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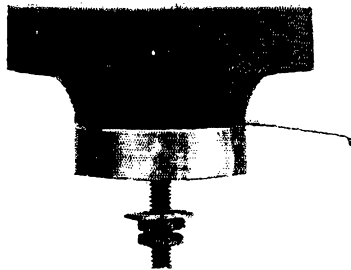
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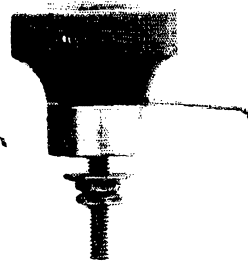
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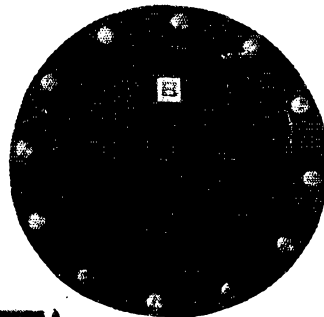
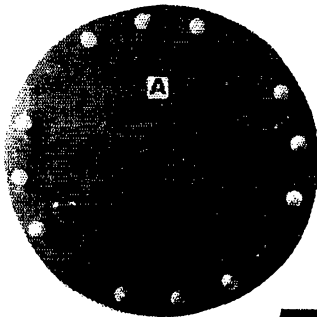
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QST

Volume II

APRIL, 1917

No. V

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QST 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. Copyright, 1917, by the QST Publishing Co., Inc. Title registered at the United States Patent Office.

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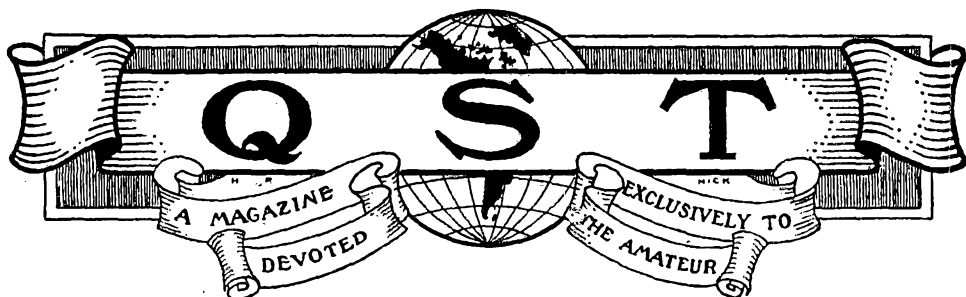


ANNOUNCEMENT

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Losses and Capacity of Multilayer Coils *

By L. A. Hazeltine

Assistant Professor of Electrical Engineering
Stevens Institute of Technology

Presented before The Radio Club of America, February 16, 1917

A large amount of material is being published on multi-layer coils. This may seem to be a very technical subject, but it is of the highest practical importance. The formulas given can be used in actual practice and deserve your serious consideration.—Editor.

1. Introduction. It is a matter of regret to the author that the experimental results given below are of a rather fragmentary sort and so are more suitable as part of a general discussion than as an independent paper. This matter was, in fact, originally intended to be a discussion of Prof. Morecroft's paper at the last meeting of the Club, and so includes many references thereto.

Prof. Morecroft seems to be of the opinion that multilayer coils and the method of computing their capacity are wholly new to the radio art. Both are however quite familiar to members of this Club. About a year ago Mr. Eastham described here coils made up of pancake sections, each section having one turn per layer, the resulting coil being equivalent to an ordinary multilayer coil except that the layers are in parallel planes instead of coaxial cylinders. Mr. Eastham gave experimental results showing how such a coil should be proportioned to minimize its effective resistance and capacity. In discussing this paper the writer described his method (which is essentially that now used

by Prof. Morecroft) for computing the capacity of a multilayer coil, and compared the measured and computed capacities of certain coils which he had constructed. In a written discussion of this paper the writer gave a formula for the distributed capacity of multilayer coils, as well as other formulas required in their design. As this discussion has not yet been published by the Club, some of these formulas are repeated below. The writer returned to the subject of multilayer coils in discussing Mr. Godley's paper at the following meeting of the Club, and again explained that the successive layers act like condensers in series. He also explained that in a single-layer coil the main part of the capacity is between the end surfaces as a whole, as represented in Prof. Morecroft's Fig. 4. This discussion was published in "QST", for September, 1916.

That multilayer coils are not new in radio work is shown by the fact that they are manufactured by several commercial concerns, one make having been described by Mr. Stevens before this Club last fall. The novelty of Prof. Morecroft's coils lies

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simply in their use of air between layers. This certainly improves the coil, but it is doubtful whether the improvement would warrant the greater difficulty of construction except in special cases.

Prof. Morecroft states that the winding cross-section should be approximately square and that a space of a millimeter or more should be left between layers. Neither of these conclusions is correct, for the resistance of the coil (for a given inductance, capacity and volume of copper) may gen-

eral proportions should not be materially different for an air dielectric, however; and other losses may readily be made small in long-wave coils.

The subject of this paper will be taken up in the following sections: first, the theory of the added losses and capacity of multilayer coils; second, their experimental determination; third, the data from the experiments; and finally, the limitations of multilayer coils due to these effects. The special notation used is tabulated below.

Symbol	Name	Unit
a	Mean radius of coil	inch
b	Axial length of coil	"
c	Winding depth of coil	"
C	Total resonant capacity	millimicrofarad
C'	Inherent effective capacity of coil	(thousandth of a microfarad)
C''	Capacity of coil due to dielectric flux between layers only	
d	Bare diameter of wire or strand	mil
E	Voltage	volt
ε	Permittivity relative to air (or "dielectric constant")	numeric
I	Self-inductance	millihenry
λ	Wave length	meter
λ	Number of turns of wire	numeric
N	Number of strands in wire	numeric
N'	Current	milliampere
P	Power loss	milliwatt
p	Power factor	numeric
r	Resistance in general	kiloohm (thousand ohms)
r _{dc}	Resistance as measured by direct current	kiloohm (thousand ohms)
r _{di}	Added effective resistance due to dielectric loss	kiloohm (thousand ohms)
r _{ec}	Added effective resistance due to eddy-current loss	kiloohm (thousand ohms)
r _{ex}	"External Effective Resistance" of coil as measured by connecting it in series with measuring circuit	kiloohm (thousand ohms)
x	Insulation thickness between layers Pitch of layer	numeric

erally be reduced by using a winding section deeper (radially) than wide (axially) and by making the space between layers less than the bare diameter of the wire. The ideal proportions will be found in the discussion of Mr. Eastham's paper already referred to; in deriving them only the effects of direct-current resistance and capacity were considered (which are also the only factors which Prof. Morecroft takes into consideration) and a solid dielectric between layers was assumed. The

It will be noted that common multiples or submultiples of the fundamental electrical units are given above. These are employed so as to give values that do not require a long row of zeros or exponential notation. They afford a consistent set among themselves and require times to be expressed in microseconds, as is often done. In some cases formulas will also be given in the fundamental units for convenience of reference, in which cases the unit will be stated. It

may be noted that all equations not containing numerical coefficients apply either with the fundamental system of units or with that given above.

2. **Capacity and Dielectric Loss.** The formula for the capacity of multilayer coil, as referred to previously, is

$$C' = \frac{a}{420} \frac{b\epsilon}{cx} \left(\frac{ab\epsilon}{420 cx} + 0.8 \right) \text{ Millimicrofarads.}$$

The first term $\left(\frac{ab\epsilon}{420 cx} \right)$ represents the capacity C'' due to the dielectric flux between layers, and includes corrections for the variations in the voltage across different parts of the layer

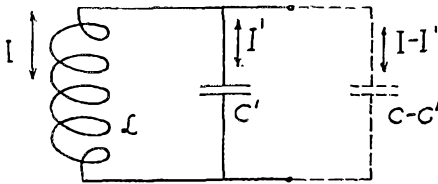


FIG. 1.

$$\left(\text{factor} \frac{4}{3} \right)$$

and across different layers (factor somewhat variable, but approximately 1.3). The second term

$$\frac{0.8a}{420}$$

represents the capacity due to the dielectric flux passing from one part of the coil surface to another, and includes a slight estimated addition due to the proximity of neighboring bodies. This formula is, of course, rather crude, but is probably correct within about 10% for coils of usual proportions. For paraffin paper ϵ may be taken equal to 2.5 and for untreated paper about 1.25; for air, of course, it is unity. It should be noted that in computing x the double thickness of the silk or cotton insulation on the wire should be added to the thickness of the paper (or air.)

