difficulties in the operation of his apparatus may secure the advice of the best Radio men in the State by addressing the Secretary and enclosing return postage. The Club hopes to overcome the amateurs' difficulties and make his station a good relay point. The Officers of the Association are members of The American Radio Relay League.

### ANOTHER RADIO CLUB

On February 3rd, Santa Cruz Radio Association was formed by sixteen of the enthusiastic wireless amateurs of Santa Cruz, Cal. The Association is now installing a set and great things are planned for the future. The following officers were elected: President, O. Wiley, Vice-President, R. Reiner, Secretary and Treasurer, Elroy Anderson, Chief Operator, R. L. Hazleton.

**MONTHLY MEETING OF THE INSTITUTE OF RADIO ENGINEERS**

On Wednesday, March 1st, in the Engineering Societies' Building, 33 West 39th Street, New York City, the Institute of Radio Engineers held their monthly meeting. A paper on "Recent Standard Radio Sets" was presented by Harry Shoemaker, the research engineer of the Marconi Company. Mr. Shoemaker described in detail the sets which the Marconi Wireless Telegraph Company of America have recently placed in several hundred ship stations.

**THE RADIO CLUB OF AMERICA**

On Friday evening, March 17th, at Columbia University, New York City, Mr. Fritz Lowenstein presented a paper on "The Efficiency of Radio Sets." Mr. Lowenstein discussed the design, installation and operation of various sizes of transmitting and receiving sets. Special consideration was given to the correct methods of tuning open spark and quenched spark transmitters. The Radio Club of America is progressing rapidly and each month has a paper similar to this. Anyone who is interested in the Association may obtain information from D. S. Browne, Corresponding Secretary, 206 West 86th St., New York City, N. Y.

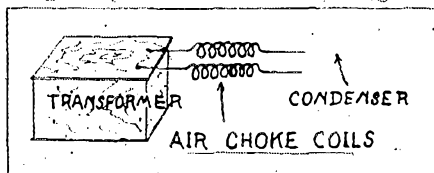
**SOS**

Wichita, Kans.—On January 4th, about three o'clock in the morning, Don I. Shepherd, a member of The American Radio Relay League was listening in and distinctly heard ..... Then the call letters of a Greek ship Thessaloniki which was some 500 miles off New York City several days before. Mr. Shepherd heard all the stations along the coast getting in their signals once in awhile and the Brooklyn Navy Yard telling NRE about the call. This is quite a record.

**SOMETHING FOR EVERYONE**

A Device Used by the Marconi Company

While visiting a friend I learned the following simple method of increasing radi-



tion, reducing the safety gap sparking, and also preventing the puncturing of transformer secondaries: For a quarter to one kilowatt sets, wind two coils of No. 4 to

12 copper wire around a tube one inch in diameter, consisting of about ten turns each. Place these air choke coils on each terminal of the transformer secondary and connect to the high frequency condenser so that each is in series with one side of the charging circuit. This air choke prevents the charged condenser from backing its current into the transformer, provided that the choking effect is greater in the coils than in the closed oscillatory circuit. The coils should be air spaced and about 3/4 of an inch in turn.

To prove there is no backward discharge at the terminals of the transformer secondary and an arc will be formed instead of a crashing spark. This simple device by directing all the energy to the close circuit, increases radiation but does not effect the wave length. For a 2 1/2 Kw. set, the writer uses two coils of No. 4 aluminum wire consisting of ten turns, two inches in diameter, and spaced one inch.

Contributed by  
ROY C. BURR.

**HIGH NOTE—LOW NOTE**

W. A. Parks, Washington, D. C. Writes:

I noticed in the February issue of "QST" that 1VN states that 75% of the stations that he hears have a high pitch (amateurs), and that on that account they are very much easier to read. I believe that the natural period of the diaphragm of the telephones has a great deal to do with this. I am using mica diaphragm phones and I find that amateurs who have a low note, in fact the very ones mentioned by 1VN are much easier to read than those having a high note. I have heard 1VN fairly loud, (using galena detector altogether), and also 8YC, 8YI, and others having a high note, and who come in fine, and I am not blind to the certain well known advantages of the high note, in a properly designed set. Personally, I prefer to read the low musical note, about 120 cycles.

I have made what I think is pretty close to the record for a crystal detector and amateur sending and receiving apparatus. At 11:42 P. M.—February 29, (my time), I copied several sentences from 90Q, Mr. Charles Coultas, 950 Beach Avenue, St. Louis, Mo. I have written to him and received his verification of the same. He was not loud but easily readable. NAA had their arc going at the time and when an arc set is going in the vicinity of a receiving station, the signals from all spark stations are very noticeably weakened.

A picture of 90Q's set appears on page 6 of the December "QST," under the title

of "One of the best equipped Stations in the League." He has a 1 Kw. Clapp-East-ham set.

March 8, 1916.

Editor QST,

Hartford, Conn.

Dear Sir:

Since receiving the February number of QST I have been giving the layout of proposed trunk lines considerable thought. As you no doubt know the average amateur is inclined to give his range as considerably greater than he is able to work under adverse conditions. The layout as given has a number of gaps to be filled before it is practicable for any but the most favorable conditions and I am on the opinion that taking into consideration the most efficient stations available that it misses most of them or at least most of those that have been really handling the relay work.

Unless I am badly mistaken there is no station in Toledo, Ohio, that does any sustained long distance working at all and the same can be said of other cities through which these trunk lines are routed. As a usual thing I am sure it will be found that the stations in the larger cities are not able to do the work the stations situated in the smaller towns can do on account of the unfavorable atmospheric conditions due to smoke, etc. and I believe further investigation along these lines will bear me out.

In this vicinity we have four efficient amateur stations. SNH at St. Marys, Ohio; 9PC at Ft. Wayne, Indiana; 8YL and myself, 8AEZ, in Lima, Ohio, and I believe that between us we handle more than 75% of all through east and west messages, 8NH forwarding by far the greater portion. 8NH has so far this season handled 157 messages for points east and west and the rest of us a great many, but we have kept no record. As all of these stations have been mentioned in every number of QST so far, I don't believe their efficiency or ability to handle the traffic will be questioned.

Now what I have to suggest is this. That one of us be appointed the official relay station for handling these messages and that the one appointed be given the privilege of using two wave lengths far enough apart so as not to interfere with the others when working long distance. With this arrangement if the operator of the relay station was not on duty when called one of the others would answer the call and take the message and we would clear them between us. This would give practically continuous service at this point and would greatly decrease the interference between us as we are all so close that when one is working the others must stand by. Owing

to the congestion of messages at this point and the fact that we all have friends with whom we like to work occasionally, the messages are often delayed for weeks at a time when by using some system they might be handled more expeditiously.

