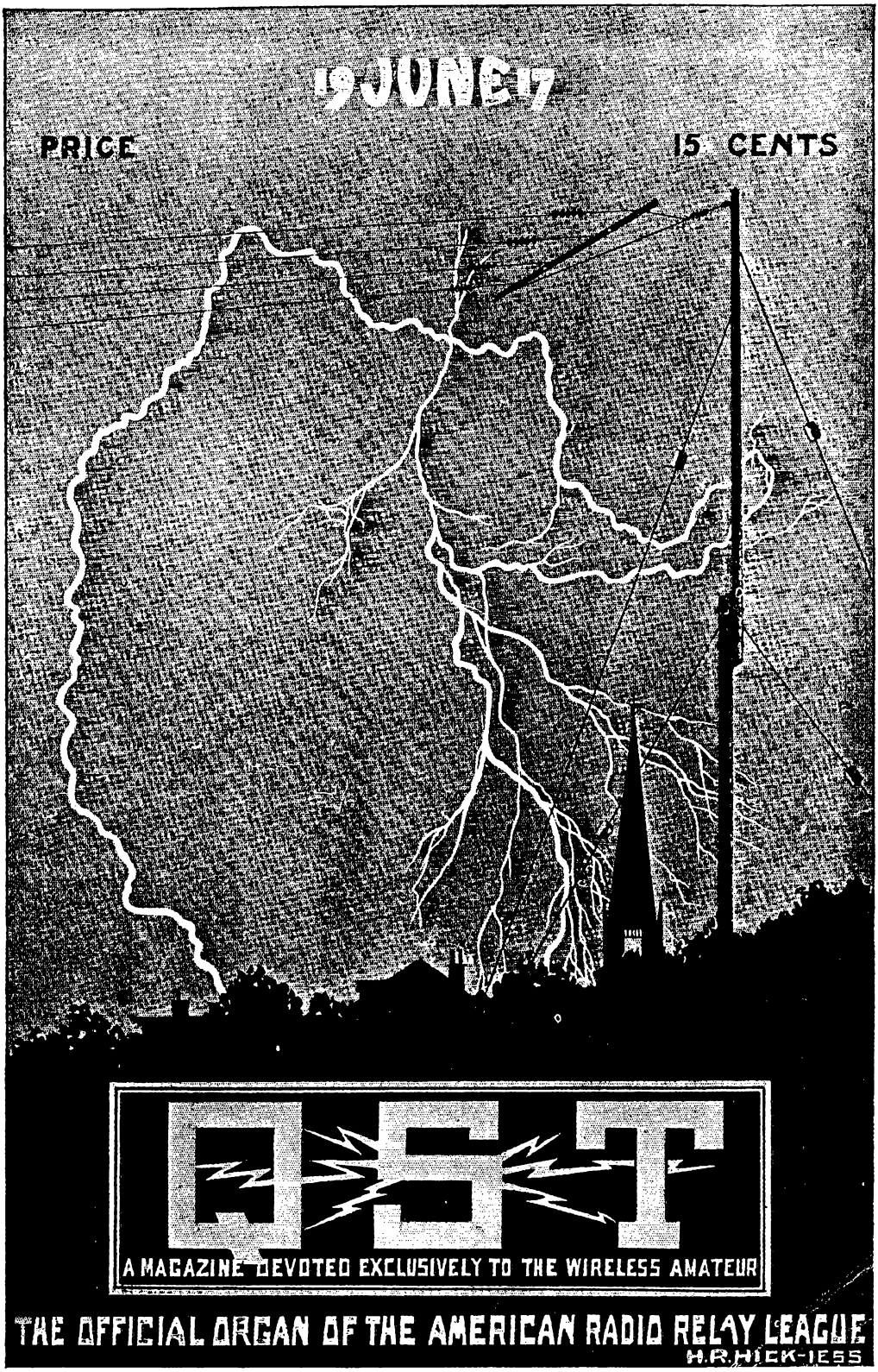

JUNE 17
PRICE
15 CENTS
QST
A MAGAZINE DEVOTED EXCLUSIVELY TO THE WIRELESS AMATEUR
THE OFFICIAL ORGAN OF THE AMERICAN RADIO RELAY LEAGUE
H.R. HICK-IESS

What Mr. Edison Thinks

Cable Address "Edison New York"

From the Laboratory of
Thomas A. Edison,
Orange, N.J. March 20, 1917.

Mr. C. D. Tuska, Editor,
"Q S T",
Hartford, Conn.

Dear Sir:-

Until I received your favor of the 14th instant and a copy of the current issue of Q S T, I was not aware of the fact that the American Radio Relay League issued such a splendid magazine. I have looked over this present number and find it very interesting.

It seems to me that a magazine so ably conducted ought to accomplish much for the advancement of the art in general, and I wish for Q S T a successful future.

It is very kind of you to place your columns open for suggestions which it may be desirable to bring before amateur wireless operators, and some day there may be reason to take advantage of this offer.

Yours very truly,

Thos A Edison

A/2612.

QST

Volume II JUNE, 1917 No. VII

CONTENTS

Hiram Percy Maxim, President — Clarence D. Tuska, Manager and Editor

¶ Q S T is published monthly by The QST Publishing Company, Incorporated at Hartford, Conn. Subscription price, $1.50 per year. Single copies, 15 cents. ¶ Entered as second-class matter March 7, 1916, at the Post Office at Hartford, Conn., under the act of Congress of March 3, 1879.

THE QST PUBLISHING COMPANY, INC.
HARTFORD, CONN.

Aviation

PRACTICAL AERONAUTICS BY MAIL

EARN $50 to $500 a Week!

BUD MORRISS, Chief Instructor American School of Aviation

HERE is the one inexhaustible gold mine of opportunity and here is the man who will lead you to it. It is the most extraordinary condition ever presented, owing to the sudden world-wide demand for aeroplanes. High class positions by the thousand calling for trained men—fame and fortune actually thrust at them. Salaries of from $50 to $500 a week are awaiting men who can fill these positions. And now, for the first time in history, a practical, home-study course in practical aeronautics is open to every man at a trifling expense. No matter what your occupation, you can prepare for a better position with big pay. Now is your opportunity.

Enter a practically untrodden field—a new profession. Sieze the opportunity that has burst upon the country with tremendous force. Hustle ahead with the rapid development of the aeroplane industry which is outrivaling that of automobile and motion picture, as the quick and sure road to financial independence.

Prepare *NOW* for these positions

- Aeronautical Engineer
- Aeronautical Instructor
- Aeronautical Contractor
- Aeroplane Repairman
- Aeroplane Mechanic
- Aeroplane Inspector
- Aeroplane Salesman
- Aeroplane Assembler
- Aeroplane Builder

Conducted by Famous Aviators and Aeroplane Builders

The Course has been prepared by men of international reputation. Mr. Bud Morriss, the well-known aviator, is Chief Instructor and personally guides the progress of each student. He is assisted by a distinguished staff of Aviators, Aeroplane manufacturers and Aeronautical Engineers. Every Lesson, Lecture, Blue Print and Bulletin is self-explanatory, in plain terms for quick understanding. The Course is absolutely up-to-the-minute with every known fact concerning Aeronautics. You get practical, working knowledge of the very highest merit. Now is the time and this is your opportunity to step right into fame and fortune. You are needed. Where there's a will here's the way.

What Our Students Say:

Mr. Stanfield Fries
Fort Bliss, Tex.
My estimation of the new course is excellent; it could positively not be any better.

Mr. Z. Purdy
Shreveport, La.
It is hard to believe that lessons on such a subject could be gotten up in such an interesting manner.

Mr. Lloyd Royer
Haigler, Neb.
I can hardly thank you enough for the way you have personally taken up my enrollment.

Mr. Mayne Eble
Manistee, Mich.
I believe I learn more from my lessons than an aviator who takes his first lesson with an airman in a aeroplane.

Write Now For Our Great Offer

Send the coupon for full particulars of our remarkable special offer open to you now. Find out all about the marvelous opportunities that are opening in the Aviation game. This offer is the greatest stepping stone to bigger opportunities ever known. Write today for complete literature, all free and prepaid. You are not obligated in any way. Do not waste time in thinking about it. Act! Send the coupon or a letter or a post card will do. Write at once.

American School of Aviation
431 So. Dearborn Street, Dept. 8046
CHICAGO, ILL.

American School
of Aviation
431 So. Dearborn St.
Dept. 8046
Chicago, Ill.

Gentlemen: Please send me free and without obligation, full particulars of your Course in Practical Aeronautics and your Special Offer to those who write at once.

Name.....

Address.....

Q S T

A Magazine Devoted Exclusively to the Radio Amateur

Lightning Phenomena

By Charles S. Ballantine

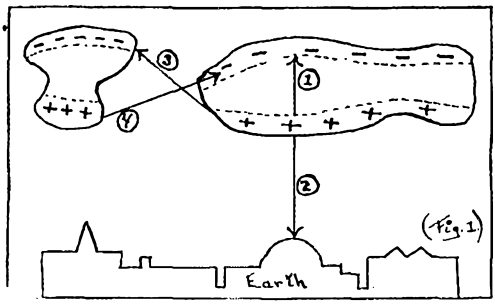
Here is a timely article by Mr. Ballantine. Lightning has always been a puzzle of the ages, and something we all wish to keep away from our aerials. Many of us have had no scientific idea of lightning. This is a chance to become acquainted with the subject.—Editor.

IN the December 1916 issue of this publication, a letter written by Mr. C. A. Service, calling the attention of the readers to the advisability of publishing an article on the subject of lightning which would treat the subject in a more or less comprehensive manner. Certain aspects of the subject have been treated in the semi-technical press but no scientific explanation of this wonderful electrical phenomena has been published to any great extent. The following paragraphs are an attempt to meet the suggestion and should be of interest to the radio field for the reasons mentioned in Mr. Service's letter.

The earliest history of the subject leads to the experiments of Benjamin Franklin made about the middle of the eighteenth century in an effort to prove the theory of the identity of lightning discharges and the electric machine sparks obtained in the laboratory. As a result of these experiments with the famous kite and key, Franklin pointed out the fact that in reality the natural phenomena was nothing more than a reproduction on an enormous scale of the static discharges obtained under artificial conditions and that on cursory observation, the two seemed to be of the same nature. In modern times however, on a closer analysis of the subject several features of difference between the two have been discovered. In the case of lightning the charge is more or less distributed throughout the volume of the cloud while the stationary or artificial discharge takes place from the surface of the electrode. In one particular the two are analagous. The fundamental requirement for discharge is a condition of ionic saturation between the charges in the path of the discharge. This is automatically taken care of when the potential has passed the critical point necessary for the formation of corona. The phenomena attending the formation of a discharge is very interesting and is somewhat as follows.

For reasons which will not be given here, an electrical separation takes place in the cloud which results in a heavily charged positive layer on the lower surface of the cloud and an equally charged negative layer on the upper surface. This state of affairs is illustrated in Figure 1. The various discharge possibilities are indicated by the dotted lines and represent the possibility of an internal discharge, a discharge to another cloud, or to the earth. It is well that when a difference of potential

exists between two electrodes, free ions are set in motion in the space between them. Now on the assumption that the potential is gradually and continuously increasing, the behavior of these ionic carriers may be studied until the passage of the spark. As the potential increases,



the velocity of the ions will become greater, resulting in a greater field intensity or gradient. At a certain theoretically definable point, the velocity over their free mean path becomes sufficiently great to form other ions by collision. This condition is dependent on the dielectric strength of the air. This process proceeds until a state of ionic saturation is reached, when the maximum number of ionic carriers are formed. At this point the air becomes partially conducting, glows, brushes, or a corona is formed. Now the dielectric flux density exceeds a certain value and the spark discharge takes place. If we are considering laboratory sparks taking place between smooth electrodes close together, the discharge results when the potential is high enough to produce over flux density at the surface of the electrodes and the formation of corona and spark-over are simultaneous. However, when the discharge is not concentrated on the electrode surface and the spacing is greater, as in the case of actual lightning, the spark-over lags considerably behind the preliminary establishment of corona.

Now considering the conditions illustrated in Figure 1 and remembering that the physical action in the atmosphere is such as to cause many cross currents of moist air to circulate between the charged portions of the cloud, it is evident that the potential gradients of the electrodes may become very steep. Of course this is equivalent to an actual lengthening of the conductor and the longer the conductor the steeper the gradient becomes so that the process is automatic. In the language of Humphreys the following description covers the formation of lightning discharges from this point on. "If these gradients are steep enough * * * * brush discharges takes place. Assume, then, that a brush discharge does take place and that there is a supply of electricity flowing into the conductor to make good the loss. The brush and the line of its most vigorous ionization necessarily will be directed along the potential gradient or towards the surface of opposite charge. But this very ionization automatically increases the length of the conductor, and as the length of the conductor grows, so too, does the steepness of its potential gradient at its forward or terminal end, and as the steepness of this gradient increases the more vigorous the discharges, always assuming an abundant electrical supply. Hence, an electric spark once started within a thunderstorm cloud has a good chance of making its own conductor as it goes, of geometrically growing into a lightning flash of large dimensions." This process is very interesting from a scientific standpoint and the explanation given has been verified by a study of the phenomena by means of the revolving camera.