The effects of the losses in a coil are most conveniently expressed in terms of the "effective resistance," which is defined as

$$r = \frac{P}{I^2}, \tag{2}$$

where P is the loss and I the current. When the coil has appreciable inherent capacity, this is open to some ambiguity, according to whether we take I as the current flowing (conductively) through the winding or as the current in the external circuit. If we take I as the current through the winding, we find that, in a coil having no losses other than that due to the direct-current resistance, the effective resistance is constant for all frequencies and is equal to the direct-current resistance; this method gives what is here called the "internal effective resistance" r , and is understood to be meant unless otherwise specified. On the other hand, if we take I as the external current, we find that the effective resistance has a sharp maximum value at the natural frequency of the coil; this gives what is here called the "external effective resistance" r_{ex} . The relation between r and r_{ex} is derived below.

In Fig. 1 the current flows through the winding and divides between the inherent capacity C' and the external capacity $(C-C')$ in proportion to the respective capacities; so

$$\frac{I'}{I} = \frac{C'}{C} \tag{3}$$

The loss is then expressed in either of the forms,

$$P = I^2 r = (I - I')^2 r_{ex} ; \tag{4}$$

so

$$r = r_{ex} \left(\frac{I - I'}{I} \right)^2 = r_{ex} \left(1 - \frac{C'}{C} \right)^2 \tag{5}$$

The added effective resistance due to dielectric loss may be expressed in terms of the power factor of the dielectric, which is defined as the ratio of the power loss to the product of the voltage and current accompanying it. In Fig. 1 let E be the voltage across the coil and p the power factor of its inherent capacity C' and let the other symbols have the meanings indicated. Then the dielectric loss is

$$P = pEI' = pEI \frac{C'}{C} \tag{6}$$

The increase in effective resistance due to this loss is

$$r_{di} = \frac{P}{I^2} = p \frac{E}{I} \frac{C'}{C} \quad (7)$$

As is well known the quotient of the voltage by the current of an oscillating current circuit, or its natural impedance, is,

$$\frac{E}{I} = \sqrt{\frac{\mathcal{L}}{C}}$$

It should be noted that ordinarily the only part of C' which is accompanied by dielectric loss is the internal part C'' . So if p is the power factor of the dielectric between layers, we have, substituting above,

$$r_{di} = p \frac{C''}{C} \sqrt{\frac{\mathcal{L}}{C}} \quad (9)$$

It is convenient to express C in terms of the wave length λ according to the equation

$$\lambda = 1885 \sqrt{C\mathcal{L}} \quad (10)$$

when C is in millimicrofarads and \mathcal{L} in millihenries.

Substituting above,

$$r_{di} = 1885^3 \times \frac{p C'' \mathcal{L}^2}{\lambda^3} \text{ kilohms; } (11)$$

or

$$r_{di} = 1000 \times 1885^3 \frac{p C'' \mathcal{L}^2}{\lambda^3} \text{ ohms. } (12)$$

If the dielectric loss is due to hysteresis, the energy loss per cycle for a given voltage will be constant; and if this energy loss is proportional to the maximum stored dielectric energy, the power factor p will be constant for all frequencies and all voltages. Many experiments indicate this to be approximately true for solid dielectrics of low factor, the values ranging from about 0.02 for paraffin paper to 0.004 for dry paper* and even down to 0.0003 for mica.**

3. **Eddy-Current Loss**—An alternating current flowing through a coil produces an alternating magnetic flux in the winding space, which induces eddy currents in the conductor and thus causes a loss in power. Fig. 2 represents the cross-section of a

single wire or strand in a uniform alternating magnetic field, the dots and crosses indicating the distribution of the eddy current. This eddy current will be in

INCREASING FLUX

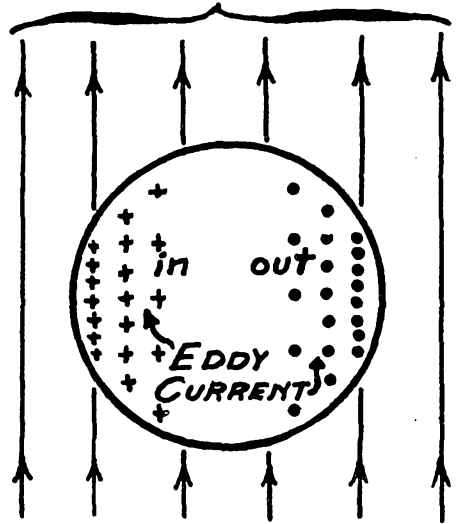


FIG. 2.

quadrature with the work current and so its loss is directly additive to the resistance loss of the work current. Only when the frequency is very high or the conductor section large will the flux density produced by the eddy current be appreciable in comparison with the flux density which induces it. This condition leads to "skin effect," but will never obtain in the wire of properly designed multilayer coils, as the eddy-current loss would then be prohibitive. Such skin-effect may occur, however, in metal screws or rods sometimes placed near the coil; the loss therein would then be less than would be computed according to the ideas described below and would not increase so rapidly with the frequency.

The average magnetic flux density in the winding section of a multilayer coil of a solid conductor carrying a work current I will be roughly proportional to

$$\frac{NI}{b+c}$$

since the average length of the magnetic

*Wagner, Electrotechnische Zeitschrift, April 8, 1915.

**Bulletin of the Bureau of Standards, Vol. 7., No. 4.

path is roughly proportional to the perimeter $2(b+c)$ of the winding section. The average density of the eddy current will be directly proportional to this flux density, to the diameter d , of the conductor and to the frequency (or inversely to the wave length λ); or

$$\text{Avg. eddy current density is proportional to } \frac{NI d}{b+c \lambda} \quad (13)$$

The total eddy-current loss is proportional to the square of this current density multiplied by the volume of conductor; or

Eddy-current loss is proportional to

$$\left[\frac{NI}{b+c} \frac{d_1}{\lambda} \right]^2 2\pi a N \frac{\pi}{4} d_1^2 \quad (14)$$

The resistance loss due to the work current I is proportional to

$$I^2 \frac{2\pi a N}{\frac{\pi}{4} d_1^2} \quad (15)$$

Hence the ratio of these losses, or the ratio of equivalent resistance, is

$$\frac{\left[\frac{N}{b+c} \frac{d_1}{\lambda} \right]^2 a N d_1^2}{\frac{a N}{d_1^2}} = \left[\frac{N d_1^3}{\lambda (b+c)} \right]^2 \quad (16)$$

In the discussion of Mr. Eastham's paper the writer gave the following approximate formula for the ratio of effective resistance to the direct-current resistance of a multi-layer coil

$$\frac{r}{r_{dc}} = 1 + \left[\frac{0.007 N d_1^3}{\lambda (b+c)} \right]^2 \quad (17)$$

where the second term represents the

relative increase in resistance due to eddy currents, as described above. This formula was based on the assumption that the curvature of the coil could be neglected—i. e., that the radius a was infinite. The effect of curvature is in general to increase the loss; and some experimental results referred to later indicate that the co-efficient 0.007 should be increased to about 0.009 for coils of ordinary proportions. The factor $(b+c)$ is also a rather crude simplification of a very complicated series worked out by the writer (but not published) for the eddy-current loss in coils of rectangular winding section and negligible curvature. The other factors enter this expression in a theoretically exact manner, provided the wire or strand is so small that skin effect is negligible.