As to the two wave lengths. Special stations should be required to use short waves when communicating with short wave stations and vice-versa and a great deal of unnecessary interference would be avoided if this were done. If the relay station were allowed two waves then in handling a bunch of messages to a special or long wave station the longer wave could be used and the other stations could go ahead and clear up the business on hand without interfering or interference. As it is, most of the business is handled on the shorter waves even for long distance and all the rest of us can do is to go to bed and wait for a night when the others are not on.

8NH would be the logical station for the appointment as she is able to spend more time at her set than most and also is a good operator and able to handle the business.

The most efficient station east of us with which we are able to work under adverse conditions is 8AAU at Jamestown, New York, and he is within easy working distance of New York City.

9FY at Duquoin, Illinois, is also one who handles a great deal of traffic for St. Louis and the West.

I am not taking into account the special stations who seem to handle very few of the through messages. If they would use the short wave when communicating with short wave stations they would be able to handle a larger share of the traffic.

Also, a regular schedule should be established for the stations that are expected to handle the longer relays, even if only one night per week and if their work was limited to messages on the schedule nights, the accumulation of messages would be quickly cleared and other stations without messages would quickly learn what was going on and avoid interference on those nights.

The message proposition gets to be a nuisance when one has several messages that are delayed for weeks because no one is on duty to take them at those times that working is possible.

I know conditions on the wireless map are changing so rapidly that permanent arrangements can not be made and in making my suggestions only those stations which are likely to be permanent are mentioned.

Also, inquiry should be made in those cities where gaps in the routes exist and very likely some amateur will be found who possess all necessary qualifications except an efficient set, and this would be provided by nothing more expensive than a little expert advice.

Often the difference in efficiency of amateur sets makes it easier to work several hundred miles to an efficient set than one hundred miles or less to a less efficient one. It seems that the best work that could be done by the league would be to develop the efficiency of the stations at points necessary and for this a much more complete description of the apparatus used would be necessary. There would be no opposition to this from a great many amateurs that I know and I am sure that the officers of the league would have the hearty co-operation of the more advanced members in assisting in this work.

As to the trunk from New York to Chicago. I would suggest that it be through, say 2JD, 8AAU, 8NH and 9IK. Each of these stations can suggest intermediate stations and by arranging regular schedule for this route all the business that is now handled in seven evenings per week can be easily handled in one evening. For instance, 8ZD could fill the gap between 8AAU and 8NH and there is surely some amateur in Goshen, Indiana or South Bend that has the means and ability to put his station in first class shape if he has the proper advice as to how to proceed. I do not mean that the above route is the only one or even perhaps the best one, but it is a feasible one.

and if established it would not be necessary for us to hold a message for New York until such a night as it would be possible to work with 2JD direct. Also, Lima, Ohio, and vicinity is the logical division point for the route to St. Louis via Indianapolis and 9FY at Duquoin, Illinois. At present I know of no one in Indianapolis, Indiana, with station efficient enough to work with us regularly direct but we can usually work direct with 9FY except under very bad conditions.

In regard to the special stations. It seems to me that they should be the collecting and forwarding points for these messages; especially when appointed through the recommendation of the League. However, at least in this section they seem to be operated in about the same manner as the ordinary amateur station and for lack of a definite understanding and because of the fact that they are usually working on a longer wave and do not hear calls from short wave stations at any distance, they handle very little of the traffic.

My purpose in making these suggestions is primarily to start a discussion along these lines and to see if we can not get some concerted action in regard to establishing a really EFFICIENT relay system. Hoping that in at least some measure my suggestions may prove of value and assuring you of my interest in the work QST and the American Radio Relay League are doing, I remain,

Very respectfully,

M. B. WEST.

#### A NEW CALL BOOK

The Secretary wishes to announce that the new Call Book is nearly ready for the printers hands. It is a matter of a few weeks before the book will be out giving the latest membership of the LEAGUE. To make sure that you will receive your copy, it would be well to make arrangements with the Secretary so that he may keep a copy for you. The new books will contain over a thousand stations and every member of the LEAGUE should buy his immediately. Enough books will be published to supply each member with one. Order now and avoid the rush.

Would you like a "How to Make It" department?

Would you like a "Question" department?

#### A CONTRIBUTION

The Secretary of the LEAGUE wishes to express most sincere thanks on the part of the LEAGUE and its members to S. Delbert, Jr. of Philadelphia, Pa. who has contributed at various times sums amounting to ten dollars. These generous gifts of Mr. Delbert have gone a long ways and have helped to put the LEAGUE records in good shape.

The Editor of "QST" is looking for comments. Comment on what you like; comment on what you don't like; comment in general, and then we shall have what you want.

## Exchange, For Sale and Wanted "Second Hand Apparatus"

In order to facilitate the exchange and sale of second hand apparatus "QST" will print, free of charge, want and for sale ads. up to a reasonable number of words. The publishers reserve the right to withhold any ad. which is against the policy of this department

**FOR SALE**—One E. I. Co. one inch coil, new \$3.00; one sending set, consists of 1½ inch coil, condenser, key, helix, electrolytic interrupter, D. P. D. T. switch, gap. Cost \$10.00. First \$5.50 takes it. Dynamo-motor, AMCO 6 volt, \$1.00. Let me hear from you. T. H. Moore, Jr., 321 N. Spring St., Pensacola, Fla.

**FOR SALE** — J. F. Arnold, \$9.00 Loose coupler, mahogany ends and base wound with silk covered wire, and guaranteed to be in first class condition and work perfectly. Will sell for \$4.00 or might consider trade. Peter A. Stover, Box 106, Marengo, Iowa.

**WANTED**—Good audion bulb, rotary gap, hot wire meter, and Navy coupler. Will pay cash or exchange for other apparatus. Write, Elliott R. Weyer, College Campus, Washington, Pa.

**FOR SALE**—Panel amplifier set, detector and two steps, equipped with all conveniences, phone jacks, Bakelite panel, provision for inductances for use on oscillating circuits, etc. Photos on request. ¼ Kw. cabinet transmitting set, rotary spark gap, etc. Gebhard, 1127 Ellicott St., Buffalo, N. Y.

**WANTED**—Small battery charging dynamo, an audion bulb in good condition or a Crystaloi "Type AA" detector. Have Murdock phones, variable condenser and cash. Address all communications to Ignatius Kennedy, 28 South Market St., Frederick, Md.

**FOR SALE**—1-inch spark coil—1 set of telephones (2 stations) and loading coil 12 inches long, 3¼ diameter hardwood base. Any reasonable offer takes them. William Beller, 588 Essex St., Brooklyn, N. Y.