A very important feature in the difference between laboratory sparks and lightning is the character of the discharge current. In the case of laboratory spark production the discharge will be oscillatory, the free period of which will depend on the dimensions of the apparatus. It has been shown that in the case of lightning, however, that there is no oscillation whatever, the discharge being unidirectional and pulsatory. This will be evident from a consideration of the mathematical conditions for the oscillatory current to take place.

Some time ago Lord Kelvin in the solution of the differential equation for the potential of a system of inductance, capacity and resistance

$$RI + L\frac{di}{at} + \frac{1}{a}\int idt$$

pointed out the interesting conclusion that when the resistance of a circuit is greater than

$$\sqrt{\frac{4L}{c}}$$

the discharge is unidirectional and no oscilations can occur. This equation practically defines the boundary conditions for the formation of oscillations in the case of lightning and a very interesting conclusion might be drawn from a substitution of the values of the inductions, capacity and resistance of a cloud in this equation. Such a calculation has been made and is very interesting.

Let "a" equal the radius of the lightning path, and "b" the equivalent radius of a cylinder concentric with this path in which the displacement current flows. The energy of the magnetic field W is then given by the equation

$$W = 2.3 \log_{10} \frac{b}{a} + .5$$

Letting b=2 kilometers and a=5 ems we have

$$W = 2.3 \log_{10} 4x14^{4} + .5 = 11 \text{ approx.}$$

The energy of one kilometer flash is then

$$W10^{5} = 11x10^{5}$$

and the self induction from this is .0022 Henry.

With a uniform field between the cloud and the earth the capacity is

$$C = \frac{a}{4\pi d} = .00000025 \text{ Farad.}$$

Hence from the Kelvin equation

R = 190 ohms per Km. about.

The critical resistance is then about 200 ohms per kilometer. This value will not vary with the height of the cloud because of the reciprocal relations of the inductance and capacity. Increasing the size of the cloud will increase the capacity directly as the area of the cloud surface while the inductance increment will depend on the Naperian logarithm of the radius of the equivalent return circuit. For a cloud area of one square kilometer

R=850 ohms per Km.

This will be less than any case occuring in practice. Now passing to the other extreme and assuming the large base area of 1,000 square kilometers

R=35 ohms per Km.

It is evident from the above that a resistance of the order of 200 ohms per kilometer of path would be sufficient to prevent the occurance of oscillations.

There are also other more practical reasons for this conclusion. The phenomena often observed in power stations after a lightning storm that the polarity of the machines has been reversed could not occur if the discharge current was other than unidirectional as the integrated average of the oscillatory current would be zero. It has also been reported by telegraph operators on the land wires that the sounders have been observed to behave very strangely during such storms which would also seem to indicate that the above view is correct.

An oscillographic study has been made with the same results. DeBlois reported an examination of lightning discharges made with the Braun tube which clearly showed a unidirectional discharge.

Another point of interest in connection with lightning phenomena is the time of the duration of the flash or discharge. This has been determined by several observers by means of the rotating camera and the oscillograph. De Blois found this time to range from .0002 to .0016 second. Flashes that last longer than this are a composite result of multiple flashes. These sometimes persist a full second. It must be remembered that the above figures represent the actual time taken for the discharge irrespective of that required for the ionization and partial discharges which build up the path of the final discharge. The time spent in this manner of course will depend on the resistance of the intervening dielectric and the potentials involved.

The real signifigance of the enormity of the forces of nature responsible for the formation of lightning can hardly be appreciated. When it is remembered that in experimental work 30,000 volts are required for a spark length of one inch, the magnitude of potentials that result in discharges kilometers in length can hardly be accounted for. It is interesting to consider the speculations of scientific men on this problem but as yet no satisfactory ex-

planation seems to have been accepted in scientific circles. One way in which the potential of certain sections of a cloud may be raised is the union of several drops into a large one. In this case the potentials are proportional to the radius of the final drop. The evaporation of moisture of course also causes an increase in charge by reducing the diameter of the drop without disturbing the discharge, thereby raising the potential in inverse proportion to the radius of the drop. However, even on the basis of these facts, it is practically impossible to conceive of the tremendous voltages formed.

As a result of the heterogeneous condition of the ionized atmosphere and the physical results of air and moisture currents, the discharge of lightning takes place in a variety of forms named after their characteristic appearance. Some typical forms are streak lightning, rocket lightning, sheet and beaded lightning. Rocket lightning is so named because of its resemblance to the path of a rocket in flight and is the result of a very slow burrowing effect of the current thru the atmosphere. Sheet lightning is largely due to reflection and refraction of internal discharges in the cloud or to corona effects.

The temperature of the lightning has a great practical significance inasmuch as the destructive effects are largely caused by the high temperatures established. The exact magnitude of this temperature is not directly determinable by theory but practical considerations indicate that it must be exceedingly high in order to have the remarkable effects which have been observed on inflamable materials. In this case the heat generated is not directly proportional to the resistance of the path as in the case of ordinary conductors but the effects of ionization and chemical decomposition are such as to absorb energy and throw out the results of such assumptions. As a result of this sudden and intense heating, the air in the vicinity of the path expands abruptly causing a zone of compression to be formed which of course is followed by one of rarification as in the case of the ordinary sound wave. This effect resembles very closely the explosion of gunpowder and the noise produced in both cases is much the same.

Perhaps to the radio man the most interesting part of lightning is the probability of discharge occurance. It is very assuring to have the opinion of scientists expressed to the effect that the possibility of earth to cloud discharge is very slight compared to that of inter-cloudal discharge because of the greater potential gradients occuring in the clouds themselves. Most of the destruction in the path of lightning is caused by the rapid heat production. We frequently hear of cases where the bark has been stripped from trees, shingles torn from roofs, holes melted in metal bells, etc. and a thousand other vagaries not to mention the most appaling of all,—the volatilization of radio antennae.

As there is little connection between lightning phenomena and our ancient enemy, "static," and that the average amateur probably knows all he cares to about this high powered transmitting set of Nature, and also that Mr. Service's letter made no reference to static, the writer will leave the explanation of this phenomena to the fertile imagination of the reader. It is interesting, however, to note that the normal gradients of potential are greatest in winter, which would suggest that lightning and the occurance of static would take place at this season. The fact that such is not the case would seem to indicate the independency of these phenomena. Another fact worthy of mention in this connection is that the gradients are greatest in the lower atmosphere from 8 to 10 o'clock both A. M. and P. M. and from 3 to 4 A. M. and as far as has been observed no closely analogous relations hold for thunderstorms.

But perhaps the strangest feature of the entire subject is the fact that a flow of negative electricity is constantly taking place from the earth to the atmosphere above. This flow amounts on the whole to about 1000 amperes. This demands the supposition of a return current but nothing of the sort has ever been detected or a satisfactory explanation of the absence of these 1,000 amperes has been offered. Rain does not offer this compensation because

(Continued on Page 10)

ROTTEN ! !

By The Old Man

IF any body wants to know the candid opinion of Yours Truly about this amateur closing up business, let him be advised right here and now, that he considers it ROTTEN. Nothing better. And if anybody else wants to know what is going to be done about it, let him be advised that the Lord only knows and he won't tell.

I have lived a long and eventful life, Mr. Editor, and have seen many rotten things, but all the Rotten Fists, Rotten Sending, Rotten QRM and Rotten Luck fade away into the lead colored background, compared with this latest and Rottenest of all Rottens. I give up. In the privacy of my little old Den, I have searched my soul and my vocabulary for words with which to express the sentiments which oscillate within me over this closing up business, but I cannot find anything with enough bite in it, and which could be put into print. Mere words fail.

It used to be that after coming home at six o'clock and getting outside of a good supper, hearing about all the things the boy had been told to do and didn't do, and all the things the little girl had been told not to do and had done, I would light up the old pipe and take a slant at the paper or the last issue of QST, knowing that along about eight o'clock I would put the phones on. It seemed very ordinary. But now, how plain it was that I did not appreciate my good fortune. Then I used to cuss the QRM and spit on the cat when signals were not properly sent. Now, I would let the cat spit on me if it would mean just five minutes of listening in.

Instead of an occupied and pleasant evening at home with the good wife at my elbow contentedly reading or sewing, now its fill up the old pipe again, stare at the remains of the good old set, contract a grouch, cause the little wife to get the fidgets, and finally storm down street to the movies. Say, do you suppose Mr. Wilson knew the awful results that would follow, when he proclamated that last one, closing us up? Ten to one he never thought of it, but just went and did what some sore head said he ought to do. What harm would we perfectly good Americans do listening in? Of course we could not expect to do any sending, but what earthly harm would we do listening? Might we not do some good? It seems to me, standing out here on the side lines, that this closing up business shuts off all us good law-abiding citizens, who wouldn't listen in even in secret because it was wrong to do so, whereas all those who are not law abiding simply hook into some kind of a hidden aerial and go ahead. It would take some smelling around to find every one of these, especially if the common garden variety of cop is the one selected to do the smelling. I will bet I could make any cop I ever saw believe any old clothes line was a secret aerial and could prove conclusively that a real working aerial was nothing but an old guy wire.

There is one thing this closing business has done and that is to brace up attendance at the Radio Clubs, where the latter are the right kind. You know there are two kinds of Radio Clubs. One kind chucks up the sponge and closes up with the receipt of the closing order. The other puts on more steam and holds meetings every week instead of once a month. Our Club is the latter kind, and it certainly does help let off pressure. We had a great meeting the other night. Old Final Authority was around, the little chap with the radical ideas on ground leads and the pointed way of expressing himself, the poor old boob with the wart on his nose and who never yet has succeeded in learning the code or understanding why an oscillation transformer is necessary and the husky president with the strong right arm and the heavy gaval. I privately suspect the latter was once a blacksmith's helper. But he is not afraid to wallop the desk until the most violent altercation is drowned out by the awful noise. He sure

knows how to preserve a dignified and scientific atmosphere, and beat the tar out of a desk.

At the meeting I refer to, the President outlined the war situation, told about the seriousness of not obeying the closing up order, and read the official notice for the benefit of the small fry who had no licenses and who did not receive a copy. As customary on occasions of this sort, he called upon Final Authority, to "state for the benefit of the members what he knew about the situation."

Final got up with ponderous dignity, knowing full well his eminent position in radio science, and stated that he had been privileged to see certain secret papers which the Government Authorities were preparing to send to the Chiefs of Police of the various towns and cities of the country. He could not tell many things which he knew about (here he stared darkly at his arch enemy, the little chap with the radical ideas on ground leads) but he could say that the Government would prosecute relentlessly any one who might have any radio apparatus of any kind which might under any circumstances whatsoever be made use of to receive or transmit radio signals; and that furthermore, Secret Service agents were known to have been instructed to bring to the bar of justice everyone against whom there was a breath of suspicion.

Final looked pointedly at his opponent of the radical ideas on ground leads as he sat down. The latter said nothing. He turned very red and wriggled in his chair a bit but bided his time.

"What about taking down masts?" asked a chap who had built four and had busted three of them trying to get them up. Final said that matter had been considered but not decided. Where the mast was on a building in which radio equipment might be secreted, it was the policy to insist that it be taken down.

"But it cost me $375 to get up what I have in the way of a pole. It would cost me $50 to take it down," objected the poor chap. Final shook his head sadly, and Radical Ideas wriggled some more in his chair.

"I understand that if you put a United States Flag on your pole they cannot make you take it down." This from the Boob with the wart on his nose, and who always understands with his feet instead of his brains.

"I have not heard of that being the case," said Final Authority, "but I can readily understand that the National Emblem may be considered as protecting everything to which it is attached".

There was a pause here, while all hands thought how easy it would be to hoist the Flag over an enemy alien's wireless set. Radical Ideas here cleared his throat, and everybody realized it was the same thing as clearing for action. "Is there some law which says that?" asked he, very pointed like, looking hard at Final.

"I am not positive, but I believe there is something on the statute books to that general effect", answered Final.

"Can the pole have guy wires and still be protected by the Flag?" continued Radical.

"It would probably depend upon the nature of the guy wires", responded Final.

"Wood guy wires with ten inch electrose insulators at each end and a lead wire connecting them be protected by the Flag?" asked Radical. The President here reached for the gavel.

Five young men tried to answer this question and when one overheated young man made a pass at Warty, bang, bang, bang, went the gavel, and time was called.

"I think there is no need carrying this discussion any further", commanded the President. The Flag obviously cannot be used to protect any illegal wireless plant. "Mr. Jones, I am told you have had some experience with the Chief of Police. Will you tell us about it?"

Mr. Jones got up and said he had taken down his aerial when the order came to do so, but that as he thought it over, it seemed to him that it was a bad idea, because if everybody followed the order there would be no way to tell if enemy aliens were not using the air. He said he began thinking about it and it occured to him that his front door bell system was pretty well insulated and ran up pretty high in the air, and was long enough to have a pretty fair wave length. He coupled on to it one evening and found he was right. He could get signals fine. He enjoyed himself a-

bout a week at it and one night he caught some signals which looked queer. He copied them and the more he studied them, the more queer they looked. He finally talked them over with Mr. Smith who was also present, and the latter decided he would also try his hand. His door bell system, however, was not so good, so he used the electric light wiring of the house, opening the main switch down in the cellar and hooking on to a socket in his wireless room. Until it got dark enough to need the lights, this worked fine, and he copied the same suspicious stuff.