If stranded wire is employed instead of solid conductor, the ratio of eddy-current resistance to direct-current resistance will evidently be the same as if all the strands were in series instead of in parallel. We must then use for d , the diameter of the strand, and instead of N we must use NN^1 , the total number of strands in the winding section. We may then express the increase in effective resistance due to eddy currents in multilayer coils as

$$r_{ec} = r_{dc} \left[\frac{0.009 NN^1 d^3}{\lambda (b+c)} \right] \quad (18)$$

approximately.

It may be noticed that the eddy-current resistance, varying as the sixth power of the diameter, will double if the next larger size of wire is employed, since the ratio of diameters of successive wire sizes in the American wire gauge is practically the sixth root of two. Prof. Morecroft mentioned, if my memory serves me correctly, that a coil of his had at 25,000 cycles per sec. (or 12,000 m. wave length) an effective resistance of about twice the direct-current resistance. Assuming that the increase is all due to eddy-current loss, this gives at 4,000 m. (about the lower limit of useful wave length for this coil effective resistance equal to ten times the direct-current resistance. If he had used either of the two next smaller sizes, he would have obtained a lower resistance for all wave lengths below 12,000 m.; and if he had used the third size smaller, and resistance at 4,000 m. would have been

less than half that of the actual coil, with less capacity, and with half the volume of copper. Of course, further improvement could be made by using stranded wire (litzendraht) and by changing the proportions.

not with \mathcal{L}_2 . As the natural wave length of \mathcal{L}_3 should be far below that used in the measurements, this connection is not suitable for short wave lengths. For this case the plate and grid coils are given a close and fixed coupling and constitute a

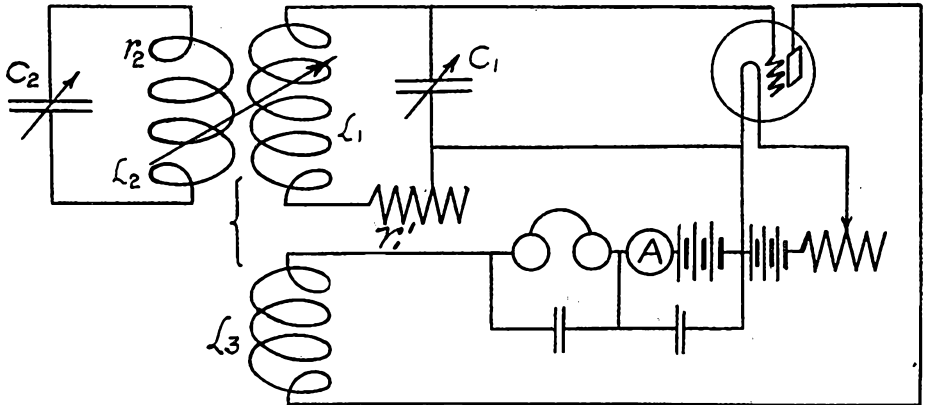


FIG. 3.

4. Method of Making Experiments.—The effective resistances and capacities of coils at various wave lengths were determined by the use of the oscillating audion connected as in Fig. 3 or 4. In these figures \mathcal{L}_2 represents the test coil forming a lo-

single self-inductance \mathcal{L}_1 , Fig. 4 across which is connected the primary condenser C_1 . The adjustable resistor r_1' in series with the primary circuit consisted of a loop of No. 40 Therlo wire whose resistance for various lengths was measured

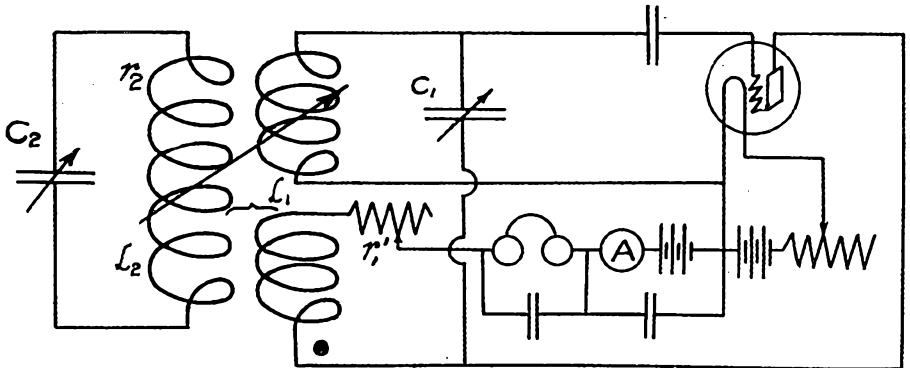


FIG. 4.

cal resonant circuit with the variable air condenser C_2 ; and \mathcal{L}_1 and C_1 form the primary resonant circuit, in which a continuous oscillation is maintained by the audion. In Fig. 3 the plate coil \mathcal{L}_3 is coupled—usually closely—with \mathcal{L}_1 , but

by direct current. The telephone receivers were shunted by an audio frequency condenser and the ammeter and battery by a very large capacity, thus providing a low-impedance path for the oscillating current. The stopping condenser in the grid

circuit had a capacity of about 0.5 millimicrofarad, but this is not material. The ammeter was a Weston d. c. instrument having a range of about 0.5 milliamperes and ordinarily indicated about 0.1 milliamperes when readings were taken. The audion used was of the ordinary round-bulb de Forest type both filaments being lighted

The procedure in taking readings was as follows: The self-inductance \mathcal{L}_1 and capacity C_1 (including the capacity of the coil, audion, etc.) were adjusted for a desired wave length; r_1 was short-circuited; and the audion was made to oscillate by adjusting its heating current. The test coil \mathcal{L}_2 was then coupled to \mathcal{L}_1 and the Condenser C_2 adjusted for resonance, as shown by a maximum reading on the ammeter. The final adjustment was made simply by moving the hand toward or away from the apparatus. As is well known, the coupled circuits have two natural frequencies of oscillation. If the coupling is close, the oscillation will change from one of these frequencies to the other when C_2 passes through the tuning point, causing a sudden drop in the ammeter reading and a click or momentary "beat" note in the receivers. As the coupling is loosened a critical coupling will be found below which only one frequency of oscillation will occur. The ammeter will then show a maximum current when the circuits are in tune, but no sudden drop. Care was taken to obtain this critical coupling and the maximum reading was noted. The test coil was then removed, open-circuited or short-circuited; and the resistance r_1 was adjusted until the ammeter reading was the same as before, so that r_1 would be the primary equivalent* of the total effective resistance r_2 of the local circuit. The

*In Fig. 3 the resistance r_1' is inserted external to the primary coil and so acts like an external resistance r_{ex} , Equation (5). When the capacity C_1' of this coil is appreciable, we must then find the true internal resistance by this equation. Fig. 4 largely obviates this correction, since the resistance r_1' is inserted in the middle of the primary coil.

latter was then computed by the relation

$$r_2 = \frac{r_1' \mathcal{L}_2}{\mathcal{L}_1} \quad (19)$$

It should be noted that r_2 includes the effective resistance of the condenser, which must therefore be made negligible. It was found that a certain well-known make of variable air condenser having a composition (probably Bakelite) case had a large effective resistance—in one case twice that of the test coil. Final tests were therefore made with improvised condensers consisting of two flat plates held apart by small pieces of mica.

It may be of interest to note that another make of variable condenser having a metal case showed no appreciable effective resistance, even when filled with oil.

By omitting the external condenser C_2 measurements could be made at the natural wave length of the test coil, giving its effective resistance as above and its capacity C_2' by the formula

$$C_2' = \frac{C_1 \mathcal{L}_1}{\mathcal{L}_2} \quad (20).$$

where C_1 includes the capacity of the primary coil, audion, etc. At other wave lengths the effective capacity C_2' of the coil may be found by subtracting the external capacity from the total capacity as given by (20).