**FOR SALE**—A 1 kw. Hytone set including key, hot wire ampmeter and all necessary instruments. Price, \$125. Write to Thomas H. Elliott, Jr., 104 Claremont Ave., Arlington Heights, Mass.

**WANTED**—Will pay cash for a '1-16 H. P. 110 volt A. C. motor with ¼-inch shaft. Must be reasonable and in first class condition. Have a ¼ Kw. Clapp-Eastham transformer which has record of 250 miles; will sell for \$8.50. All letters answered. James M. Sommer, 2338 North Talbott Ave., Indianapolis, Ind.

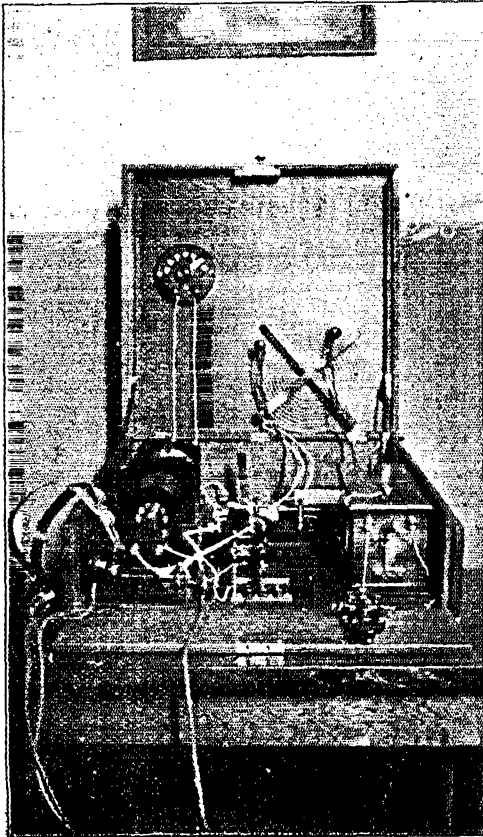
**BARGAIN**—½ Kw. Thordarson transformer, as good as new, including line protector, \$9.00. Cost \$16.00, a bargain at \$9.00. Harlow M. Case, Benzonia, Mich

# Pictorial Section

## Among the Radio Stations

Showing many stations which operated in the Relay of February 22nd

To make "QST" the magazine which you want and need, we must have a large number of pictures of wireless stations. These illustrations bring suggestions and ideas to you. In a picture you may see a better way to arrange your set, a shorter-lead connection, a new oscillation transformer, an ideal condenser. All these things help to improve your set, increase your range, and develop your ability as a Relay Station. If you have a photograph, send it in today. This will help you and your fellow amateurs. If you can write a short description, do that too. Don't think your set is not as good as the other fellows. QST, QST, QST, QRU? QRU? QST?

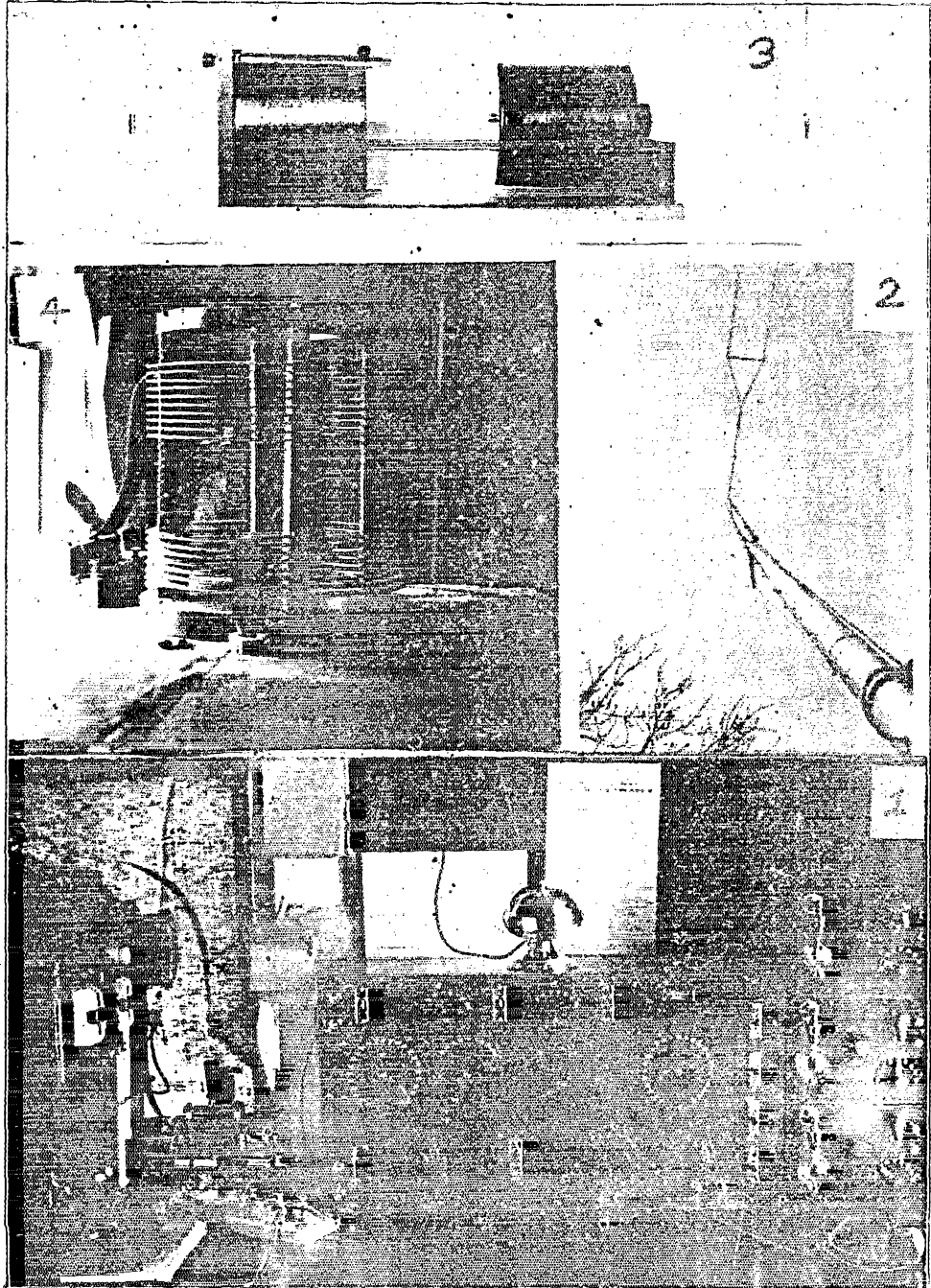


## A Portable Outfit

The accompanying illustration is that of a portable outfit mounted in a specially designed quartered oak case, made by the owner. The outfit consists of a loose coupler, fixed condenser, variable condenser, Galena Molybdenite and Silicon detectors. A three thousand Ohm head set completes the receiving outfit. The sending is comprised of a fixed gap, 2" spark coil, moulded condenser, helix, aerial switch, and key which is mounted on the front cover so that it is on a level as is shown. Lately a five thousand meter loading coil has been placed in the cabinet.