When this had gone on another week, they decided to see the Chief of Police. The later had indicated considerable interest but seemed in a quandary as to what to do. One moment he seemed to think he ought to hang them both for operating a secret wireless station and the next he thought they were deserving of some kind of a medal. He seemed to be up a stump, in other words, and finally said he would report the matter, but they must stop operating their wireless instruments, and if they heard any more signals to please let him know!

A laugh greeted this story, and each bug began mentally considering the suitability of his dor bell system and electric light wiring.

Final knocked it all, however. He allowed as how it was plainly contrary to the Navy Department's orders to operate any kind of an antenna.

Radical, who had not had enough yet, came back and asked what constituted an antenna. Final was leary and hesitated, while the President reached for his war club again.

"An antenna is anything which may be used for the collection of radio signals," finally decided Final.

"All right! Is a coil of wire on a spool resting on my table an antenna?" came back instantly.

"Why, no—that is—I should say—hardly —under ordinary circumstances".

"All right! Is a Paragon Regenerative Receiver standing on a table an antenna?"

"I do not believe it is".

"All right. Is a ground lead an antenna?"

Here the President hitched forward ready for the trouble that was surely coming. Ground Leads is a delicate subject in our club.

"I would rather not pass on that until I saw the ground lead", parried Final.

"Never mind the ground lead then. Is a Paragon Regenerative Receiver standing on a table and a pair of phones connected to it an antenna?"

"I should say no."

"Well, then, I can go on listening to Tuckerton and Sayville, because I have no ground lead and no antenna and they both come in fine".

Silence fell and darn near broke a hole in the floor. Everybody looked at everyone else and gasped. Radical had thrown another bomb.

The whole blamed outfit started to ask him what sort of a bulb he used, how he tuned, etc. etc. etc., when the President again called a halt by whacking the desk. Final arose and said that the question was entirely beside the point, because he happened to know positively that no radio signals must be received, no matter by what means, antenna or no antenna, and no radio apparatus must remain in such condition that it might be used for the reception of any electrical impulses.

"Can't I have my tuner on the table?" blurted out Radical.

"I think it amounts to primafacie evidence if you do," replied Final.

"Can I put it on a chair?"

"I think it would be construed as an equivalent".

"Well, how about the floor?"

"The same thing applies".

"Well, for the love of Mike, where can I put the thing and not be liable?" asked Radical, getting mad.

"Your case is peculiar", answers Final, taking upon himself the whole responsibility for the United States of America. "I grant your set is disconnected as to ground and antenna, but the order states that you must not receive any signals with it".

"Suppose I dig a hole out in the back yard and bury the thing? That would be safe, wouldn't it?"

"Yes, I imagine that would be conctrued as complying with the law," smiles back Final.

"All right", hops back Radical. "Suppose, to protect it from injury, I put it in a porcelain box. Is that all right?"

"I think one may rightfully take any steps necessary to protect one's property from injury", returns Final, showing signs of being bored.

"All right. Now suppose I bury my amplifier, and my battery and my loud speaking phone and horn along with it. And suppose the binding posts accidentally touched each other and the set amounted to being connected up the same as it is on the table in the house, and suppose the horn of the loud speaking phone sticks out above the surface of the ground. Would everybody who happened to hear a radio signal that came out of that horn be hung?"

Final had trouble with his collar at this point. After re-adjusting it and dusting off his well creased trousers, he took a long dark look at Radical over the tops of his glasses. "Under the terms of the law, it is my opinion that the owner of the set and the owner of the ground in which it is buried, would be liable."

"All right. Suppose both these criminals happened to be out of town at the time. How about the neighbors?"

"Accessories, and liable under the terms of the law," announces the judicial Final.

"All right. Then, the only way that anybody with normal hearing powers can escape being pinched in this here country, is to go around with their fingers in their ears, or else train a dog to learn the smell of an audion bulb. Me for the criminal classes under these conditions", and Radical tipped back in his chair with brush discharge leaping from every corner of him.

The gang here took voice again and the President nearly split himself walloping the desk. After everybody stopped talking and the President satisfied himself, he announced that it was time for adjournment and that it would be necessary to continue the discussion of this knotty legal problem at the next meeting.

I have a hunch that there will be several interesting tests to be reported upon at the next meeting. I am glad the meetings come every week these days. Will tell you how things come out next QST, provided I do not get landed in jail for living in the same town with Radical. GN GN.

LIGHTNING PHENOMENA

Continued From Page 6

it is largely positive and the return must be negative and a great deal of it. "Neither as far as is known, is compensation supplied by means of lightning for in the majority of cases, this too is positive from cloud to earth. And so the puzzle remains."

*****

BIBLIOGRAPHY.

W. J. Humphreys Journal of the Franklin Inst. Vol. 178, 6.

Annalen der Physik u. Chemic, Liepsig, 1899,68, 776.

Leduc, Comptes Rendes, Paris, 1899, 129,37.

Nature, London, 1903-68, 559.

Ciel et Terre, Bruxelles, 1910-31, 449.

Comptes Rendes, Paris, 1901-132, 1537.

Annalen der Physik, Leipsig, 1900-22, 623.

Science, New York, 1899-10, 717.

Astrophysical Journal, Chicago, 1903-18, 294.

Proc. Am. Inst. Elec. Eng., New York, 1914-33, 563.

Fleming's Principles Or Electric Wave Telegraphy, 1910-228.

Thompsons Conduction of Electricity Thru Gases * * *

Annales de Geographis, Paris, 1914-23, 109.

A One Kilowatt Transformer

IN response to many requests, we are giving data for the construction of a one kilowatt transformer. Many of the amateurs will find the task an enjoyable one, especially if they have the proper tools. A lathe is almost necessary in winding the secondary, but it is possible if you are ambitious, to construct a winding machine which will be a successful substitute.

One of the first essentials is the core. Here it will be advisable to purchase silicon steel which is used in the commercial transformers. It is possible to get this all cut to size and the writer would not advise anyone to attempt cutting it by hand. The better grade of steel you can get, the higher efficiency will your transformer develop. Do not substitute some cheap iron which will have no permeability or desirable properties. Sometimes it is advisable to shellac each separate sheet of the core but in many cases the steel has a layer of oxide which will act the same way. While it is not intended to develop the theoretical side of transformer design, it would not be out of place to say that the

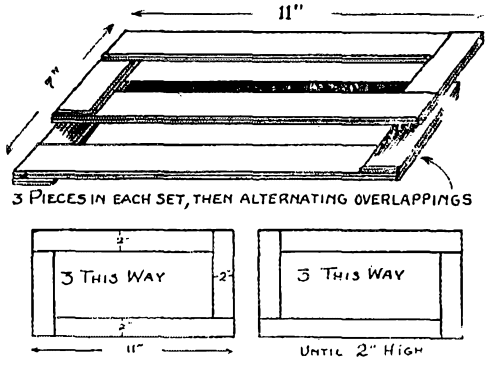


FIG. 1

core is laminated to avoid the serious heat or hysteresis loss. If the core were solid, the alternating current would heat it and losses would result. The laminated core allows the flux to change in direction with less heat effect.

As to actual sizes, the core should be seven inches wide by eleven inches long outside, and three inches by seven inches inside. It is built up of strips nine inches by two inches wide and five inches by two inches and of about twenty-eight gauge stock. The core is put together as shown in Figure 1 by laying the strips in alternate manner. After the core has been

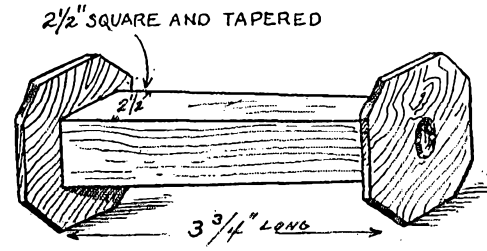


FIG. 2

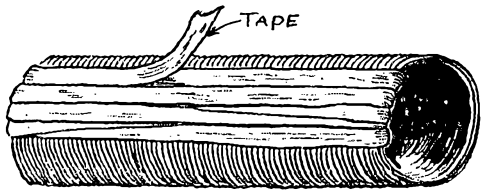
built up, it is taped together and one side is removed to allow the primary and secondary coils to be put on. These coils will now be described.

The primary coil is made up of 300 turns of No. 10 double cotton covered copper wire. The coil may be wound by hand on a form as shown in Figure 2. The center core of this form is made slightly larger than the core of the transformer, and is tapered so that we may slip the wire off after it has been wound. No instructions are given for the fastening of each end as every amateur has a method of his own. Let it be sufficient to say that the terminals should be of fairly long length—about twelve inches. After the primary has been removed from the winding form, it must be carefully taped as shown in Figure 3. One of the legs of the core is now built up with Empire tape until the primary will just slip on.

Now we come to the more difficult and sometimes less pleasant task of winding the secondary. First, a form must be made similar to Figure 4. In this form slots are cut in the sides as shown, and heavy cord slipped into them leaving length enough to pull it over the finished secondary winding, and tie it in order that the winding may be taken off the form. It is

advisable to construct the winding form so that it may be put in a lathe, but if no lathe can be had, some fashion of belting it to a hand winder will have to be devised. This is left to the ingenuity of the reader. A few suggestions which might be adopted are to commandeer the sewing machine or a motor from a rotary gap either of which could be belted to the winding gear.

For the actual winding we use No. 32 double cotton covered which is fed into the form as evenly as possible. Six pies are made with approximately 10,000 turns each. As the transformer is designed to work on 110 volts, this gives a ratio of 300 to 60,000 which will give a voltage of approximately 20,000. After each pie has been wound the four strings are tied and with a little care, the winding can be taken off the form. It should then be dipped in melted paraffine which is just warm enough to stay in a liquid state. After the air bubbles have all escaped the pie is taken out and pressed together with two boards as it is cooling. When dry and hard it is ready to handle and then you should use care. A slight break in the wire is enough to ruin a winding. The secondary winding is taped in the same manner as the primary, each pie being handled separately, and be sure to mark plainly the direction of the winding, for it is necessary to have all the turns in the same direction when we connect the pies of the secondary together The lower terminal of each pie is connected to the upper terminal of the next, leaving a lower and upper terminal as our secondary leads as shown in Figure 5. Care should be taken to insulate the core carefully before the secondary is slipped on. Between each of the pies of the secondary insert two or three thicknesses of paraffine paper which act as insulators.



PRIMARY—TAPE ON OUTSIDE RUNNING THRU CORE AND ACROSS WINDING.

FIG. 3.

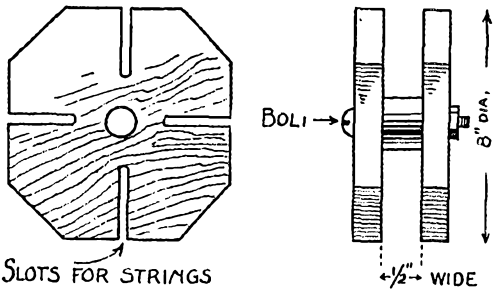


FIG. 4

After the secondary has been connected together, slipped on the core and well insulated, we are ready to put the core together again and the transformer may now be mounted in any manner the reader wishes. This transformer will prove not only efficient, but big and husky and willing to work hard.

ALL PIES WOUND IN THE SAME DIRECTION.

FIG 5

SOUTHERN TIER RADIO ASSOCIATION

The Southern Tier Radio Association, has been formed in Elmira, N. Y., with headquarters located at 717 W. Gray St. The officers of the Association are: President, Joel Young; Vice President and Treasurer, Charles Huff; Secretary, John McNevin.

The purpose of the Association is to work on the plan of the commercial station, i. e., each station has fixed time of at least fifteen minutes a day, for listening in, thus enabling a message to be sent to a place every day with certainty.

Long and Short Wave Audion Sets

By A. L. Groves

SINCE my letter appeared in the March number of QST mentioning certain long distance stations received by me, I have been in receipt of numerous inquiries concerning what I use to get them, the wave lengths and working hours of these stations. I hope this description of my set will help many readers of QST.

One of the mistakes made by many amateurs in receiving the long wave stations with the audion, is too close coupling, and one of the greatest problems is to get a transformer that will respond to the long waves, at a price within reach. Therefore, the first and most important thing I shall describe is a form of receiving transformer, which will practically eliminate the habit of using too close a coupling, and at the same time give louder response to signals and greater selectivity than the loose couplers sold on the open market. It is also easier to handle, can be used in either a vertical or a horizontal position and in comparison with other loose couplers of equal wavelength its cost is next to nothing.

There is no such thing as a 10,000 or 15,000 meter transformer, strictly speaking and for best results these instruments must be designed to suit the particular station for which they are to be used at. For instance, a transformer designed to respond to waves of 15,000 meters on an aerial 150 feet long would be next to useless in a station with an aerial three or four times this length, as the undue size and unused turns in the primary would cause considerable loss.