5. Results of Experiments. It was the writer's original intention to present the results in the forms of curves; but the experiments are so far from being exhaustive and the results are capable of being expressed so simply (as far as the experiments have been carried) that the following summary will suffice:

(a) In multilayer coils wound with litzendraht and having paper between layers, the effective resistance is increased by dielectric losses and by eddy-current losses, either of which may be the larger according to the proportions of the coil and to the wave length. The coils tested by the writer included some in which the dielectric loss was negligible in comparison with the eddy-current loss, thus serving to separate them.

(b) The increase in effective resistance due to eddy currents is approximately

ly in accord with formula (18) for coils of ordinary proportions.

(c) The increase in effective resistance due to dielectric loss in paraffin paper (in the coils tested) corresponds to a power factor in the dielectric of approximately ($p = 0.02$), equation (12). In untreated paper the power factor is greater, due to moisture; the resultant increase in resistance at a given wave length is however less than for paraffin paper in dry weather on account of the lower capacity; but in damp weather the untreated paper gives the greater effective resistance.

6. Limitations of Multilayer Coils. We will consider in order the various features which limit, or have been thought to limit, the use of multilayer coils in radio work.

(a) **Capacity.** Since no losses are directly introduced by capacity, the only objections to its presence in a coil are: first, that it cannot be varied to change the wave length; and, second, that it causes the "external effective resistance" of the coil to increase when it is large compared with the external capacity. If formula (1) is applied to various coil proportions and sizes it will be found that the capacity can readily be made less than the minimum capacity of an ordinary variable condenser (viz., about 0.020 millimicrofarads), even with a solid dielectric thinner than the wire diameter; and that, if desired, the capacity can be reduced to the same order of magnitude as that of the audion itself and the necessary connections (say 0.005 millimicrofarads) without employing an uneconomical shape or special construction. It is therefore safe to say that capacity, though a considerable factor in coil design, does not of itself impose any limitation to the application of multilayer coils.

(b) **Dielectric Loss.** This is a more serious matter than the capacity which it accompanies, as the power factor of solid dielectric (0.02 for paraffin paper) is relatively high compared with that which should be attained in efficient radio circuits (0.001 to 0.005). However by us-

ing a short coil and thick dielectric, the capacity between layers may be reduced to a small fraction of the total capacity, even at the adjustment for the shortest wave length. The total dielectric power factor will then be of the same order of magnitude as that of a coil without dielectric losses; so the increase in effective resistance will not be prohibitive. It also seems probable that a better method of treating the paper, or the use of other materials between layers will considerably lower the dielectric power factor below the value 0.02. In cases where extremely low losses are desired a special construction may be the resort. Besides that described by Prof. Morecroft we have that described by Mr. Stevens, employing several pan-cake multilayer sections in series, or we may use an extremely short coil and, in the limit, a one-turn-per-layer coil or its equivalent, the single-layer coil.

(c) **Eddy-Current Losses.** These must always be considered in the design, and for an efficient coil of moderate inductance—require the use of "litzendraht," consisting of insulated strands. Litzendraht is commercially available in two sizes—ten strands of No. 38 and twenty strands of No. 38. Either of these may be used in long-wave coils without prohibitive loss; but—as shown by substituting reasonable values in equation (18)—give for short waves a coil whose turns are so few and far between that they may as well be arranged in a single layer. Here then we find the only real limitation to multilayer coils—that for short waves, say below 1,000 m., the eddy-current losses are excessive unless the strands of wire are much smaller than No. 38. As such wire is not, and can hardly be expected to be, a commercial article, we are driven to the single-layer type. In this type we incidently eliminate most of the dielectric loss also, although the capacity may be as large or larger than that of an equivalent multilayer coil, due to the larger radius. It seems safe to say that all efficient coils for radio use, single-layer or multilayer, should be wound with litzendraht to minimize the eddy-current loss.

A Discussion of this Paper by Professor Morecroft and Others will be Published in the Next Issue—Editor

One Too Many For Adam

By Ryer Knickerbocker Borden

Another article which will make QST famous is printed in this issue. Mr. Borden had an imagination when he wrote this article which is on par with the theory that static is a message in Chinese. The whole description is a wonder and every true amateur should read it so he may see himself as he would be if others saw him. An article of note; read it.—Editor.

THERE is nothing so irritating as suspense;—and suspense was in the atmosphere that surrounded an odd-looking group of persons standing on the bank of a river. Irritation was in the tones of their voices.

"Isn't he slow about coming?" said one.

"What do you suppose is keeping him so long?" asked another.

"That's he, in the distance," declared a high-pitched, distinctly feminine voice.

"Where? What? That? That is only a cloud," stated another, equally shrill, with an added air of authority.

"No, no; I don't mean that heavy gray. I mean——there, don't you see it?"

"Here, use my telescope. Let Science aid you," said a quiet, masculine voice.

"Oh, Galileo!" exclaimed Queen Elizabeth, "You make me weary with your old spy-glass. How can you expect to see anything but stars with that ridiculous thing?"

"Never mind, Mistress Elizabeth, my ridiculous spy-glass, as you call it, has made it possible for men of earth to see what was on the moon; so it ought to show us things nearer. What do you say, Benjamin?" turning to an elderly gentleman who had drawn near.

"I really do not think it wise to commit myself by saying, on the spur of the moment, just what I do think. But, an' it please thee, I will fly my kite. By so doing perhaps we can discover if there be an electric spark in the atmosphere, I understand our new recruit is interested in electricity, and it is possible that by flying my kite we can"——

"What good will that do," asked a new voice.

All turned to look at the stranger who had the temerity to interrupt an Authority when he was speaking. "Friend," said Benjamin, in a condescending manner, "I think we do not know thee."

"What of that? I am here. What are you watching for?"

"Our Ferryman hath gone to fetch another Illustrious One," replied Benjamin, "and he is overlong returning."

"We are wondering what can be keeping him," added Galileo.

"Oh, Fly your kite, Sir," to Benjamin, "may be there is something to be discovered yet."

Deliberately, so as not to appear too anxious, Benjamin proceeded to open out a bundle of sticks and silk which he carried carefully in his hand. He slipped a few braces into place, gave the now opened kite a little shake to see if it were all solid, and nodded his head gravely; then stepping back a little, and making a sweeping gesture prepared to launch it into the air, but stopped, and, putting his finger into his mouth, he held the moistened digit up for a moment, then sadly shook his head. Slowly, and with seeming disappointment, he drew a modest handkerchief from his pocket—it measured some three feet each way, when he spread it out—and wiped his finger.

"What 's the matter?" asked everybody, crowding around.

"No wind," replied Benjamin, succinctly, as he slowly replaced the vermilion article and prepared to close his kite.

"No wind? Oh, I can fix that," exclaimed a Dapper Youth, stepping up.

"How?" chorused the bystanders; and Benjamin, looking benignly over his octa-

gonal spectacles added, "Thee seems over young to know very much. The youths of the world have enough to do, learning of their elders and betters. Thee hadst best be conning thy manners, and wait till thee is spoken to."

"Gee! You needn't rub it in like that! And don't you put on so many frills, just because you made a silk kite and got hit with the lightning. What if you did visit the French court? That cuts no figure with me; I'm a travelling man, too, and I've as much right to talk as you. If you want a wind, just start the women talking fashions. Tell Elizabeth and Mary, over there, that their clothes are out of date. Let me make a few suggestions as to alterations (I was a designer, once, and sold corsets on the side). Believe me, you'll get enough air in a few minutes to sail Columbus' boats, let alone your kite. Come! Who's game?"

"Thy language is far from genteel, young sir; but I have learned to accept many things, since coming here, that I once would have scorned to try, and would have scoffed at. Try thy experiment in the interest of Science; but in the future—Bless my soul! Where has the young scamp gone?"