The owner, Darrel J. Cyr, of Sioux City, Ia. has an aerial erected for the set which consists of six wires spaced eighteen inches apart in the shape of a "V" and hung on eighteen foot poles from the top of a house 35' high. Mr. Cyr is a member of The American Radio Relay League and other Radio Associations. His call letters are 9TO.

# An Amateur Station





## An Amateur Station

By Geo. C. Cannon

(1) Shows panel receiving set with audion detector and two step amplifier for waves from 600 to nearly 10,000 meters. Cabinet containing transmitter of 1 to 1½ Kw. at left, only end with meters etc. visible. Novel features:—Vertical row of four telephone switches, just at left of audion bulbs, allow instant amplification of signals without changing phone connections, or other adjustment, one or two amplifications or single detector, or vice-versa. No interference with sensitiveness when these switches are in neutral position. Two telephone switches, center top, place loading coil, both primary and secondary, in circuit for waves over 2500 meters. These loaders in no way effect sensitiveness of coupler when switches are in neutral position. Telephone switch, middle near bottom, throws wave meter into circuit on audion, waves up to 3,000 meters, receiving, measurable. This switch also prevents loss of sensitiveness when in neutral position. Aerial switch of special construction breaks both aerial and ground circuits when transmitting, preventing any POSSIBLE trouble with receiver, also starts and stops rotary, one movement, one wire common to both transformer and motor of rotary. This set not efficient under 600 meters receiving.

(2) Eighty foot spruce pole, set in concrete, supporting one end of two wire aerial. Two wires spaced about 6 feet apart found to be very practical. Insulation, two ten-inch electrose insulators in series, each end. Standard phosphor bronz wire. Bamboo spreaders. Aerial held taut by 60 lbs. cast iron counterbalance, this rises and falls during storm, relieving strain.

(3) Special loose coupler for amateur waves. Tunes with above aerial only up to 600 meters. Wire on primary and secondary wound with one-sixteenth separation between turns. Secondary inductance not adjustable, but coupling variable, minimum wave 250 meters, above this condenser added in shunt with secondary, or variometer in series with secondary. Capacity in secondary of audion circuit cuts down signals. Excess wire in primary of ordinary loose coupler re-radiates energy, and cuts down signals.

(4) Oscillation transformer of transmitter. Note loose coupling and also heavy copper strip used in closed circuit. Practically no inductance on this instrument except that in use; this gives more satisfactory results than usual practice. Oscillating transformer set on top of cabinet which contains transformer, condensers and rotary, so placed to make all leads very short, longest one not over fourteen inches. Note:—

One wave, sharp, radiating three amperes letter than set which may have three waves, radiating respectively, 2½, 1½, ½, or total 4½ amps. Receiving set can only take advantage of radiation on ONE wave; hence, often a looser coupling, and decreased radiation in amps, if set is tuned sharp, gives greater transmitting distance.

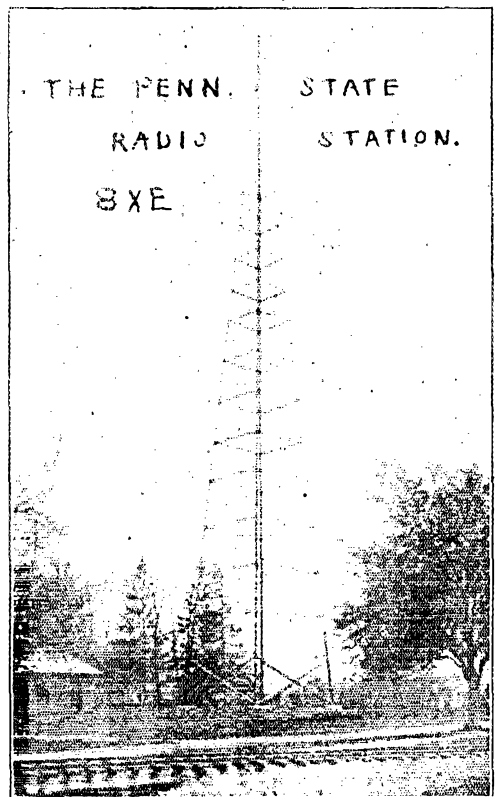
Transmitting range of this station well over 1,000 miles, night work, winter. Receiving undetermined, but well over 3,500 miles.

Note:—This set receives continuous wave signals, and acts as oscillator, on ALL wave lengths, by changing one connection on audion circuit and adding small variable condenser.

## 8XE

By M. R. Strausberger.

The picture shows the exterior view of the Pennsylvania State College Radio Station.



The tower is 210 feet high and insulated from the ground. The aerial is a six wire phosphor bronze of the straight-away type.

The interior of the station is very conveniently arranged and includes a 2 Kw. Clapp-Eastham type "E" transformer and a rotary gap with the other usual transmitting apparatus. All transmitting except in times of QRM is done on 500 meters.

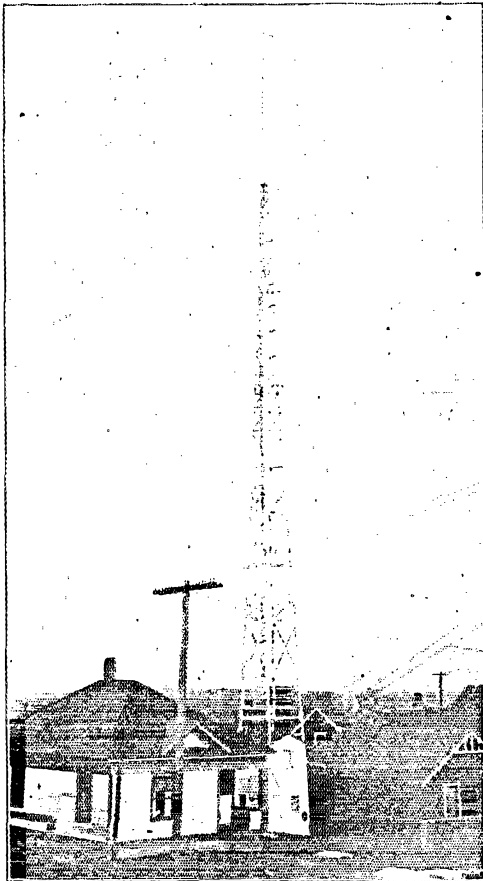
The receiving set consists of an audion detector, Stromberg-Carlson phones and a Clapp-Eastham type variometer tuner. A new receiving set is now under construction and when completed will be thoroughly up-to-date and will include both oscillating

and plain circuits with a range in wave length from 200 to 15,000 meters. The "nite" range of the station is 800 miles and many times can work a greater distance.