For best results for all around work, at least three transformers should be used: one for short waves, 200-600 meters; one for waves up to about 3,000 meters, and another for the longest waves. With a small aerial it is best to have them arranged about as follows: One for waves 200-600 meters without employing a loading coil. One for waves up to about 3,000 meters without a loading coil and the last for waves up to about 6,000 meters without employing a loading coil in the primary circuit, and having a loading coil for waves over 6,000 meters. The loading coil should be capable of boosting the primary circuit up to about 12,000 meters, as this is about the longest wave used by any station in regular service at this time.

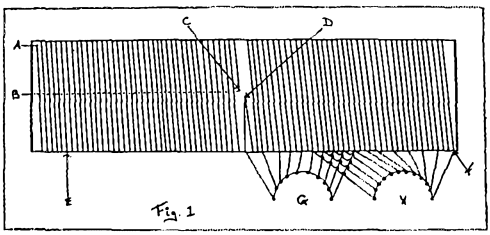
The loading coil should not be over 6 inches in diameter and wound with not smaller than No. 24 copper wire, though if your aerial is small and space is at a premium No. 26 may be used. No. 20 or 22 wire is even better where the aerial and space available will allow it.

Referring to Fig. 1, which represents these transformers, a cardboard cylinder of the required dimensions is obtained, 6 inches in diameter and 24 inches in length, and starting at point "A" the wire is made secure to the cylinder and wound in the usual manner until point "C" is reached. Here the wire is put through a small hole in the cylinder and run on the inside to the point "B" as shown by the spaced line. This end of the wire is connected to the ground when the instrument is in operation. This part of the winding is known as the primary and the inductance is varied by a slider as shown at "E". The aerial is connected to the rod that controls the slider when the instrument is in operation.

Next secure the wire at the point "D" which should be directly under the point "C" and leave a tap "X" at this point to be connected to switchpoint "Y" of switch "G" when the instrument is completed. Wind the coil in the usual manner, taking taps off every 1-4 inch for 1 inch; every 1-2 inch for the 2nd and 3rd inches and every 1 inch for the remainder of the distance, or after 6 inches the taps may be taken off every 1 1-2 or 2 inches.

The winding is made fast at the point "F" and a tap left to be connected to switchpoint "Z" of switch "H". This is known as the secondary coil.

The taps taken off should be connected to the points of switches "G" and "H" on the order shown. Enough taps should be connected to switch "G" to include about half of the inductance of the secondary coil.



In operation, the slide "E" is used to vary the primary inductance as in the usual loose coupler, and the switch "H" is used to vary secondary inductance. The switch "G" is the most novel part of the instrument and has the effect of varying the coupling. When on switchpoint "Y" the coupling is closest and as it is placed on the other points the coupling is loosened as desired.

The SAME SIZE wire should be used on the whole coil and while No. 24 copper wire is preferable, No. 26 may be used with a small aerial. The maximum diameter of the coil should not be over 6 inches at the outside, for the longest waves, and not over 5 inches for waves up to about 3,000 meters.

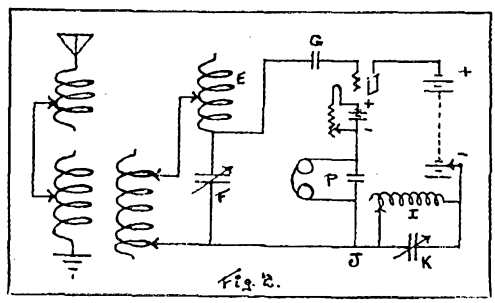
The length of the coil can only be determined by the aerial in use, but for the longest waves the secondary portion may not be over 12 inches long, and for waves up to 3,000 meters the secondary portion may not be over 10 inches long. This small difference in the lengths of the small and large coils does not seem right, but experience has proven that it is not practicable to have the secondary coil over 12 inches long and a coil under 9 or 10 inches long will not allow for sufficient loose coupling on the shorter waves. With the circuits now in use for long wave stations the major portion of the secondary inductance is obtained from a secondary loading coil, sometimes called the "Grid" coil.

Two pounds of No. 24 SCC copper wire or a little less of No. 26 SCC wire is required to wind a cylinder 5 1-4 inches in diameter and 24 inches long, so you can calculate your requirements very close by this. Tubes up to 24 inches long and of any diameter can be obtained from Messrs. Ware & Company, New York, N. Y., varying from about 15 to 25 cents per foot, according to diameter. Wire, if purchased in 5 pound lots or more can be obtained direct from Jno. A. Roebling, Trenton, N. J. at a considerable saving over the prices asked by retailers.

About 25 switchpoints and two switchblades are enough for the "G" and "H" switches of any coil, and the only other requirement is a rod and slider for the primary coil. A coil 6 inches in diameter and 24 inches long wound with No. 24 or No. 26 SCC wire can be built for less than $5.00 at the present high cost of material, and you will undoubtedly have a more efficient coil than those on the market selling for from $25.00 to $40.00 or more, and at the same time you have the privilege of placing it in any position.

If you wish to make a cabinet for the coil, the woodwork can be obtained from Messrs. Bubeck & Guerin, New York, N. Y. at a price that will surprise you, and any thickness, widths or lengths desired, within reason, of course, all planed smooth and ready to work on.

With most amateurs the financial problem must be considered in the operation of a wireless set, and in this connection most amateurs are mislead by thinking they must



pay a high price in order to get good results from the instruments purchased. For sending sets where high frequency is used, the best of insulation and the best of apparatus should be used, but for receiving all the talk about high insulation is non-

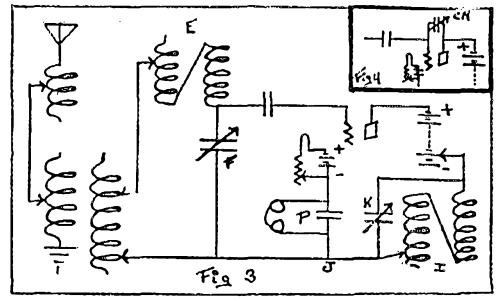
sense, and plain seasoned wood will give just as good results as all the hard rubber, bakelite. etc., in the world, and when a fellow buys something all done up in bakelite, he is paying for something which is not necessary.

The next most important thing in the reception of long distance messages is an efficient aerial. The aerial, of course, should be as high and as long as it is reasonably possible to have it, but with an aerial about 75 feet high and 250 feet long an amateur should be able to receive several thousand miles, even in broad daylight under favorable conditions, unless some unusual local conditions prevent.

For receiving, No. 14 aluminum wire has been found to work very well. Its conductivity is almost the same as copper wire, and it does not offer undue strain on the aerial masts and spreaders, and a greater number of strands can be used, which is of great benefit in tuning to the long wave stations. Aluminum wire will stand up remarkably well if a little care is exercised in putting it in place. I have had a span of nearly 600 feet in service for about two years and in that time not one of the aluminum wires have broken. I use No. 12 copper wires for the lead-in, and always use the same number of lead-in wires as there are wires in the aerial.

As the aerial is exposed to all kinds of weather conditions, and is often used more in bad weather than in good weather because we cannot get out to do much else, it should be well insulated, with nothing less than the ball type of electrose insulators. The lightning switch should also be well insulated to prevent any possible leakage in wet weather, and you should not rely upon its insulating base alone, but make other preparations that will make it almost, if not quite impossible for water to form an unbroken path from any part of the aerial system to the ground.

The masts, if not of wood, should be thoroughly insulated from the ground, and the guy wires must not be directly grounded. Neither should any two guy wires be connected together, either on the mast or their supports. If it is impracticable to arrange this under ordinary conditions, insulators should be inserted in the guy wires about two feet from the mast and about five feet from the ground. If the mast is of wood, and wood posts are used to support the guy wires, the guys can be attached in such a manner that they may not touch each other without the use of insulators, however, one insulator inserted in each guy wire at a point five or six feet from the ground is advisable, especially in the guys that run to the top of the aerial pole.



The ground is a most important consideration and this should have even more consideration than a thorough insulation of the aerial,—for without a good ground connection, the very best aerial is useless, or almost so. A good rule to remember when planning your ground is that "Electricity takes the shortest course to the ground." This is certainly true in wireless work, for if you have one of the best ground connections in the world, say 25 feet from your instruments, and a very poor ground connection 5 feet from your instruments the wireless waves will use the closest ground, in this case the poor connection, 5 feet from the instruments, and you will not get good results.

As an instance of this kind, I will mention that when I first erected a wireless set I had an iron pipe driven in the ground some eight or ten feet from my instruments and intended to use this as a ground but realized this was not sufficient, and buried several copper plates in moist ground a little distance away. Well, I didn't get any better results although I had a pretty good lot of copper plates buried, so one day I happened to disconnect the wire from the iron pipe and the signals came jumping in so much better that I could hardly believe I was awake. Since

then I have made numerous experiments along this line and they have always shown that the poor connection cuts down the signals if it is the closest to the instruments. If it is the furthest from the instruments there is no change, as the "good" ground takes care of the energy before it reaches the "poor" ground. Since then I have proven to my own satisfaction that the ground should be buried in the form of a circle or semi-circle and the connection made to the center of the circle. Also the plates should be buried "Flat" and not stood upon end or side. This part of it puzzles me, but plates buried on their end or side do not give as good results as plates laid flat. This has always been my experience.

Again we come to the expensive part when we buy and bury copper plates for a ground, especially at the present time. Equally good results can be obtained with common roofing tin, buried in place of the copper, and the tin will last for years. Much depends upon the soil surrounding the station, but I have found that about one roll of tin will form the best ground. Two rolls may be required in some places.

It is best to bury it in sets of about three squares, first soldering the squares together, and taking the lead from the center square, and after burying several sections as described, a test should be made on some very weak signals before connecting up permanently. That is, connect up one plate and listen for a signal, after hearing it attach another plate (while still listening) and note the increase in strength of signals, then connect another and another, and continue to do this until there is absolutely no increase in strength of signals when even two plates are connected at the same time. This should be considered just one half of the ground required, and enough material (tin or copper as you prefer) should be purchased for the other half.

This method can easily be arranged by most everyone, and it will abundantly repay you for the time and trouble taken, while at the same time if one plate is found to deaden the signals, instead of increasing them, you can easily determine which one and remove, or replace it from the circuit. This is hardly likely to occur if the plates are buried in a circle, and care taken that all leads are the same length.

After being assured that your aerial and ground are in good shape the next thing to consider is the circuits which will bring best results. There are numerous hook-ups being circulated these days and practically all of them will give results, and if you have not had any experience with good circuits you may think that one of these inferior circuits is the real thing because you can get signals from quite a distance, but in reality you may not be getting half the results that could be had from the same aerial with a real good hook-up.

It must be remembered that the three element valves operate on voltage, and any circuit which tends to lessen the inductances of the secondary circuit (or grid circuit) cannot possibly do full justice to the valve under all conditions.

A good idea of this can be had from the past season. This circuit takes full advantage of the voltage principle of the valve. While it is impracticable for many amateurs to build variometers for the long wave circuits, as used in the Paragon short wave circuits, it is possible to take advantage of the voltage of the valve to an even greater extent on the long waves than on the short ones, as much greater inductances can, and must, be used on the long waves. The greatest reason why variometers cannot successfully be used by amateur experimenters on the long waves as they can on the short waves, is that amateurs wish to operate over a wide range of wave lengths and it would be quite impracticable to do this with a non-dead-end circuit such as the Paragon. Tapped coils and variable condensers must be used on the long waves to give the flexibility necessary to tune to a wide range of wave lengths.

Those who have never operated on the long waves have no idea of the ease and pleasure with which these stations can be heard. The operation on long waves is far different than on the short waves. There is nothing freakish about long ones and nine times out of ten what you hear today you can hear tomorrow and next week too. What you can hear at mid-

night you can also hear at noon, and the chances are ten to one that you can hear even more at noon than at midnight. Compare this to the uncertainty of short waves,—where a station will come howling in one minute and fade almost entirely out the next; where you can probably hear a thousand miles one night and only a hundred the next; where QRM is so great that it makes you *—?—!—!.; where you can scarcely do any work in the day time at all; and where freak work is the rule rather than the exception. Which do you prefer?

The worst enemy of the long wave is QRN, but the flute like tones of the arc stations, and the high pitched tones of the spark stations tend to overcome this to a great extent. You can read these stations through QRN which would be almost impossible on the short waves.

Perhaps a finer point of explanation will not be amiss as to the operation on long waves, as that given above is not exactly correct when it comes to the fine points of operation. Long wave signals do fade, but their fading is nothing like the fading known on lower waves. It usually runs in periods of days or weeks at a time. In an hour or two you will note no appreciable change in their strength. In a north and south direction in the U. S. you will not note any great change in strength of signals in the day or night. What little increase in night signals there is from these stations, is more than offset by the increased QRN, and taking everything into consideration you will be able to copy these stations even better in the day time than at night.