The Dapper Youth waited not to hear the finish of the admonition, but turned, and taking Elizabeth and Mary each by a friendly arm, led them away, and in an incredibly short time was surrounded by the entire feminine population, all talking at once in the most excited manner.

Benjamin looked after him, and was about to turn away when he felt a slight tug at the kite. Soon it began to move restlessly and in another instant it was floating high in the air.

"Well, well, he did know what he was talking about," began Benjamin, but was interrupted by an exclamation from the first stranger who had spoken.

"What's that? What's that?" he demanded in an excited tone. "What have they done to my Code? That Idiot is sending balderdash; pure balderdash. Oh! My Code, my Code!"

"What ails thee, Friend?" asked Benjamin in consternation.

"My Code! My Code! Listen! Put your ear to the key and listen!"

Gravely Benjamin put his ear to the string of the kite. "I hear nothing, Friend," he observed.

"Did you expect to? I said 'the key,' not the tail of the kite." There was withering sarcasm in the stranger's tone.

Again Benjamin bent to hear, and after a moment said, "I hear naught but a woodpecker."

"That's no woodpecker; that's my telegraph code. But some one has done something to it, and it doesn't make sense. "Then with a sudden accession of fury he demanded, "Who has dared to tamper with my Code?"

"That is easily explained," said another newcomer. "I changed some of the characters in the Morse code, and it is called the International Morse Code"——

"You? Who are you, I'd like to know? What do you call yourself?"

"Does a name matter?"

"It certainly does! I am the Morse whose Code you blandly state you have changed. Yonder is Franklin, with his Kite. The man with the spyglass, over there, is Galilio. What does a name matter? It matters a great deal, let me tell you!"

"Perhaps it does. However, I prefer to be known by my works."

"Since you know so much, read what that Idiot is sending, then," said Morse, and Franklin added, "Please do, for I begin to fear the breeze will soon die down. It does not last long when it blows as warm as this."

The modest man bent his ear to the large brass key that dangled from the tail of the kite, and presently quoted as he listened, "This is some old Chinese junk I am on, and the crew is one aged duffer. Will call you up when I land. Water smooth, not much current. Weather fair and warm. 73 A. R. R. L. That is all. He has signed off."

"What does 'Signed off' mean?" asked Galilio, squinting through his telescope.

"Where do you suppose the sound comes from?" asked Franklin, in the same breath.

"Yonder. See, there comes the wherry," said Galilio, pointing with his instrument, which he lowered as he spoke.

They looked. Coming slowly across the black, oily water was the Barque that had gone on so many similar journeys. The

Boatman, gaunt and skinny, with flowing white hair and beard, and the folds of his gray-white garments flapping idly about him, rowed languidly, with one oar.

Galileo turned to a stout individual sitting near by, holding a long pipe in his mouth, and said with the air of one renewing an argument, "I tell thee again, he hath surely learned to handle a skiff in my loved Venice."

"Nah, nah," replied the other, stolidly, taking his pipe from his mouth, "In Amsterdam ve row on der canals chust der same," and closing his little eyes, he resumed his pipe, as if the argument was finished as it had been finished many times before.

The Dapper Youth had now joined the party, and at this junction cried, "What is the matter with that boat? Did you ever see anything like it before?"

All gazed at the approaching craft in growing wonder. The wherry which had left the shore a model of repose and dignity, was returning adorned with a tall slender pole at either end, standing like soldiers on parade, while numerous lines passed from cross-pieces attached to each pole. These, in turn, converged at the middle, descending in a heavier line to the boat, where sat the most uncouth figure they had ever seen.

"Didst ever see so weird a creature before?" queried Elizabeth in a hushed voice.

All the feminine population crowded close. Even interest in dress flagging for the moment in the face of this new spectacle.

"I never should trust anything like that," said Marie Antoinette, with a shudder.

"What a strange head it has," added Joan of Arc. "Like a martyr."

"Do you suppose they use those things to see with?" asked Pocahontas.

"No one ever looked like that when I was a girl," said a placid old lady, coming up just then.

"Well, Mother, there have been some changes since your day," remarked Lucrezia Borgia, in a superior manner.

"Perhaps," replied the old lady, as she pushed up a stray gray curl, "I don't know what your father will say to this."

"Mother Eve, dear, you must let me

make you some boudoir caps," interrupted Charlotte Corday. "Your hair blows about so. I am sure Papa will like it—won't you, Daddy?" to a very old gentleman, who was hurrying by as fast as his feebleness would allow.

"Eh? Yes, yes, I suppose so, I suppose so," replied that ancient individual. "Bless me, what have we here? I thought my days for naming things were over. I must look into this. They are keeping me busy all the time, and I thought I had it all arranged so that I would not have anything more to do," and leaning heavily on his crooked stick as he spoke he made his way to the edge of the water, forcing the other men out of the way with a "Here, stand back, you children, let me get at this new problem."

All but one obeyed his bidding, but he came close, saying, "Better let me look after things, Father. I'll bring him up to you as soon as he lands, and I have examined him."

The old man's eyes blazed with wrath. "Noah!" he exclaimed in a voice that was harsh and cracked with rage. "How often have I told you that I know how to take care of myself? Do you think, because you kept dry in a heavy shower that I am afraid of a little wetting? Bah, sir, bah! Stand back!"

The boat, meantime, had come to a stop; and all crowded near to see what the passenger might look like. He was busy with a strange instrument. Presently he bent and then the ears of the watchers were accosted with a sound of whirring, followed by a noise that sent them all scurrying for safety. The Newcomer had put his hand on a small black knob and instantly there leaped into the air a sound never heard on those shores before.

"My soul and snuffbox!" exclaimed Franklin, excitedly, "He has the very lightning itself there! Think what I have done! I have opened the gates of Science, and now, thanks to me, men may not only use the lightning, but may put it in a box, to use as they need!"

"Don't flatter yourself so much," remarked Noah, in a patronizing way, "If it had not been for me, you wouldn't have happened to even know what lightning was. Why——"

"Hark!" interrupted Morse, "He is calling M-A-S-T, M-A-S-T. What's that for?"

"Pardon me," said the Modest Man, "He is calling Q-S-T. You are a little mixed, yet, on the International Code, Mr. Morse."

"Oh, I am, am I," snapped Morse, "Then tell us what he is saying."

"Just now he is listening for an answer," replied the other, as the strange sound stopped. "Now," as the noise began again, "He is calling Q-S-T. Ah, he probably got them, for he says, 'Tell all those that are interested that I am going to start a R-R-L out here. The place looks good to me, and there seem to be plenty of the boys ready for organization. I was afraid someone else might be ahead of me, but I guess I have it all my own way. You keep the earth, and I'll take this place. 73 A-R-R-L.' Now he has stopped."

"A most extraordinary message," remarked Morse, thoughtfully. His anger had disappeared, and he watched the old gentleman making his way to the edge of the water.

Father Adam stood gazing with interest, both hands resting on his stick. A slight wind which had sprung up, wafted his white hair and whiter beard in flappy little spurts.

"Hello, O M," said the Newcomer with the half-upward glance of one fully and intently occupied. "How's everything? Got your 'phones? Gee. This atmosphere is great!"

"Got my what?" asked Adam blankly.

"Your 'phones. What sort of a "Bug" are you to come around without 'phones? Lucky thing I have an extra pair, I always have 'em. Hey, you! "to the Boatman." Keep your old tub still, will you? Want to get the whole blame thing out of adjustment again? If you spoil my connection now, I'll knock your block off! It's hard enough to separate anyone from a good bulb, these days, without taking a lot of fool chances with a Dub like you.—Now, here you are, O M; put those over your harkers and see what you hear. What do you make of that? Some sound, eh?" And he held out two black discs invitingly to the shrinking old gentleman. Adam backed away a little more, and, waving his stick asked, "What do you call all

this?"