The following schedule has been adopted for the ensuing college year. The periods for "listening in" will be as follows: All days except Friday, 7:30-7:45; 8:30-8:45; 9:45-10:15. Friday, 9:45-10:15 only. Athletic results, etc. will be sent at 9:00 o'clock on the days of the contests.

Anyone hearing us at a considerable distance will please notify: M. R. Strausberger, 102 Foster Ave., State College, Pa.

## Some Pole!



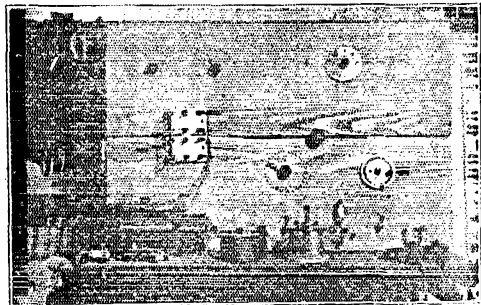
This photograph illustrates one of the stations which handled the famous relay of February 22nd. Mr. O. M. Heacock of La Grande, Oregon, one of the LEAGUE members sends us the following description:

Total height to top of pole is 140 feet; height of tower, 110 feet; the mast is eight feet square at the bottom with the wireless room built in.

Aerial: 135 feet high, three wings of six wires each, 20 feet long, spaced  $3\frac{1}{2}$  feet. One wing north, one south, and one nearly vertical. The lead-in consists of six wires connected to place where all wings are joined. A 200 meter aerial is at the side of tower. - Radiation 4.6 amps.

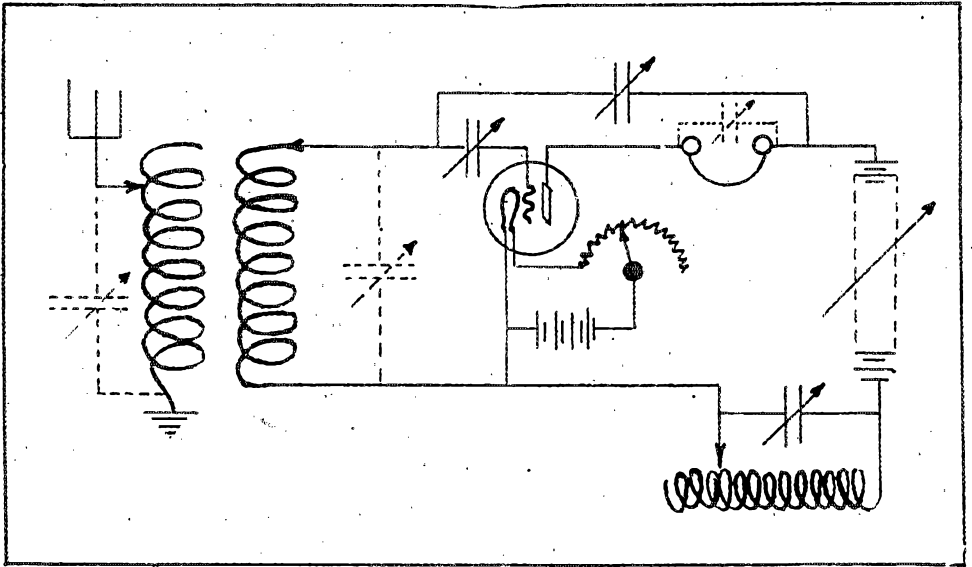
## Radio Station 8TY

This illustration shows the receiving set owned by Mr. Roy C. Ehrhardt of Scranton, Pa. One audion is used in this station and all the continuous waves are received from stations along the Atlantic and Gulf Coasts including San Juan, Porto Rico, Guantanamo, Cuba, Darien, Panama, also

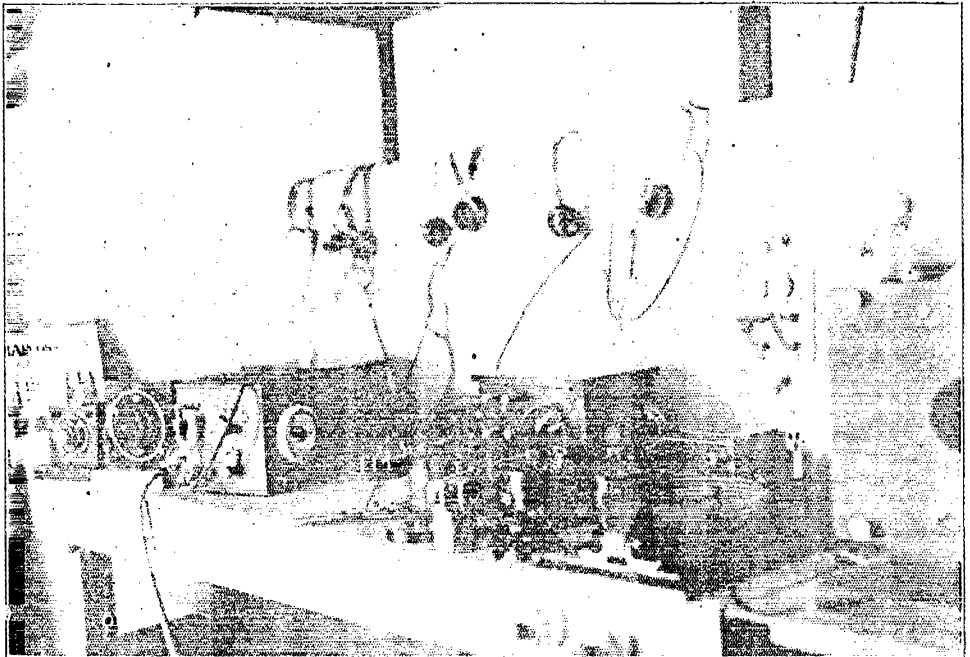


San Diego, Cal., and last but not least, Hanover Germany. The illustration shows the hook-up which is used and in the photograph the four pole double throw switch controls both tuners, the small one outside the cabinet and the large tuner which is inside. The same audion hook-up is used for both tuners.