Stations to the east of you at a considerable distance will be at their best nine times out of ten from about 2 P. M. until about dark and stations to the west will be from daylight to 10 A. M. This is accounted for by the fact that it is dark at the sending station and light at your station, which gives the sending station the benefit of a good start and the receiving station has much less QRN to copy the signals through. As QRN is always much less in the early morning, you will have a better chance to copy practically all stations at this time, especially those to the west. These conditions generally prevail.

During July, August and the first part of September the worst conditions are encountered, but you can operate your long wave set the whole summer. Only when an electrical storm is raging close to you, will your set be entirely out of commission. The formation of storms is such in the summer months that you will find, with the exception of the QRN from an approaching electrical storm, the conditions will be very passable.

Figure 2 shows one of the simplest efficient forms of connection for long waves. The size of coils "E" and "I" depends upon the maximum wavelength you wish to copy from, and as practically all amateurs wish to copy over the entire scale of wavelengths in regular use, long coils should be made.

It has been found best to have these coils at least 4½ or 5 inches in diameter and 40 inches long, wound full of No. 30 SCC wire with taps taken off every 2 or three inches of winding. This will be sufficient for the coil "I". A coil twice this length can be used to advantage on long waves for the coil "E". As coils of these length are impracticable to the great majority, coils 40 inches long may be used. This may be divided into two coils each 20 inches long and connected in series as shown in Figure 3 Three or four coils can be connected in series in this manner and if more coils are added to coil "E" better results will be obtained from the very long waves. The coil "I" need not be any larger than suggested above, for the longest waves.

The coils "E" and "I" should not be placed in close inductive relation to each other, good practise is to stand them on end, keeping the coils of "E" and "I" separated as far apart as convenient having them not less than 18 inches apart.

If you cannot make coils as long as those described, you can build up the wave by placing a small variable condenser across the grid and plate of the valve as shown at "CN" Fig. 4. This condenser should be kept at its zero capacity when operating on waves where the inductances of the coils "E" and "I" are sufficient. This condenser should not be over .0005 or .0008 Mfd. capacity. The condensers "F" and "K" should be each of about .001 Mfd.

capacity and variable. The telephone condenser "P" is of fixed capacity. The Grid condenser "G" should be of mica and tinfoil, about 2x4 inches, or mica and copper. The mica should be a little larger than the sheeting or tinfoil to avoid short-circuiting.

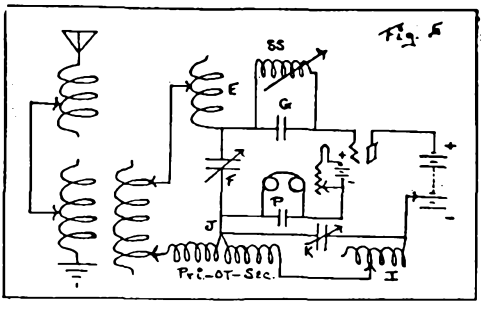


Fig. 5

Figure 5 shows a slightly better arrangement, inasmuch as it includes an oscillation transformer "OT" and static shunt across the grid condenser "SS". The OT helps out considerable in tuning-in arc stations and the static shunt helps considerable to keep the static from rendering the bulb inoperative. A variable static shunt, which is the best, can be purchased from the Radio Apparatus Co., Philadelphia, Pa. at a small price.

The OT can be made most any size, and is so arranged that the secondary slides in and out of the primary. A convenient size for this instrument is Primary 5¼" diameter and 6" long wound with No. 28 SCC wire: Secondary 4½" diameter and 6" long, wound with No. 30 SCC wire. No taps are taken off except at the ends, and the two "inside" leads are connected together and the two outside connected as shown. A lead from each of the condensers "F" and "K" and one lead from the receiver is connected to the two "inside" ends that have been previously connected together. Other coils are of the same size as described before.

With the circuit shown in Fig. 5, it is possible to get all "out" of a bulb that is "in" it, —provided the coils are of sufficient size and the manner of connections followed closely. I might mention that it is absolutely necessary to follow the diagram closely and do not reverse any of the connections. That is, the positive end of the high voltage battery must be connected with the plate of the valve, the switch end of the coil "I" must be connected away from the plate, the switch end of the coil "E" must be connected away from the grid. This is true to all the diagrams submitted herewith.

It is best to build your coils yourself, then you can make sure they are wound in the same direction. This is important. If one coil is wound in one direction and another in the opposite direction considerable losses will occur due to their opposing each other. If the coils are to be stood on end, it is well to use a little shellac to hold the winding in place. Do not use very much shellac, though a thin coat about one half inch wide run up four opposite sides of the coil will be sufficient to hold the winding in place.

Any of the above connections may be used to copy either damped or undamped waves with equal results, but it is best to have the "OT" coupling as loose as possible when receiving from spark stations.

When it comes to the actual operation of the instruments you must shift for yourself and learn how. One of the first things you will notice is that for a great many stations it will not make much difference where the primary slide is located, within certain limits of course, but you will soon learn that this is the fault of your tuning. Rest assured that you are not getting half the results possible. When you learn how

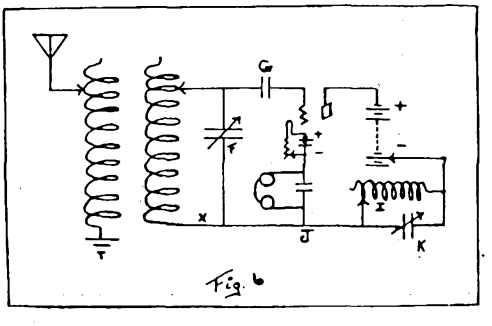


Fig. 6

to tune, one turn of wire in the primary circuit will often cut signals entirely out that were plainly audible before. This is a good way to learn to tune, as when you can move your primary slider without a great change occuring in the signals,

you are not properly tuned to the station, and by manipulating the various instruments you will soon learn the best adjustment. The main object is to keep the grid circuit at a slightly higher wavelength adjustment than the plate circuit. Practically constant values of capacity and inductances for a given wave is had in the grid circuit, but values in the plate circuit will vary according to the voltage used and the degree of brightness at which the filament is burned, and according to the coupling between the primary and secondary of the oscillation transformer, which also effects the adjustment of the grid circuit.

Many amateurs may also want to build a short wave re-generative set. One that will meet requirements is shown in Fig. 6. Most any small loose coupler can be used and the coil "I" should be about 2½ inches in diameter and 2½ or three inches long wound full of No. 30 SCC wire with five or six taps taken off. This arrangement will give excellent results on waves between 180 and 600 meters and is very cheap as the only instruments required outside of the regular audion equipment are the coil "I" and condenser K. If the secondary of the transformer has not enough inductance for 600 meters a small coil may be added at "X".

Figure 7 shows the method of connecting up a short wave re-generative circuit with Variometers. If both of these circuits are made properly I believe it is only a matter of personal opinion which one will operate best. Some like the Variometer adjustment and some the condenser adjustment, but personally I do not think there is much if any to choose between the two, provided the operator understands both sets and that both sets are the best of their kind possible for him to make.

In any of the above diagrams the point "J" may be grounded if so desired. Some claim a slight advantage by doing so, especially with a few bulbs, but with the general run this is not necessary, and in fact will decrease the sensitivity of some bulbs.

Also in any of these diagrams the High Voltage batteries may be removed from the position shown and the coil "I" connected to the plate, and the negative side of the High Voltage battery connected to the Negative side of the filament battery and the positive side connected to the receivers.

With the circuits shown, in connection with an aerial with a flat top length of

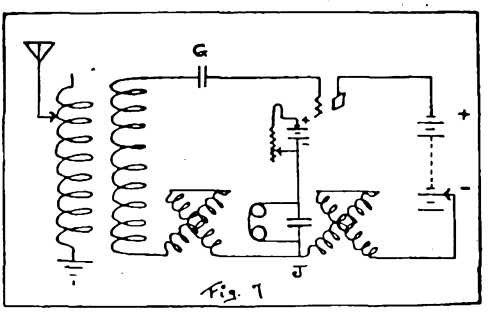


Fig. 7

about 100 to 125 feet and 50 to 60 feet high, signals from Europe and like distances can be copied with fair regularity by amateurs in the eastern part of the United States and stations within a radius of 2,000 miles should be heard with ease. Using no aerial at all I have often copied signals from a distance of over 400 miles, and distances of 250 miles can be covered easily with no aerial.

The round Audion bulb is, from my experience, the most economical and satisfactory valve on the market today. Some of the tubular bulbs have their advantages but they also have their disadvantages, and chief among these is their great cost of operation. I have found that 9 dry cells will operate the average round audion bulb from 6 to 8 months; while with the same or even less use, 12 dry cells will not operate the average tubular bulb one month. This is something worth considering when buying valves. Used in the circuits described the round audion will give just as good results from the long wave arc and spark stations as the tubular bulbs. A peculiar thing in this connection is that it seems that just so long as the bulb is oscillating good results can be obtained with any valve that employs the internal grid.

There is doubt which of the valves really gives the best results on the short waves. The tubular valve probably gets the lead here, though the difference seems to be in a slightly higher amplification and not in any actual distances.

HELP KEEP QST GOING

If there is one thing which we of the A. R. R. L. need, it is that our QST be kept going during the war. It is the only thing we have which binds us together. The air is silent these days and most of us have almost forgotten what a signal sounds like. If we had no means of communicating with each other, it would be impossible to hold our organization together. It would be like a chain of sand.

Our QST means a lot to us all. We think we are justified in saying that it is the medium which forms the nucleus of the strongest and most influential organization of amateur wireless station owners in the country. This organization has already reached a point where its strength has been felt. Our Board of Direction is made up of men whose influence carries far and as there is every reason for believing that amateur wireless will be reopened and encouraged by the Government after the war is over, we should not let anything happen which will permit this organization to break down. QST can hold it together and even strengthen it, if it is published every month on the lines which have been established. We must, therefore, do everything in our power to keep things moving.

Your editor is of military age, and to the best of his knowledge and belief, he has neither flat feet nor a leaky heart. Therefore, he is liable to be plucked out of the editorial chair and deposited in the trenches "some where in France" unless he enrolls in the Naval Reserve, Radio, which he would have done months ago had it not been for QST. He probably will be unable to hold on much longer and it will then become necessary for somebody with a more or less defective anatomy to edit and hustle out QST every month. While the work might be done better by the new than it has been done by the old, nevertheless the breaking in of the new will take time and cost money. Therefore, again, all the more reason why you fellows should HELP KEEP QST GOING. If you have not sent in your subscription or your annual dues to the A. R. R. L. for Heaven's sake send them now. If you buy at the news-stand, for Heaven's sake keep it up or send in your subscription for a whole year and your dues. If you know anybody who is interested in wireless, for Heaven's sake call them on the phone and make them promise to subscribe for the sake of the future of amateur wireless. If you are thinking of any electrical experiments which can be conducted under the present conditions, for Heaven's sake write to the manufacturers who advertise in QST about the apparatus you need and tell them to keep a stiff upper lip and also keep up their advertising in QST. In short, do your bit and HELP KEEP QST GOING.

ENROLL--ENROLL--ENROLL

They still want us, fellows. Radio operators who can take twenty words a minute and who understand station operation are wanted, whether they are men or women. We had this straight from the top the other day.

The way to answer the call is to ENROLL in the Naval Reserve. This puts you in for the duration of the war only, unless you want to stay in. It gives you good pay, good associations, an exceptional training in electrical engineering and above all, the tremendously valuable military discipline. The latter will stand any young man in good stead all his life long. It will make him stand up straight in his shoes and look the other fellow in the eye and it will make him understand what is necessary in order to obtain success. He will be made to understand all that lies underneath the surface in that expression, "Carrying the message to Garcia."

If any fellow finds difficulty in getting himself started, simply as a result of his country's call, he ought not to have any difficulty in getting himself started for his own personal good. The opportunity is simply without parallel. The Government actually is going to pay you for the privilege of teaching you one of the most valuable courses in electrical engineering, during the summer time when everything is pleasant and when the vacation season offers itself. You will be sorry to the last days of your life if you do not enroll before it is too late.

SUBMARINE DETECTOR

Not one of the hundred thousand of us amateur radio engineers would hesitate a moment if asked to produce something which would detect the presence of an electro-magnetic strain in the ether. Even if the spot from which this strain came from were a thousand miles away, and were incomprehensibly feeble, we would not hesitate. We would rig up an audion detector and we know just how we would make use of regenerative and amplifying arrangements so as to make this feeble little strain coming from a point a thousand miles away, easily detectable.

Now, when we can do this, why cannot we detect the presence of a submarine ten miles away, when this submarine consists of several hundred tons of iron and also a few hundred volts of difference of potential?

There is nothing we Allies need so much right now as a submarine detector. That person, be he man, woman or child, who can come forward at this time with an apparatus which can be placed upon the ordinary merchant ship, and will tell the Captain when he is within five miles of a submarine and where that submarine is located, would be hailed as the greatest benefactor the human race has produced. He would end this terrible war, where no one else has succeeded.