"Sh-sh-sh! Ah! There's 2-Z-P! Gee! This is great! Hurry up and get in on this, if you want to hear something Real!" and the new arrival became oblivious of everything but the instrument under his hands. Suddenly he exclaimed, "Holy smoke! There's 8-N-H! First time in months. Wonder if I can get her to answer?" and with the words he started his 'lightning' again, causing the spectators, who had drawn near, to scurry away once more.

"What's he saying?" demanded Morse, impatiently, of the Modest Man.

"He is calling 8-N-H. She says, 'It is great out here. Call me any time.' Now he's trying 2-Z-H. (Odd sort of calls they have!)—Evidently this fellow is slow. Ah, he has him, now. He says, 'I don't know just where I am, but I am the only one here. Going to start an A-R-R-L out here. Tell the boys to give me a call any time, there does not seem to be much else to do. No Q-R-N around here, and no Q-R-T.' Now he is trying to get one that he tried before: 1-Z-T. All he says this time is, 'How does my spark sound? Do I come in loud?' There is another one, 2-Z-E. He tells this one, 'Better join me out here, wherever it is. There seems to be some good material lying around loose.' Now he is calling Q-R-U and Q-S-P."

"See here," demanded Morse, "How do you know all this? Are you making it all up?"

"I am not making it up. I know it, because, while you fellows have been sitting around bragging about what you did, goodness-knows-how-many-years-ago, I have been going about among the progressive ones on earth. I am the one who is back of every new invention in the Wireless line, and the improved Code. The men who have done things do not know, of course, that it is due to my being constantly with them, that they have accomplished what they have; they think it is just their own ideas; but their ideas wouldn't have been worth a hoot if I had not kept prodding them. Take this fellow: he does not know why he is so infatuated with the science; but I made up my mind, the first time I saw him coming from a Radio Club Meeting—(that is a society devoted to the in-

terests of this new science)—that he was the one to show you chaps all about it. I have kept after him ever since. In other words, I keep abreast of the times. You won't find me getting to be a fossil while I can go back to America and visit these chaps."

Meantime Adam had again advanced to the edge of the river; this time reaching the side of the boat. He touched the newcomer on the arm. "My son," he said.

The Newcomer looked up. "Hello, Pop!" he said, heartily, "What can I do for you? Want to listen in? I offered somebody a pair of 'phones a while ago, but I guess the old skate got cold feet. Well, what'll you have?" and he removed the disfigured instrument from his own head.

"Why!" exclaimed Adam, in surprise, "you are no different from any other man!"

"Sure! What did you think I was?"

"I thought you were some part of creation I had not named."

"You hadn't named? Who in Blazes, are you?"

"My name, sir," replied the old gentleman, with dignity, "is Adam. These, my children, say I am the Father of the human race; and they say rightly, for I am the First Man."

"Well! Can you beat that? Just wait till I tell some of the fellows back where I came from about this!" and he turned to his instrument.

"Hold, my son," said, Adam, laying a detaining hand on his arm, "I must examine this strange thing you have here, and name it. I have never seen an animal like it before. What are its parents? It is an animal, isn't it? It does not crawl, therefore it is not a serpent; it does not fly, so it is not a bird. It is not a plant, for it has no leaves—does it swim? I confess, I am puzzled to know just what to call it."

"Oh, don't let that keep you awake. This is just a 1-k-w set, with a 600-meter wave length, I had to cut down my aerial to fit the ark I came in, or you would have seen a beaut. Got any good wire here? The old Geezer maed me chuck out half I had."

"Your aerial?"

"Sure. My antenna."

"Your antenna? You do not think yourself a butterfly, surely?" It is only such light things that have those."

"You are quite wrong, Dad," interrupted Noah, at this point. "It is quite likely to be as he says. I had lots of odd things that sprouted antenna, on my houseboat."

"Don't put on airs and call it a houseboat," reprimanded Adam, sharply. "It was an ark, and nothing but an ark."

"All the best people say houseboat," retorted Noah, sullenly.

The newcomer's eyes had been getting larger, during this family colloquy, and he now broke in with a hopeless gesture. "Will somebody please tell me where I am?"

"Sir," said a courtly personage, stepping up, "You are on the bank of the River Styx. The Ferryman who pilotted you over is called Charon. These, all are Scientists, great Scientists, in one walk of life or another. The elderly gentleman with whom you have been talking is the Father of the Race, Adam. This," indicating with a wave of his hand, "is Benjamin Franklin. This is Noah, a famous sea Captain; you may have heard of him. This gentleman, with the excited manner, is Samuel Finley Breese Morse. I am Christopher Columbus."

"Great Snakes! This is Some Society to be with. Am I a dead one?"

"Not if you throw your forces with me," said the Modest Man, coming forward.

"Stick to me, and we will keep alive even though we are no longer seen on the earth. We will leave these men to gloat and glory in what they have done in the past, while we go among men and keep up with the march of events—and help them along.

"I'm on. Where can I put my outfit?"

"Outfit? What do you mean by outfit?" demanded a wheezy little man at the question.

"Is it the same kind that wild Arizonian had here a while ago? I offered to buy it and take him in partnership, and we could make a fine show, but he wouldn't."

"Barnum, as I live! No, thanks, no show like that for mine! That, there, is my outfit. I want to get my aerial up, and my set in circuit. Some of the fellows

may call me. Want to look over it? See, let me show you. Look at this! This has every set on record beat to a pulp on amplification. Why, one night, while I was in that there Tub, I put on the 'phones to see if there was anything doing, and say! Arlington come in so it nearly knocked me over. And say! The way 8-A-E-Z comes in on this tuning—Gee! You'd just ought to hear him! You see, this is my own invention. It's a Murdock made over, with a Mesco and a DeForest thrown in for balance. This is a composite Fleming-DeForest Audion-valve, with a Len-zite-Carborundum auxiliary detector. Why, when I get the whole thing working, I can hear a fly scratching his ear, if he is on anybody's gap. I tell you, it's great! Come on, listen!"

The Modest Man approached and put on the extra 'phones, and the newcomer began to turn one after the other of the knobs with which the instrument bristled.

"Wow!" he shouted, "What do you think of that for tuning?"

"Who is it?"

"He is a one-inch coil, outin the middle West."

"I don't understand."

"Oh, Nutty! The feller that's sending—get that? You hear that squeaky little spark? Well, he has a one-inch spark coil; he is working that; and he lives in Iowa, or Missouri." Got any cigarettes?" as he searched his pockets. The Modest Man shook his head. "What? No smoking allowed?"

"We have none here. If you want to smell some smoke, come with me, and we will visit some of the amateur stations; You'll get all you want, there."

"Oh, my eye! Smell smoke! Well," taking off his 'phones, "Now I know I'm a dead one. I didn't believe it before. Come on. Bo, Let's go buzz some of the Inventors. Say, you," turning to Charon, "Put my stuff up here on the sand where it wont get wet, will you? I'll be back later, when I've had a nose full. Come on," and he hooked his arm through that of his new companion.

"Wait a moment," called Adam, as he hurried after them, "I have not yet given

you and your—your—Well, I have to name you, you know."

"Just list me as a new Bug; and that,—that's it. Come on, O. M."

They went away arm in arm, leaving Adam gazing sadly after them. Slowly he shook his head, and, as he stood, seemed to lean more heavily on his stick.

"What's the matter, Pa," asked Mother Eve, tenderly, as she placed a loving hand on his shoulder. "Anything gone wrong?"

"Mother, I'm beat," and his voice trembled with emotion. "I thought I knew everything that moves, but the newest arrival says he is a Bug, and that—that—THING of his is "IT." I don't remember any bugs like him, do you? And what, what could possibly be an "IT?" Mother, I guess you and I would best go back to the Garden."

Slowly they moved away; he shaking his head and gesticulating with his stick; she listening patiently, and giving him a loving pat on the arm occasionally. Those that were left gathered around the strange instrument, fingering it gingerly, ready to jump, if the 'lightning' should sound again.