Another illustration for this article on page following



An A. R. R. L. Station

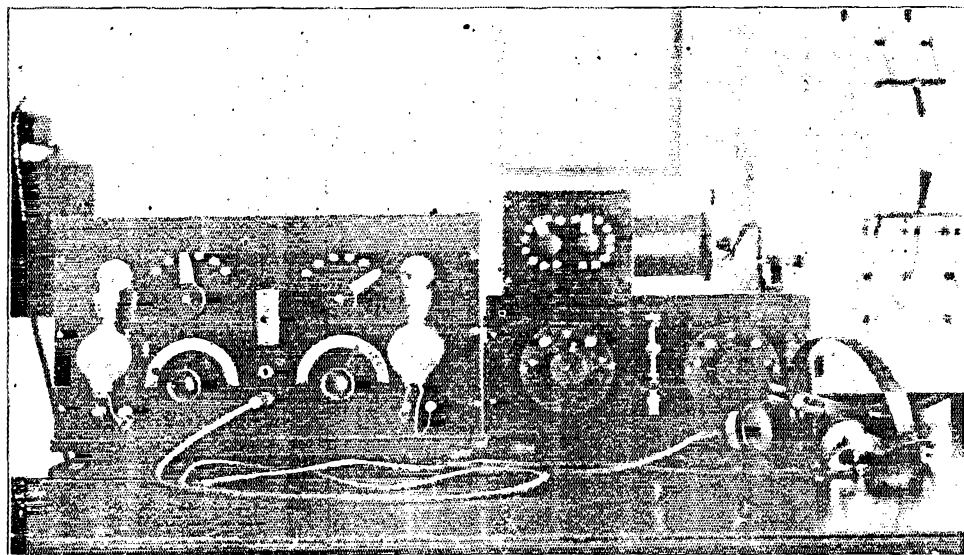


This illustration shows G. L. LaPlant's set in St. Anthony, Ia. The picture explains itself except that an RJ8 audion and an ultraudion hook-up have been added since the photograph was taken. 9KT, the owner, has a well-equipped sending outfit which

does not appear in the picture. Calabar and Louiston, Montana, report QRK. While R. D. Simmons, of Shreveport, La. advises "you will undoubtedly be interested to know that you are being heard down here in Shreveport via wireless."

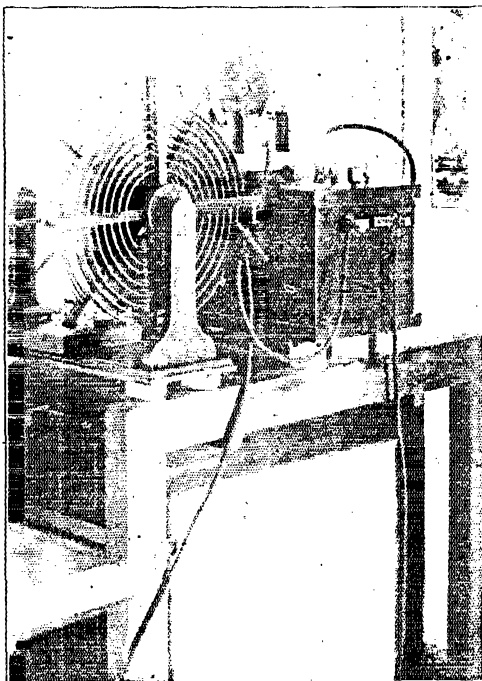
## The Radio Station of Orrin E. Dunlap, Jr.

Niagara Falls.

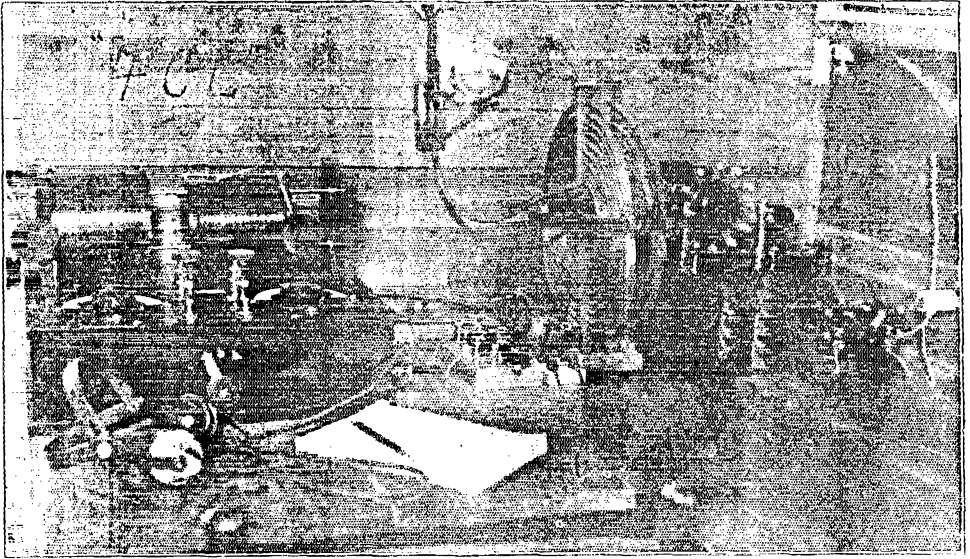


Although the weather conditions for amateur radio work have never been over good in this section of the country, I have picked up quite a few distant amateurs this year. Among them are, 9NN, 9SP, 9UC, 9DB, 1ZR, 1ZL, 1ON, 1ZM, 1ZW, 2ZP, 2SX, 2PV, 2MA, 2DL, 2LK, 2DA, 3WN, 3FR, 3NB, 3ALE, 3WW, 3OU, 3XA, 3NH, 3AMX, 3ER, 3MW, 3MC, 3JK, 3BK, 3RV, 3JX, 3CX, 3DX, and 3NQ. The majority of times when transmission seems at its best are nights when it is rather warm, thirty to forty degrees. This is especially true in regard to the stations west of here. One afternoon about five o'clock 9UC came in very loud and steady.

I have a quarter Kw. and was heard by 1ZR while giving 1ON a message. In this city is another amateur with practically the same apparatus, but he has not as yet been successful in long distance work. My aerial runs in the same direction as the isogonic line while his is at right angles. We have often wondered if this can be the reason for our difference in transmission range. I would be pleased to hear from the readers as to their transmission and direction of aerial as compared to isogonic line nearest to them.