We radio experimenters ought to think about this problem. We know more about detecting feeble magnetic and electrical values than any one else. That little glass bulb with the grid and the plate and the filament inside of it possesses all the necessities for determining the presence of a continuous magnetic or electric influence, just exactly as well as an alternating or oscillating magnetic or electric influence. Taken with the delicate magnetic needle of the compass, which will respond to the feeblest of feeble magnetic flux, and which will serve as a pointer for direction, we have two very important devices, about which every one of us amateur radio inventors should think.

OUR CONTENTS

Of course you have noticed how we have taken out several jars and how our capacity has been correspondingly reduced. But, have you also done some noticing as to quality and variety. Notwithstanding the capacity reduction, we have worked the series parallel scheme so that our contents stand double the strain.

It has taken a lot of double distilled thinking to get this quality and variety into the limited number of pages we can print during these war days. At the risk of being considered chesty in the matter, we think the Old Man's "Rotten," the "Short and Long Wave Audion Sets" and the "Lightning Phenomena" articles are worth reading. The "Rotten" is in a class by itself, as all of our "Old Man's" stuff always is. The wouff-hong seems to have been dropped for the moment, but there is a plenty of the special variety of pep which we have found so delightful in the past. The "Short and Long Wave Audion Sets" is a liberal education on a very timely subject. It is written by Mr. A. L. Groves from actual experience. It's semi-technical and its constructional features make it especially suitable at this time for both the novice and the experienced amateur. These are the days when we want to improve our knowledge on the audion as a receiver and no matter how many times one reads over an article like this he can always come back to it and get something new.

Backing up the above with Mr. Ballantine's, "Lightning Phenomena," makes this number good and hearty even though there is not much thickness to it. Fortunately, we have coming to QST, everything the world of wireless affords, and we hope to be able to show during the coming months first class stuff on every page of QST. In order to make it a certainty, all we need is for you fellows to back us up by sending in subscriptions and your annual dues. Every dollar helps.

THE IDEAL STATION

This is the time to put into effect a scheme suggested by our member, Mr. James M. Sommer, better known in the air as 9JI. We have been turning it over in our minds for some months and it strikes us that right now is the time to present it to you fellows who are thirsting for something in the way of a radio problem. Here she is:—

The specifications in complete form for an ideal amateur radio station.

In the next number of QST, we shall publish Mr. Sommer's idea of a perfect amateur station. We will discuss its make-up and endeavor to show why it is the best. We probably will get about as far as the method of soldering the joints in the ground lead when some of you specialists will buck and have a better method. In the next issue of QST, we will give you your chance to show why Mr. Sommer's scheme is no good and yours the only proper way. Your's will probably live the long life of just one month when somebody else will come along and show you where you get off and make way for something still better.

We hope we can go all through a station in this manner and have a complete and thorough discussion of every detail by those who have actually done big things during the past season. We certainly have among us, the best amateur experience there is in the world, and if you fellows will only dip in and say what you think, we will all profit mightily. Every fellow is a past master on some particular detail. What we want is the advice of all the different past masters. This ought to start something.

THE FUTURE LOOKS SAFE

Provided we and our allied friends come out on top in this big scrap, it seems likely that the future of amateur wireless will be safe, as far as legal matters go. We have heard several rumors during the past month about some sinister legislation which was nosing around down in Washington and which was going to put the amateur out of business for all time. It was even stated that a bill was pending before Congress. We took occasion to run these rumors to earth, going so far as to have an investigation made in Washington as to the pending legislation on Radio matters. This investigation developed the fact that there was a bill pending, but when a copy of the bill was obtained, it also developed that absolutely nothing in it threatened the amateur. It is known as HOUSE BILL NO. 2573 and it has to do wholly with Commercial stations and specifically exempts amateur stations.

At the hearing in Washington early in the winter on the old bill, the Navy Department made it very plain that they did not intend to kill amateur wireless. We were present at the hearing and heard the whole thing with our own ears. We always have had the greatest confidence in the U. S. Navy Department and we think there is a square deal to be expected from them absolutely. When the war is over, it is our guess that we will be re-opened and that every encouragement will be held out to us to improve the art of radio communication, insofar as is possible and not cause interference with the protection of life at sea. Those of us who are near the coasts must always be subjected to greater limitations than those of us who are inland. All you fellows who have accumulated any new ideas in the last few months regarding better efficiency apparatus, may go on with the good work in the confidence that when the war clouds roll away, you will be able to build your apparatus and use it.

RELAY, CONVERSATION, TESTING

Every once in a while some anarchist radio bug gets up on a chair and waves a red flag and yells for his rights. It usually follows a night when some thoughtless relayer spent four hours or more monopolizing the air getting through relay traffic. Of course the chap who was QRMed cursed relay work and everybody connected with it and raised his voice in favor of consigning it to everlasting limbo. He hollers for the right to have a little friendly conversation. He hollers so loud he wakes up the fellow who wants to test all the time and the two of them holler in concert until you cannot hear yourself think.

We cannot deny that each of these fellows has something on his side. Scarcely one of us who has ever done any relaying but knows that he must have shut out a lot of those who wanted to indulge in something else besides relaying. It is something which we should think about when the happy days of re-opening come. We must somehow fix it so that we can relay, and converse and test. Each must allow the rights of the other and it seems that the only way to do this is on the time allotment method. Relaying should be done only between certain hours and it should have the right of way during these hours. Conversing should be given certain hours and it should have the right of way during these hours. Testing should have its allotment and be protected therein. When we are re-opened we certainly must take the matter up with the authorities and make it a question of law. Then somebody can control it and mete out punishment to those who will not observe the rules of the game.

Radio Communications by the Amateurs

The Publisher's of QST assume no responsibility for the statements made herein by correspondents.

QST --- QSL

Who Can Answer These Questions?

THE trouble with QST is that it's so good that I can't do anything else until I've digested its entire contents and it's getting so big that I can't spare the time to inhale it all at one sitting. So what am I to do, please? Just wanted to tell you I know Friend Bill of 9HS hits the gong when he "testifies" for QST. O. M., we simply **love** you; our magazine is great. Here suggestion: why don't you send a fistful of application blanks to all the ardent admirers who write in, and request that some of their boosting abilities be directed toward non-subscribers. I'm on myself, as I wrote you the other day to enter me in the subscription contest.

What you Hartford lads didn't know when QST started, I guess you have learned since. I've a couple of perplexers. While I may write at length, I'd be glad to have you give me a brief answer in your columns, or otherwise comment on 'em, if you can follow my wandering style.

Do you believe that the altitude above sea-level affects the range of a wireless transmitter? I've never been able to do the work of fellows more advantageously located, altho with a set as good. I have about come to the conclusion that it's the geography, in spite of theory that wireless waves follow the curvature of the earth. At 9FW we have a homemade transformer with secondary voltage about 18,000; oil-immersed plate condenser, .01 mfds; rotary giving frequency of 800; pancake OT; a well-insulated 5-wire aerial about 75 ft. high and 65 ft. long; a No. 4 lead-in; a ground much better than the average; and we show a radiation of 7.6 amps on a new Brandes' HWA located in the **aerial** lead, on a wave length of approximately 275 meters. The coupling used is rather close, but we seem to get pretty good quenching from our gap as our wave is reported to be decently sharp. But with our 7.6 amperes we are unable to do consistently good work. I do not know how to account for it. I hold a "first com" license, have a hot-wire-ammeter and a wave meter, and know how to tune a set. The station is owned jointly and consequently I can't tear it up and fix it altogther like I'd like to, and there are therefore some points that could be considerably bettered, but it is nevertheless a good station, works good some times, is heard well in some directions, puts 7.6 as I say, but is a great big disappointment. Mathews jerked me off of Trunk Line E because I couldn't work 9GY. 9GY comes in like seven hundred dollars one minute and thirty seconds later can't be read, but the trouble is he can't hear me any better. I work 9ABD only with greatest difficulty. I've worked 8NH only once this season. We are directive due south, but I do not believe in the theory of directional effects except in cases where the flat-top length is about four or more times longer than the height above-ground. It is a fact that southward, however, we can work great. Mobile, Dallas, Franklinton, Shreveport, Birmingham, Houston, etc., are pie, and I can hear those stations better than most

others. I have also worked ships several hundred miles off WHK. We have, of course, occasionally done excellent work in every direction, but not consistently satisfactory. It beats me; as I say I know the station can be improved, but isn't the fact that we put out 7 amps enough to insure everything being OK here? Cairo is on the extreme southern point of Illinois, at the confluence of the Ohio and Mississippi Rivers. It's altitude in respect to sea-level is very low, remarkable for an inland town I believe. I have come to the conclusion that it is this low geographical location which holds us down. Note that southward thru the Valley, thru territory equally as low as this, we are able to work excellently, even out into the Gulf. Now 9NN is just 28 miles from here, but sits on a high hill in a town on bluffs high above the Mississippi River, so that his aerial is perhaps 100 to 150 feet higher (above sea-level) than mine. Last season he had a neat little ½ K. W. set, efficiently made and well tuned, but putting out not near what I do. Was it his geographical location that made 9NN the most consistently heard 9th district station on the Atlantic Coast. Brother John Berchmans, of Christian Brothers College, has stated to me that at the old 5XC at Memphis, a town as low as Cairo, their average range was 500 miles on 5 K. W. as against 9XC, at St. Louis, quite high, with 1,000 miles average on 2½ K. W. Results at 9NN and 9FW are very similar. I started out the past radio season with an appointment on Trunk Line E, with with the expectation of working up my station to where it put out some juice on the aerial and making good. She puts out the juice but don't make good. You understand that I have done just lots of good work, but generally in directions of no benefit from a relay standpoint, and a sad disappointment when compared with similarly-equipped stations elsewhere. Hence I ask you, do radio waves follow the curvature of the ground, and do you or do you not consider the geography of this section responsible for 9FW's poor showing?

Do not amperes put on the aerial govern the range absolutely? I mean, does not any change that increases the reading also increase the range, barring limitations in broadness of wave and frequency of tone? I recollect reading an article, by whom I know not, to the effect that the indicated radiation was made up of the sum of individual radiations on the different humps of an impure wave. For instance, consider a certain double-humped wave, which would have 2 amps in the little wave and 4 amps in the larger, so that the HWA would indicate 6 amps. Now a receiving set can receive but one wave at a time; consequently if transmitter is returned to one wave, perhaps the radiation is 5 amps, being lower than before, but carrying further because there is more energy in the one hump than before. To what extent need I be concerned over this theory. In my case, with a reasonable coupling and reports of fairly sharp wave, can I not be positive that any change made which increases the indication will also increase the range?

Now there are many unfavorable radio conditions which affect the transmitter more than the receptor, but my receiving has been equally unsatisfactory. We have two audions, several loose-couplers, and a Paragon RA-6, the latter lately acquired. I find by reference to my log that I have heard 340 different stations this season (since middle of October). But none of these are truly long-distance. I have never heard a 6th, 7th, or 3d district station in my life, and I'll bet my neck my receiving set is first-class and that I know how to work it. I hear the rest of 'em by the hundreds. Last winter I copied 1ZL one night—the only 1st district I've ever heard. Since getting the Paragon I've heard 2AGJ once and 2PM once—a disappointment of course, as I'd hoped the Paragon would solve it, but apparently the difficulty lies not in our receiving apparatus. More geography? 9NN worked 2PM an hour the other night.

Here is a loud scream about fading. Faint stations fade regularly here. I have established that the street cars of the electric traction system are mainly responsible. I know that sounds queer and perhaps there is the usual amount of fading from the better-know (or better-recognized) causes, but I have proven to my own satisfaction that fading of signals and

increases as well, are caused by the cars. The Armory Building on which our aerial is erected, is on a main street, with double car tracks in front. Aerial is right angles to trolley. Cars pass at rate of about 20 per hour. There is a certain position of street cars on that street at which signals are received at considerably more than normal strength, and then as the cars progress up the street, signals fade, frequently entirely out, and gradually come back again. I know it is the cars because I hear them coming at a certain point up the street, then signals increase, then fade, then the car passes, and then the signals swing back in. Last winter I had an aerial on the other side of the street a half dozen blocks down, and noted similar effects, this time on galena, proving that it was not some sort of induced potential which put a finer adjustment of voltage on the audion grid, etc., if such a theory would be admissable. These circumstances are extremely embarrassing. I have often heard a strange station, called, got an answer, and heard the response dwindle to nothing, and then realize that the car was passing and that the only reason I had heard him at all was because of the favorable condition originally caused by the car and then nullified as the car progressed. Now, wattel? Is it re-radiated radio energy from the trolley wire, the wave length of which is governed and changed by the circuit from trolley thru car-motor to earth, producing alternately a favorable or unfavorable change from normal? Have you ever struck any thing like this before, and can you explain it or suggest a remedy?

Let me register a loud second to 8AEZ's plea for the adoption of Western Union preamble VSS, the long-drawn out ones so often used. I spend hours listening, for reasons above set forth, and countless times have heard stations become unreadable, either from fading or QRM, just as they get to the "To:" Exasperating, to say the least, and so easily bettered.