Benjamin Franklin folded up his kite with an air of finality, slipped the large brass key into his capacious pocket, and turned to follow Adam and Eve.



Join Mr. Hebert's early bird club, for Relaying Relayists and avoid the midnight rush.

The Trans-continental Record

THE great problem of sending a message from the Atlantic to the Pacific and having the answer back the same night has been done. It was accomplished in the early morning hours of February 6th, 1917, which date will be an historic one in the years to come. The job was done by 2PM, Faraon & Grinan in New York City, 8JZ, Alfred J. Manning, Cleveland Ohio; 9ABD, Willis P. Corwin, Jefferson City, Mo., 9ZF, W. H. Smith, Denver, Col., and 6EA, Seefred Bros., Los Angeles, Cal.

Messages have been got across to Pacific coast stations in the past, and those sent late in January from 6EA to 1ZM made the passage in two or three days time. Even earlier than this, messages sent on QST signals have been got across. Never before, however, to the best of our knowledge has a message been sent out on a regular route and the answer brought back the same night. The time in which this splendid effort was done, is also a matter of record, and which will probably stand for some time to come. We understand the message left the station of 2PM, at 1:40 a. m., and the answer was back at 2PM at 3:00 a. m. The time is, therefore, one hour and twenty minutes.

It would seem as though very perfect organization and discipline would be necessary to beat this record. And yet we hesitate to say that this record will stand for a long time to come. Things move so quickly in amateur wireless, that it is a hazardous thing to predict. If we had stated in December that in three months time, we would have handled a message out to the Pacific Coast and back in less than two hours, we would have felt guilty of over stating the possibilities. We hesitate, therefore, to state now that this re-

cord of one hour and twenty minutes will not be broken very soon. We would not be at all surprised to receive evidence before bad summer weather begins that a message had gone out on one relay only at Denver, and the answer received back in like manner and the time something of the order of twenty minutes. We confess to shrinking a little as we write this, but as we have said, things happen almighty swiftly in this game of ours. 2PM has heard 9ZF at Denver and stations east of Denver have heard Pacific Coast stations. Therefore it is only a matter of some of the fellows taking advantage of an especially good night when certain especially good stations are on. It is likely to happen.

Trans-continental traffic is now a regular thing over three routes. Mr. Mathews is authority for the statement, and it is substantiated by the actual receipt of messages addressed to Headquarters, that messages can be handled from Hoquiam in Washington across the northern Trunk Line via Grand Forks, and Chicago, also across the central Trunk Line from San Francisco via Denver and Jefferson City, Mo., and finally across the southern Trunk Line from Los Angeles via Phoenix and Dallas. We have knowledge of fully fifty messages which have already been handled across the continent on one or the other of these three routes. It is a matter in which we all may take great pride. We of the A. R. R. L. cannot but feel that our work has been one of the important contributing elements in the success of the thing. But, whether one of us or not one of us, everybody who had anything to do with this fine effort deserves credit, and we derive a great pleasure from extending our heartiest congratulations to all concerned. Let us use this successful effort as an example of what we can do in the future by organization and enthusiasm.

Trans-continental Traffic Begins

ON the night of January 27th, 1917, the great event was successfully accomplished. A message from a citizen on the Pacific Coast was released to a citizen on the Atlantic Coast. In fact, there were three of them which came through all at once. The first one, was from Seefred Bros., at Los Angeles, 6EA, to Mr. Hiram Percy Maxim, at Hartford, Conn., 1ZM, President of the A. R. R. L. The second one, came from Mr. Lindley Winsor of Bakersfield, Cal., to Mr. C. D. Tuska, Hartford, Conn., Secretary of the A. R. R. L. The third one was another from Seefred Bros. to Mr. Maxim.

This marks the first real amateur radio communication with a definite address. We are told that broad cast messages have been put across before, but it is an altogether different thing to get something across by luck, trusting to any station who may happen to hear it, and to handle a message to a definite address through definite relay stations.

The fortunate stations to go down in radio history as the ones handling the first Trans-continental message were,

Seefred Bros., Los Angeles, Cal., 6EA.

Capt. E. A. Smith, Denver, Col., 9ZF.

Willis P. Corwin Jefferson City, Mo., 9ABD

Kenneth Hewitt, Albany, N. Y., 2AGJ.

Hiram Percy Maxim, Hartford, Conn. 1ZM.

Like many other of the big Trans-continental attempts, the first real one came from the west to the east. The distances between these relay stations are of particular interest. They are from Los Angeles, to Denver, approximately 850 miles. From Denver to Jefferson City, approximately 750 miles. From Jefferson City to Albany, approximately 1,040 miles, and from Albany to Hartford, only 100 miles. The big credit is therefore due to 2AGJ at Albany and 9ABD at Jefferson City. All

hail to them both. The shortest jump was from Albany to Hartford, a little step of only one hundred miles, but this was the irony of fate. We at headquarters feel perfectly satisfied to be the little fellows in the big event.

The connecting link which was solely responsible for getting across, was 9ZF at Denver, and although his distance was not as great as that covered between 9ABD and 2AGJ, he remains as the sole station in the chain across. Unless 9ZF can work both ways, we are stuck, at least at this writing. Our chain therefore is single stranded at this point. East of Missouri, there are any number of strands. We expect that by the time this is in print, 5DU and 6DM at Dallas, Texas, and Phoenix, Ariz. respectively, may be able to do something. Probably there will be others. After the start was made by 9ZF, it was not long before a flood of messages from coast to coast began. Up to February 5th, twenty-one Trans-continental messages had gone through 9ABD at Jefferson City, Mo. All of them went via 9ZF at Denver.

This seems to establish a new line, and the matter will be put in the hands of Mr. Matthews, Trunk Line Manager at Chicago, for him to lay out. From his knowledge of the conditions, he will be able to decide whether to establish an additional Trunk Line for Trans-continental traffic only, or whether to modify some existing Trunk Line to embrace the route found able to handle the traffic. In the next issue, we shall have some interesting details to give about the working conditions. Here at Headquarters, we have heard the middle western stations calling and working 9ZF and it is the next thing to actually hearing 9ZF here on the Atlantic Coast. This is a great and fine thing for amateur wireless and will put a lot of ginger into everybody. We hope to see the fellows along the northern tier of States and also the southern get busy and get their share of the interesting traffic.

New England Waking Up

EVERYBODY will be glad to know that the New England District, with Boston as the center, has waked up. It is not a case of a temporary manifestation of returning life, but instead, a real permanent arousing. The Amateur Wireless Association of New England having a membership in the vicinity of 500, were offered the restaurant of the Filene Company in Boston, and they held a banquet and a meeting on the evening of February 23rd. The President of the Association, Mr. G. R. Entwistle, formerly known as 1JJ, but now holding new call letters which we shall hear about later, presided and acted as toastmaster. On his right sat Lieut. E. S. Blakeslee, U. S. N., representative of the United States Naval Radio Service, and on his left, sat the representative of our American Radio Relay League, in the person of our president, Mr. Maxim. Capt. Gawler, the Chief Radio Inspector of the First District, Mr. Butterworth, First Assistant Inspector, Mr. Nichols, Manager of the Marconi Company in New England, Mr. Power of Tufts College, and Mr. Harlow of the Filene Company were also present, and formed a very distinguished group.

After the dinner, the two hundred amateur radio enthusiasts were very enthusiastic in their greetings to the various speakers. Lieut. Blakeslee told exactly what the government wanted from the amateurs in the way of enlistment in the regular Naval Radio Service, and enrollment in the Naval Radio Reserve. For the first time, the amateur was given in plain language just what the government wanted of him in time of war. Mr. Harlow of the Filene Company was especially enjoyed because of his whole hearted welcome to the amateurs of the District. He said the growth of interest in amateur wireless exceeded anything he had dreamed of two years ago. The Filene Company take the handsome attitude of holding out the helping hand to the amateurs around Boston, offering them a place to meet, and giving

them all the encouragement that can be thought of. The Boston amateurs are certainly to be congratulated on having such a good and influential friend as the Filene Company and Mr. R. L. Harlow.