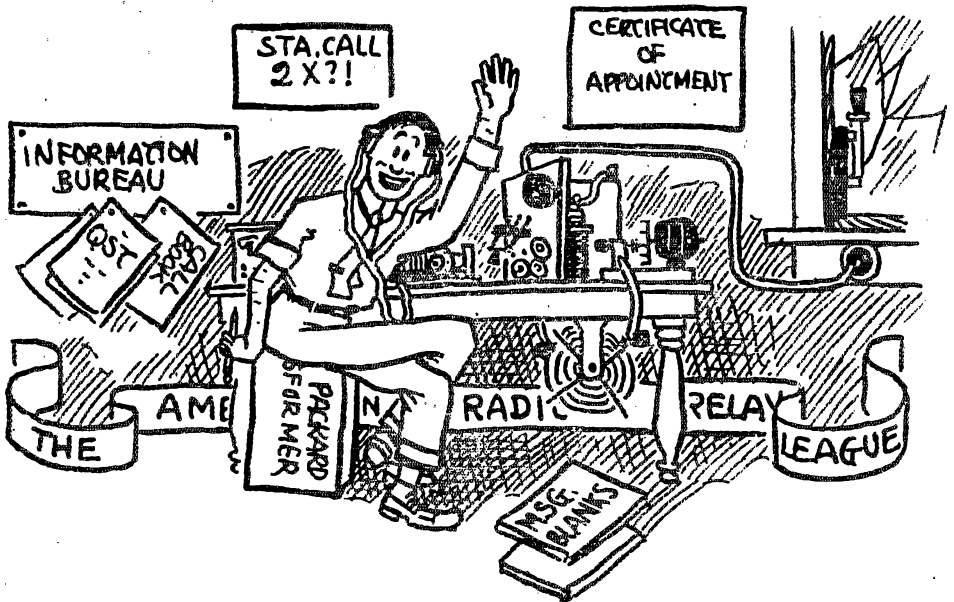


4CL



Mr. F. F. Merriam is the owner of this station in College Park, Ga. This is the type of set which the editor has been advocating. Here we find a station built on the "short lead" principle. The transformer is home-made and one Kw. Murdock has

furnished a moulded condenser and rotary gap. The hot wire ammeter and key are of the Clapp-Eastham make. The oscillation transformer is a home-made affair manufactured by 4CL. Mr. Merriam says "QST" fills a long-felt want.



## Latest List of Additions to American Radio Relay League Stations

### CALIFORNIA

Pomona	Paul Rutherford	431 San Francisco Ave.	SNK
Redlands	H. B. Hamilton	1218-6th St.	6PU
San Francisco	Eugene LeFevre	243 Bomrin Ave.	6EL
San Francisco	Fred Nielsen	136 Caine Ave.	6OR

### CONNECTICUT

Ansonia	Joseph Zander	34 South St.	1VC
Greenwich	S. B. Ween	Dublin Road	CK
New London	Richard Hitchcock	11 Waller Court	1LP

### FLORIDA

DeFuniak Springs	C. M. Gordon		4AX
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### IOWA

Dubuque	C. W. Patch	5 Villa Street	
Boone	Neff Maynard	208 West 7th St.	9MN
Davenport	H. & H. Fedder	1440 West High St.	9ABT

### ILLINOIS

Granite City	A. T. Tronske	2219 State St.	9IU
Rockford	Rudolph Graf	1061 Mulberry St.	9RP

### MASSACHUSETTS

Beverly	Charles U. Clark	25 Pierce Avenue	1ABC
Braintree	Philip F. Robinson	149 Hollis Avenue	1EJ
Campello	William J. Loheed, Jr.	12 Clifton Avenue	1PK
Prides Crossing	Francis H. Cumming		1GT

### MICHIGAN

Sheboygan	James E. Hull	331 North Main Street	8AOE
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## NEW YORK

Albany	J. K. Hewitt	92 Willett Street	2AGJ
Brooklyn	Charles E. Francis	70th Street	2KM
Brooklyn	Maurice B. Strauss	582-5th Street	2AEV
Gloversville	Leonard J. Edick	89 Forest Street	8VL
Gloversville	Richard Y. Sandford	89 Forest Street	8VL
Lisle	Ransom Perry, Jr.		8AEF
New York City	Lester Reiss	580 West 161th Street	2RH
Plattsburgh	C. W. Spaulding	32 Robinson Terrace	8AKX
Portchester	Leonard H. Marshall	240 Westchester Ave.	2AHN

## NEW JERSEY

Montclair	Philander H. Betts	238 Valley Road	2MN
Trenton	Martin K. Pillsbury	Washington Market	3MC
Trenton	Edward G. Raser	931 Edgewood Avenue	3NG

## NORTH DAKOTA

Fargo	Worth Bergherm	103-13th Street, N.	
Fargo	Geo. R. Langen	103-13th Street, N.	

## OHIO

Steubenville	Walter L. Myers	1512 West Market St.	8ABD
Tiffin	Paul E. Frederick	215 Clay St.	8NB
Wapakoneta	Eurcile L. Shaw	205½ E. Anglaize St.	8PA

## PENNSYLVANIA

Norristown	Norristown Radio Club	Main Street	3AGT
Harrisburgh	Chas. J. Mehring	414 Reily Street	3KW
Philadelphia	J. Elton Ellis	1929 Hoffman Street	3LU
Philadelphia	James F. Rau	2085 E. Kingston St.	3AEP
Pittsburgh	Biddle Arthurs, Jr.	3046 Centre Avenue	8JN
Philadelphia	Lewis D. Stevens, II	5224 DeLancey Street	3QA

## SOUTH CAROLINA

Honea Path	J. A. Featherston		4AJ
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## TEXAS

Dallas	Frank M. Corlett	1101 E. Eighth Street	5ZC
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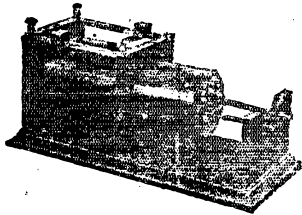
## WASHINGTON

Tacoma	Howard Barnhisel	505 North I Street	7JA
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## WISCONSIN

Racine	Thorvald L. Haines	842 Main Street	9MY
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## Our Standard Loose Coupler



The greatest thing out. 7 in. high, 7 in. wide, 15 in. over all. Wound with Enameled wire (secondary with silk, if desired), has double slide and eight taps, with heavy rheostat handle. Woodwork mahogany finished. Price, \$7.00. Also have a new one, 6 in. high, 6 in. wide, 14 in. over all, wound with same wire, but with single slide. Only \$4.50.

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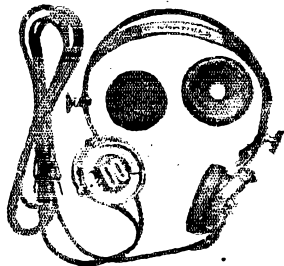
QST needs bright young men in all parts of the country to act as circulation agents. This is an opportunity for you to earn some money in your spare time. If you would like to become a circulation agent for QST, send in your name and address for the "salesman" proposition.