The Demon Static is with us again. Had our Equinoxal storm Sunday, with much lightning. Operating has been generally difficult since early February. This very forcibly makes me wish there existed some hope of perfecting a static eliminator. You no doubt realize, as is clearly apparent to me, than in the amateurs of the United States is the greatest body of experimenters in existence. Many have ability and ample means to go into a thing exhaustively. I feel that almost any proposition that the amateur body as a whole bucks down to, can be worked out. Let me ask if there is existant today, any theory, system, or experimental apparatus having any hope of minimizing static? I recollect reading, perhaps a couple years ago, of Professor Pupin's experiments along that line, but the details escape me. Seems it was something in the way of choke coils or other windings, tunable more or less to a definite spark frequency and hence eliminating the low growl of static. Considering the oft-made remark that progressive amateurs can solve anything they start after, can you not start something BIG by working up the dope, particularly on Prof. Pupin's work if it holds any chance of success, and giving it to us to go ahead with? Why, O. M., if by your so doing, some of us could hit something that would reduce the ill effects of QRN just 10%, think what glory! And relay work would be just 10% more reliable.

With reference your suggestion that energy be directed toward perfecting a truly efficient transmitter, in line with recent development of the regenerative receiver. Impact excitation transmitters seem to offer the best field, if we are to branch away from standard spark systems, as few amateurs can afford high-frequency generators and undamped wave systems using arcs seem too complicated. Impact excitation has advantages of low voltage, extremely sharp tuning, and ability to radiate any wave length within reason without putting the two circuits in resonance. Can you give us anything to work on in the way of constructural details of gap, etc.

Friend Editor, I imagine you should take some Sunday off to read this. This is what you get for suggesting that readers express themselves. This ought to be enough from Illinois for some time. Many tks OM for taking your time. You have my best wishes and 73's.

Sincerly,

K. B. WARNER,
402 Washington Ave., Cairo, Ill.

MORE DEMAND FOR MATHEMATICS

Mr Harmon B. Deal, Cape Girardeau, Mo., writes: "I can appreciate that the introduction of any extensive mathematical discussions into QST would 'scare' off quite a few of a class of amateurs, but for my part I should like to see more scientific and mathematical articles. Amateurs as a rule are unscientific. They are apt to think in a rut and when some seemingly unexplainable phenomena occurs they do not stop to analyze it. I have known where one very good amateur drew a general conclusion as to some phase of designing of a transmitter from ONE experiment upon his own set in absolute contradiction to a very common and well known formula that he did not know of.

It is my idea that far more than the value of the messages that are sent over the A. R. R. L., the technical and scientific training the amateur gets and also the ability to work together and to organize is the real worth of the organization.

I realize that it is difficult to make a scientific article popular, but I think that as a whole the "Game" would benefit more from more technical articles, besides my own selfishness would like to see them introduced.

Whatever else may happen to QST however, I hope that it will not lose that comraderie and spirit of fellowship that runs through all the articles and editorials. That's what makes the magazine. One feels that he knows the writer personally when he has finished reading some of them.

This spring will be my last as far as amateur operating is concerned, but I shall always be an amateur at heart and I shall be a constant supporter of amateur wireless.

You have my best wishes for your continued and ever increasing success."

*****

RADIO CLUB OF UTICA, N. Y.

The Radio Club of Utica, N. Y., has elected the following officers: President, George M. Benas; Vice President, Dean Wallace; and Secretary-Treasurer, Charles Schrader. All communications should be addressed to the Secretary at 450 Columbia St., Utica, N. Y.

The membership of the club at the present time is twenty-five.

ON DEPUTY INSPECTORS.

Mr. K. R. Caldwell, 9NW, of Decatur, Ills., writes: "I want to express my appreciation of the greatest radio magazine in the world. QST certainly beats any I have ever seen. I have received more useful and practical information from it than from any other source, altho I have been with you for only a few months—but long enough to be convinced.

The OLD MAN surely hits the nail on the head about QRM and other dope. Let us hear more from him. The articles by Dr. Radio are certainly fine, and the ones in regard to transmitters, make more than one of us stop, get out our pencils and begin to figure. I believe that plan for QRM control is a good one and hope that something of that sort will be carried out. It is mighty disheartening to have a bunch of messages to send or take, give the other fellow the K, and have some local "ham" with a nauseous spark and no oscillation transformer start calling and keep it up for ten to fifteen minutes straight without even listening-in. This thing occurs every night till about eleven P. M., and a fellow cannot stay up every morning till two or three A. M., and be OK the next day. Of course the most of these fellows who cause this unnecessary QRM are ignorant of the fact, but I think that the idea of Deputy Inspectors with their reports would show them how much trouble they are causing.

Using a regenerative set made from data given in the December QST the following stations were copied on the night of February 16th from 11 P. M. to 1:30 A. M.:

2AGJ, 4CL, 5DU, 5YG, 8AEZ, 8AFW, 8AIR, 8AMG, 8AMT, 8JG, 8JQ, 8OT, 8NH, 8VP, 8YO, 8YL, 9AAB, 9ABD, 9AMI, 9AMP, 9BA, 9EP, 9RD, 9KD, 9QJ, 9VH, 9JW, 9QR, 9DK, 9WG, BCH, and quite a number of closer one. Also, 9XA, 9XN, 9XM, 9ZI, 9ZN,, All QSA.

Also the following during the past two weeks: 2PM, 4AT, 4BY, 4DM, 5AB, 5BB, 5BT, 5BV, 5ZC, 8AEH, 8AIT, 8AAK, 8ARH, 8AOI, 5DC, 5ZD, 8NH, 8QB, 8NN, 8JZ, 8VX, 8YI, 9AIH, 9AKP, 9ABM, 9AMY, 9AHO, 9AIH, 9AGE, 9ALM, 9AU, 9PJ, 9PF, 9HS, 9PI, 9PY, 9AIK, 9VP, 9LO, 9AIM, 9TR, 9NN, 9VG, 9DV, 9ZK, 9HQ, 9DM, 9RP, 9GJ, 9HU, 9JQ, 9RW, 9LR, this being a partial list.

Well OM, sorry to take up so much of your time, but must get this out of my system. Hurry up next QST pse. Waiting patiently. 73"

SOME GOOD SUGGESTIONS.

Mr. L. Spangenberg, 2ZM of Lakeview, N. J., writes: "Our friend, the March number of the QST, is with us again. Thanks to the editor, and wish to congratulate you for the unexcelled issue of the liveliest, up-to-the-minute wireless magazine on the press today. You are also to be congratulated on the efforts you have taken to have the QST reach us on time, so our anxiety does not get the better of us.

In regard to this relay game. In my experience the only hinderance is the QRM and QRN, mostly the QRM. Without these, everything would be O. K. The QRN at present we cannot control, but the QRM we should all work together and let the station that can handle the work successfully in each vicinity, clear their business. The time, at the most, would not exceed thirty minutes, and then the ether is free for others to do distance work.

Would sugges that the A. R. R. L. make it a rule with members in all districts that the time to carry on tests and chats, such as the telephone was invented for, be in the evening, of course, but must stop not later than 9:30 P. M. and from 9:30 on until morning be set aside for relay work and long distance conversations. These conversations, to most amateurs are more important to them than relay work, and perhaps so, but the relay work should be permitted to go through. Why not let these conversations consist of relay messages, then the long distance test to be carried on when the relay work has all been cleared up. In most cases, the writer has noticed that when a station raises a distant station, this station generally comes back with a message; then, to my way of thinking, the long distance becomes relay work and should be governed accordingly.

Another suggestion to relay workers is never to send a message out of its course. The writer has heard messages starting from Philadelphia, going to Pittsburgh via the N. Y. C. stations. This method adds unnecessary work for stations in and around New York City and vicinity, which already have a large amount of business to handle.

In my location, in the second district, which is near New York City, I do not believe that any other district has so much QRM as here and taking this as a whole, the business gets through. The results are the cooperation of all stations around here and in the near future, I believe that after 10:00 P. M. our relay branch in and around New York City will handle the work very satisfactorily.

In my opinion, by no means discontinue the publishing of stations heard by other relay stations, as I, for one, am anxious to know who has heard my station. That is the only way we know that our signals are heard by other stations, as they are either too busy, or think it not necessary to drop us a card, telling us of our signals. Please press this on the minds of the QST readers to do their best to let each other know of hearing their signals—this would be one way for us all to get acquainted. At the present time, I have twelve cards ready for mailing, telling others of their signals.

The system of Mr. H. J. Murphy refers to keeping records of the stations heard. This is a very good way, as the writer has found a similar record of great help.

As for giving all the stations heard, say over 200 miles away, it would take the best part of a page and as space is limited and as I have made a practice of informing all stations by mail, I do not think it will be necessary for me to give the complete list. Would say that the stations heard are located in the 1st, 3rd, 4th, 5th, 8th and 9th districts, and have tried to notify each by a card. The come-back has been very small, due, I suppose, to the fact that the ones interested are too busy to answer.

In regard to my ability to handle the relay work at the key, will say that there are other relay stations in the second district that either by their location or experience, mostly experience, can handle long distance better than I (although I can boast of eleven years in the wireless game, so our friend Mr. I. Vermilya has not got so much on RS now 2ZM). Late nights and early A. M's. after all others have said GN or GM, you will find me 2ZM still trying to get a couple of long distance messages through for luck. My work is to gather up the local messages and start them on the right course.

Please inform the members of the A. R. R. L., through the QST that my call (2IM) has been changed to 2ZM.

With best wishes for the continued success of the QST, I remain."

*****

HAS THE TRUE A. R. R. L. BROTHERLY SPIRIT.

Gilbert E. Maul of Chatham, N. J., writes the following interesting letter: "Just a line or two in regard to QST. I note on Page 28 of your March issue (some issue, believe me!) that you want the opinions of your readers on the "calls heard" proposition. As for me, I think that the "100 mile or over" plan will be just great! I think that the calls under that radius are not absolutely necessary and as the space in QST is limited, the unnecessary ones have to be omitted.

I am especially interested in your magazine from the point of view that when you see a fellow's name in it, you feel "right off" that he is your friend. And talk about those articles by "Irv Vermilya" or V. N., Well! he has the experience of every "bug" in a nutshell!

About the QRM question: I think that a little diplomacy will be more effective than antagonism. If we only make a trip to the "little boy with the spark coil around the corner" and tell him how to tune his set and present the proposition about working from 9 P. M. to 7 A. M., I think that he will have some respect for us and will take the "spite book off his key" when we want to do some L D working.

How many "bugs" have read the radio laws and acts? Do you know that it is unlawful to repeat a call more than three times and it must not be transmitted more than three times at intervals of two minutes and then not resumed for fifteen minutes? If this rule could only be followed, it would save an awful waste of time in handling L D work.

I myself have an awful lot of sympathy for the fellow with the spark coil and other cheap goods. He should be respected and not looked down upon because he hasn't the "mazuma" with which to get better apparatus.

I think that a separate department for the "calls heard" would be a good idea. They might be listed in the following form: "1ZM heard on March 10th: 1ZL, 1IZ, 2ARF, etc."

Who will kick about the price of our worthy magazine being raised to fifteen cents? Isn't it worth it? Can any other magazine in the country begin to compare with it? NO! then say we, IT'S WORTH IT!

Have you noticed the designs on the covers? Three cheers to old H. R. Hick! He's got the right idea!

Well, so long, I guess I have no more QRU for you now, but a big load is off my mind. If you are not QRW, would be glad to hear from U. QSA, QRX, I will have to QRT now."

*****

GET ACQUAINTED

Mr. W. J. Howell, 135 Edgecombe Ave., New York, writes: "Just finished the February issue, very good but the parts written by Members and Editorially regarding the QRM as practised by some of the savage guys that don't care a darn when told nicely to stand by, seems to me a subject that ought not to cause trouble if a systematic remedy could be applied.

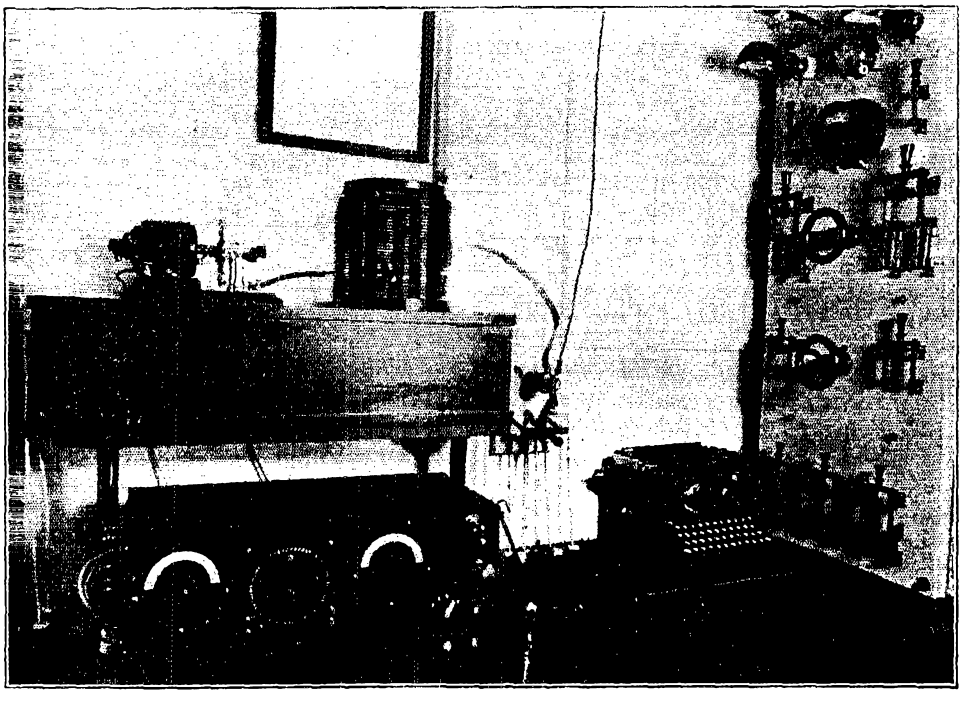
I am of the opinion that the majority of Amateurs are not at heart just the fellows they seem to be over the wire and that if Members of the Relay League would find the time, look up the QRMers and get acquainted with them and by gentle persuasion let them see that they are only hurting themselves by being stubborn and not giving the other fellow a chance, that much will be done toward keeping peace in the family.

I realize that in the widely spearated districts that seeing and talking to the QRMmy is an impossible thing in most cases but there still remains the possibility of writing and let the other chap know you and your interests. Talking things over is the best little trouble and bad feeling killer known and I have yet to find a fellow bug who will close down for a time if his friend asked him to.

Trusting that my idea may help a little, I remain."

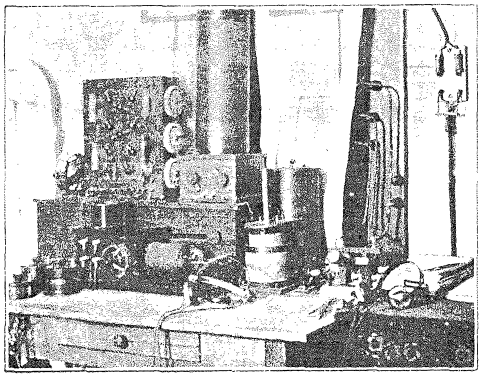
PICTORIAL SECTION

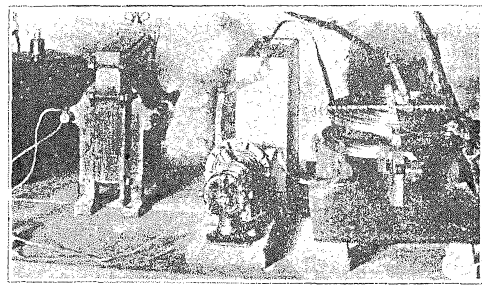
Station 8ADE



This very businesslike outfit belongs to Conway L. Todd of Rochester, N. Y. The photo of this extremely neat station needs no explanation.

8OT, Lansing, Michigan



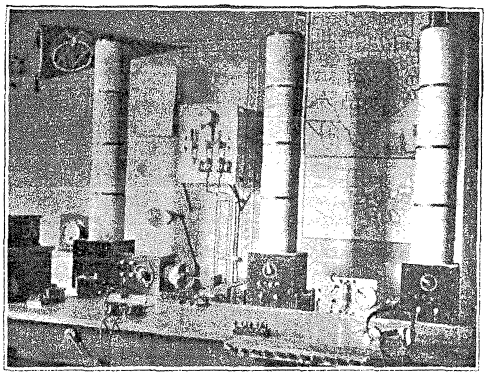


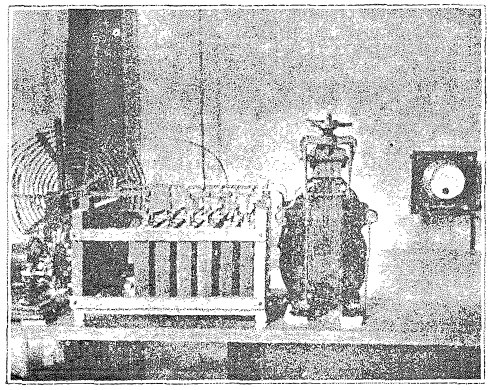
The station shown in the photographs herewith is owned and operated by R. D. Wyckoff—9FJ, and M. N. Pancost—8OT.

Their aerial is 70 feet long but only 40 feet high. They are, however able to work over 1,000 miles and have been heard 1,100 miles, using an input of 1 KW.

The receiving set is universal. They report Tuckerton loud enough to be heard many feet from the phones.

A Southern Station





We print the accompanying illustrations knowing that all will be interested in seeing the widely known station of 5ZC, Frank M. Corlett, Dallas Texas. The photo of the sending outfit is self-explanatory. It has been heard in Fargo, N. Dak., Buffalo, N. Y., Jacksonville, Fla., Puebla Mexico, Phoenix, Ariz., and Denver, Col.

The interesting long wave arrangement has brought in KPH, KET, KIE, NPL, NBA, NAW, NAR, NAA, NAJ, WGG, WSL, OUI, and as Mr. Corlett himself says, "just about everything that makes a noise between these."

FOR SALE & EXCHANGE

FOR SALE OR EXCHANGE: One auto spark coil with vibrator, fine for gasoline engine, $3.00; 110 v. A. C. motor, 40 to 70 cycles, $3.00; Erector motor, 3v., $.75; Battery volt meter (new) $1.00; battery volt and am. meter (new) $1.25; wireless books, 15c. each; magneto generator, 10,000 ohm, three magnet, $3.00; Telephone transmitter, $1.00; 1,000 ohm Ringer coils and bells, $2.50; two 75 ohm relays, brass, rubber, covered magnets, $3.00 each; (new) 75 ohm telephone receivers and cord, $.75; Banjo-mandolin, nickel plated, fine condition, $4.00; 21 ribbed madoline, made of black walnut, $12.00 value, $7.00. A. Wilhagen, 444 40th St., Brooklyn, N. Y.

FOR SALE: One $12. Mesco audion intensifying coil, $8.00; one new Blitzen, $7.50 wave meter, $5.00; one Electron relay bulb (new) on panel, $7.50. Jeter Pinkston, Valdosta, Ga.

FOR SALE OR EXCHANGE: Cabinet receiving set consisting of: Murdock, Blitzen and Duck instruments in A1 condition. Reason for selling, going to University. Price $25., or exchange for ½ Kw. sending set. Send stamp for photo. All letters answered. Write Howard Forlner, Windsor, Ill.

FOR SALE: Two Monotone quenched gaps, $1.50 each; one Murdock variable condenser No. 369, $1.50; 100 3¼ x5½ photo plates, 10c., doz.; 200 5x7 used photo plates, 15c. doz.; Westinghouse voltage transformer steps 2400 v. down to 110 or 55v. 65 watts, 60 cycles, can be used to step up $3.00; 15 rolls No. 17 steel wire bare 25 ft. each, 5c.; E. I. Co., 1,000 ohm receiver with head band leather cover, $1.00; draftsman folding table 2x2 ft. adjustable to different heights, 45.00; two books I. C. S. course on show card and sign painting complete, $7.00; one-half Kw. closed core transformer about 50 lbs., home-made, $5.00; one-half Kw. condenser, forty-eight 8x10 plates in four sections with rack $4.00; rotary gap used on batteries or with resistance on A. C. $2.00. S. Webster Piper, 188 E. Antietam St., Hagerstown, Md.

FOR SALE: Two-hundred cycle generator, 2 Kw. capacity, gives A. C. and D. C. current rheostat switches and protective rods. 1 ½ Kw., tarnsformer 2,000 volts, oscillation transformer, condenser, etc. Just the outfit for the fellow who has no power line near. All in fine shape and running order. This is a snap for $75.00 Photo of set appeared in November QST. R. A. Miller, R. F. D. Box No. 47, Ione, Cal.

FOR SALE AND EXCHANGE: Complete 9PZ. I will sell my complete station to the first comer at a very reasonable price or will sell sending or receiving sets separate. ½ Kw. sending set; range of receiving set 1800 miles. This set took part in the famous Washington Birthday relay last year. Price complete, including 50 ft. No. 4 braided rubber covered cable, ground connection, switches, etc., $60.00. Thos. Tallentine, 182 Fairfield Ave., Bellevue, Ky.

FOR SALE: Round Ultra audion, two filament (Hudson) X bulb. Cost $10.00 with renewal. Sell for $7.00, no renewal. Excellent condition, used less than an hour. City offers preferred. Ernest Cyriax, 219 East 71st St., New York, N. Y.

FOR SALE OR EXCHANGE: Want stranded aerial wire. Hyman Domash, 222 Cherry St., New York, N. Y.

FOR SALE: One Mignon 9,000 meter R. L. C. 5 cabinet, $37.50; one R. B. D. S. Mignon detector, $30.00; one R. W. 2 undamped wave receiving cabinet, $37.50; one R. B. D. Mignon detector, five hours in electrical show. Any one who takes two of these instruments, I will pay transportation charges. I also have the following articles, 250 ft. bronze aerial wire, $2.50; one 100 ampere 250 v. lightning switch, $1.50; four Electrose insulators, $.60; one six volt motor suitable for running rotary gap, described in February issue of QST, $3.00. Write for list of other electrical and wireless goods. Roy Ward, Bardstown Junction, Ky.

EXCHANGE One 20 ohm telegraph sounder, a complete telephone, one E. I. Co., 1,000 ohm receiver, and a small telephone operation receiver, very sensitive; also an auto spark coil for variables or audion bulb. H. Presby, 7430 Second Ave., East Lake, Ala.

FOR SALE: A one step audion amplifier, one filament burned out, price $30.; this outfit contains a good set of high voltage, a Blitzen amplifying transformer and a 6 v. 20 A. H. storage battery. It is mounted on a bakelite front with enclosed rheostat, size 9 inches by 7 inches by 10 inches deep. Robert Hall, 23 Merriam Place, St. Paul, Minn.

FOR SALE OR EXCHANGE: 53 copies of Popular Mechanics, 3,000 ohm Mesco headset, one single 75 ohm headset, 2 Xmas tree outfits (no lamps) electric engines, etc. Send for list; all letters answered. H. B. Kahane, 136 E. 127th St., New York, N. Y.

FOR SALE: One Multi-Audi-Fone and one pocket receiving set. R. B. Tenney, 1215 Franklin St., Waco, Texas.

FOR SALE: One Chaffee arc gap, aluminum type, $5.00. L. Andonegui, 27 Linnaean Street, Cambridge, Mass.

FOR SALE: Home-made amateur coupler, $1.25, also an $18. Chamber undamped coupler and a $15. Murdock coupler. State your price, cash only. All perfect condition. L. D. Ziegler, 3rd, 1608 N. 16th Street, Philadelphia, Pa.

FOR SALE: One piece XX grade Bakelite-Dilecto, black, 40 in.x12 in.x⅜ in., smooth edges. Material has very high insulating properties and is waterproof. Would make an excellent panel. $16.50 takes it. Charles Henry, Loras Hall, Dubuque, Ia.

FOR SALE: One Kw. Thordarson $16.; one Arnold Navy coupler, $12.; one rotary gap, 8 in. disc, $16.; one key, $1.50; one pair Holtzer-Cabot 3,000 ohm phones, $4.00; one mineral detector, $.50; 800 ft. No. 14 antenna wire, $6.; 17 electrose insulators, $3.; 6 D. P. D. T. switches, $.25 each; 4 D. P. S. T. and 6 S. P. S. T. switches, $.10 each. R. C. Bender, 2642 Norwood St., N. S., Pittsburgh, Pa.

FOR SALE: Wireless receiving outfit. Write for cut, description and price. Miles Bruning, Hamilton, Ohio.

FOR SALE: One short wave regenerative receiving set described in the December number of QST. The wood-work is walnut finished in dark mahogany. All parts are nickel plated and highly polished. Price complete, with high voltage batteries $34.00. Also many other receiving instruments for sale. Monroe Bovard, 522 Stewart Ave., Grove City, Pa.

WANTED: An August issue of QST for the year of 1916. Willing to pay double the price for same. J. Ward Weaver, Pleasantville, N. J.

FOR SALE: A complete transmitting set, consisting of a $4.00 Step Down transformer, a $1.50 ½ in. spark coil, a $.50 E. I. gap, a $.45 E. I. wireless key, a $.30 glass plate condenser and a new $1.50 pancake helix. The set cost $8.25. Will sell for $6.50. Will send postpaid upon the receipt of a money order for $6.50. Ralph H. Hoffman, 905 Clay St., La Porte, Ind.

NOW'S THE TIME TO STUDY WIRELESS

QST READERS

While your station is closed and you cannot operate, you should study the theory. You can use this information to good advantage when you are opened up.

QST has made arrangements to run a book department. We shall be ready to fill orders by return mail.

Look these over for a starter:

Edelman's Experimental Wireless Stations	$1.50
Edelman's Experiments	1.50
Zenneck's Wireless Telegraphy	4.00
Text Book on Wireless Telegraphy	2.25
An Elementary Manual of Radio-telegraphy and Radio-telephony	2.00

and others

THE QST PUBLISHING COMPANY, INC.
(Book Department)
HARTFORD, CONNECTICUT