**The American Radio  
Relay League**

Hartford - Connecticut

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SUPERIOR TYPE, \$5.00



Made for Long Distance Reading

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Washington, D. C.**

## FOR SALE!

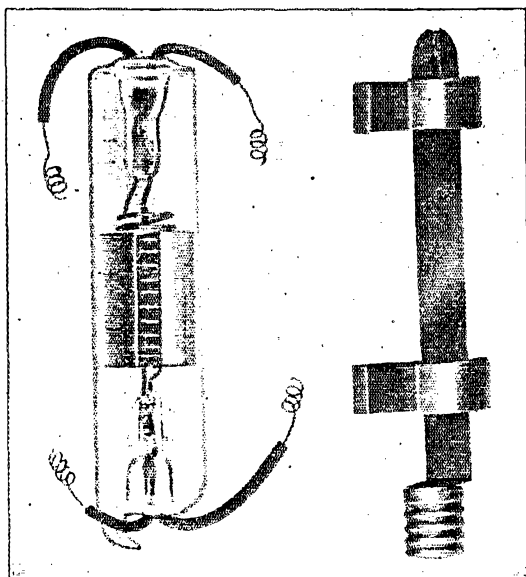
14 Perikon Detectors mounted on maple and mahogany bases, 3 1/2 x 4 1/2 inches and ready to work. Prices very reasonable to members of The American Radio Relay League.

**FURMAN**  
5528 Echo Street  
LOS ANGELES CAL.



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For the benefit of the amateurs, and particularly the ones who cannot afford to purchase a complete Audion Detector, we now offer for the first time, the genuine DeForest Type T Tubular Audion SEPARATELY. As many may be purchased, without the instrument or accessories, as may be desired, without returning old tubes.



The Type T Tubular Audion has a single, straight-line filament of tungsten. It gives very loud response to signals. It passes our usual careful test against a standard which is fully 50 percent more sensitive than any other known form of detector.

This type of Audion is not interchangeable with our round Audion Bulbs, which will be sold, as heretofore, for renewals only for our instruments, on return of the old bulb.

The adapter illustrated fits the tube to a regular screw socket. Price, 40 cents extra.

The Type T Tubular Audion will be furnished at \$5.50 each with the guarantee that it has passed our test and that it will be delivered safely to our agents or users, but no further guarantee can or will be made covering accidental breakage or burning out thereafter by the operator.

NEW BULLETIN R16 WILL BE SENT IF STAMP IS ENCLOSED

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Telephone & Telegraph Company**

101 PARK AVENUE

**New York, N. Y.**

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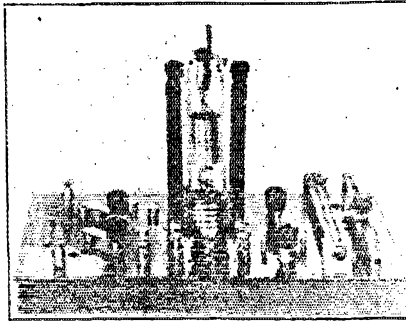
## "COS-RADIO" AUDIO TRON DETECTOR

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(only)

Delivered

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**Detector**

Mounted as in  
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Complete with  
2 condensers

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"There is only one Audion-the De Forest"

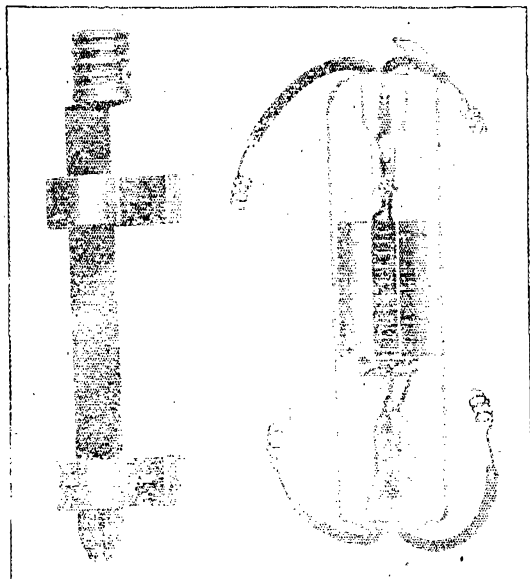
The New Type T Tubular Audion Bulb, gives very loud signals from powerful stations. It has a large cylindrical plate, a spiral grid and only one filament of tungsten. As this is a long, straight-line filament, it has a long life. Edison effects are completely eliminated. The plate is in contact with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



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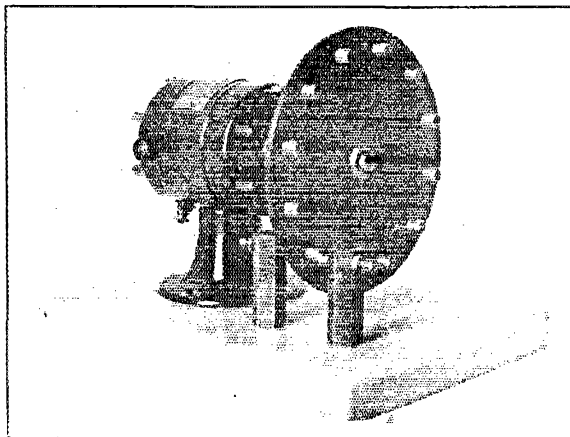
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## Klitzzen Apparatus means Efficiency



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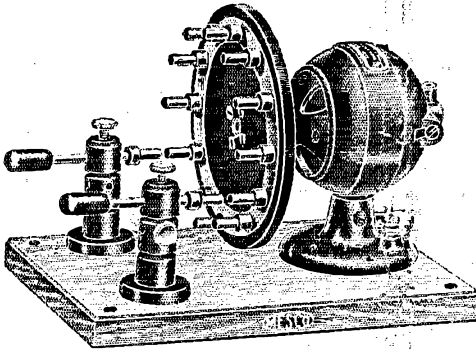
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216 Rotary Unit only, with two Stationary Electrodes, 1 3/16 in. shaft .....	5.00

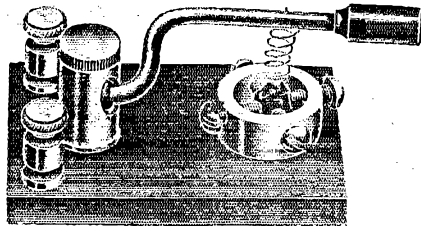
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