Mr. Nichols of the Marconi Company was listened to with especial interest because the amateur felt as he always feels that he is not always looked upon with friendly feelings by the commercial man. Mr. Nichols was kind enough to tell the two hundred young men present that the Marconi station, WBF, had very little complaint to make from the amateurs. Where complaints were necessary, the amateur in each case had hastened to do everything possible to prevent the trouble recurring. Mr. Nichols had hoped that the friendly relations would continue and encouraged the fellows to improve their apparatus and take part in the relay and long distance traffic, pointing out that it was perfectly possible by means of sharp tuning to avoid interference with WBF.

Capt. Gawler, one of the most popular radio men among the amateurs of the country, was given a rousing welcome when he rose to his feet. The Captain secures his popularity by his frank methods. He enjoys the distinction of being able to tell you your faults in such a nice way that you feel as if you were under obligations to him. He told those present that they were good law abiding citizens, all right, and evidently knew radio science better than the average, but that they were backward on organization. He urged that the amateurs of the section make a better attempt at getting into contact with the other amateurs of the country and not be satisfied with telegraphing between themselves. He pointed to the work of the American Radio Relay League as representative of what the Boston amateurs should do. His assistant, Mr. Butterworth, followed him with a very interesting line of statistics. From him it was learned that there were 962 licensed amateur stations in the First District, and that 636 of these

were in Massachusetts, and that 325 of this latter were in the immediate vicinity of Boston. He stated that the First District was the most populous from an amateur radio standpoint than any of the other districts, and yet in spite of this, there was almost no long distance work done by the amateurs of New England, as compared with what is done in the Second, Third, Eighth and Ninth Districts.

Mr. Power was very interesting in his talk about the early days. He was followed by the last speaker, Mr. Maxim, who was also given a very warm reception when he arose. Mr. Maxim told about what was being done by the other amateurs of the country, and of the efforts of the A. R. R. L. to join the amateurs together into an organization for handling relay traffic and improving the conditions of the amateur generally. He urged the fellows around Boston to appoint a committee who could meet representatives of the Board of Directions of the A. R. R. L. and decide upon a District Superintendent for the Boston District who would develop Branch and Trunk Lines so that traffic from the west and south could be got into New England and traffic from

Boston and points north gotten out. He said that as it stood, it was almost as though New England east of Springfield was off the map, and that it was on account of lack of organization and not lack of stations and knowledge.

The meeting was voted a great success and it unquestionably will result in a big improvement in amateur conditions throughout New England. Since the meeting, a conference has been held between five representatives from New England and Messrs Maxim, Hebert, Tuska, and Smith of the A. R. R. L. Board of Directions. Mr. Allison, 1ZW, at Worcester and Mr. Readio, 1ZS, at Springfield, also attended the conference, being important connecting links. At this conference, Mr. G. R. Entwistle was selected as District Superintendent and arrangements were made for lining up various stations on a regular schedule. There is every reason to believe that messages from the rest of the country will soon be handled through to Boston and points north, with the same certainly that now exists in other parts of the country. Future Trunk Line reports will include data from Mr. Entwistle.

ARRESTED FOR HIS S O S.

Wireless Amateur's Distress Call Had the Navy on its Toes.

The New York Times says: January 21 last the battleship Arizona at the Brooklyn Navy Yard picked up a faint S. O. S. wireless call, several times repeated. The radio station at the yard was notified, the news was flashed to Washington, and immediately every wireless station from Maine to Cape Hatteras began trying to communicate with the supposed vessel in distress, of which neither name nor location was given. Several coast guard cutters, it was said, hurried out from various Atlantic ports and searched for days in the hope of finding some derelict and rescuing its company before it sank. Then the hunt was abandoned.

Several times in ensuing weeks similar calls perplexed the naval authorities. Chief Radio Inspector Louis Krumm of the Bureau of Navigation of the Department of Commerce was sent here.

Working on the theory that the calls came from within a mile or so of the Yard he investigated every licensed amateur without result. By a process of elimination he called a couple of days ago on William Eckhoff, a studious looking youth of 16, who had an amateur plant with its aerial on the roof of his home at 195 Court Street, Brooklyn. He was arrested.

According to the Federal authorities, he confessed to sending out the call just to show friends how it was done. He explained that he thought his wave lengths were too short to be heard far and would cause no trouble.

Eckhoff had no lawyer when he was arraigned before United States Commissioner Bick yesterday and his hearing was postponed to Monday. The extreme penalty for the offense is five years in a federal prison. It is not expected, however, that the authorities will deal severely with him.

Antennas and Grounds

By Wm. C. Ballard, Jr.
Radio Laboratory, Cornell University

THE writer while only a very recent subscriber to "QST" has in that brief time become very much interested in that publication, and feels that it is accomplishing very admirable results.

In the January issue an article appeared signed by "Dr. Radio" which gave some very good pointers in regard to amateur transmitters in general, in which the importance of the ground connection was very justly emphasized. In presenting this subject to my classes a slightly different viewpoint is taken, and I am outlining the same with the hope that perhaps it may clear up some of the problems in regard to the so-called ground connection.

The term "ground connection" is more or less of a misnomer, as it is very apt to give an entirely wrong impression of its real function. In the first place it is perfectly possible to transmit radio signals with absolutely no connection to the ground, as is done in all cases where the so-called counterpoise or capacity ground is installed. This type of antenna employs a series of wires a short distance above the ground, under the antenna proper, and entirely insulated from the ground; the secondary of the oscillation transformer being connected between the antenna proper and the counterpoise, no direct connection at all being made to the ground.

In order to clear up this matter, let us first consider what constitutes a good condenser. Someone will say, two conducting plates separated by a good dielectric. What are the properties of a good dielectric? In the first place, it must be a very good insulator, that is, it must offer an almost infinite resistance to the passage of direct current. If we consider the condensers with which we are most familiar, we will remember that air, glass, oil, hard rubber, mica etc. which forms the "dielectric" are all extremely good insulators.

Suppose however, we build a condenser of two copper plates separated by a piece of damp wood, or some partially conducting material of that character, it will be self evident that we could never expect such a condenser to act efficiently or remain charged for any length of time on account of the tendency of the so called charge to leak thru the wood between the plates.

While we are all familiar with the fact that an antenna is supposed to have capacity, yet few of us realize that every antenna is nothing more or less than a condenser built on a very large scale. In presenting this fact to a young radio enthusiast, a good friend of mine, I was greeted with a rather surprised look, and the following was our conversation. "Suppose I have two sheets of copper one hundred feet square, and spread one on the ground and support the other one six inches above it, will this be a condenser?" "Yes" was his reply. "Now suppose that instead of using the entire upper sheet substitute four narrow strips, or better yet, four wires spaced thirty feet apart and six inches above the lower plate, will we still have a condenser?" "Yes." "Then if I change the spacing of the wires so that they are four feet apart, and one hundred feet above the lower plate, will I have lost the condenser?" At this point it dawned upon him that the four wires a hundred feet high were simply his antenna wires, but the question of the lower plate bothered him, and it is bothering a good many of us who are trying to get maximum transmitting range with the power we have available.

If our antenna is erected over salt water or salt marshes, then we may say that the surface of the earth will correspond to the lower plate, since the salt water being a good conductor, forms a conducting film on the surface of the earth, but for the sake of argument, suppose our antenna is erected on moderately dry soil and we are grounded to the water pip-

ing system which is buried say ten feet below the surface of the earth. Now we can say that the lower plate corresponds to the network of water piping, providing of course the waterpiping runs under the antenna, and for our "antenna-condenser" dielectric we have first a layer of air one hundred feet thick, this being the height of the antenna above the ground, and a layer of earth ten feet thick, this being the depth of the "lower plate" below the surface of the ground. In the light of our former considerations, it is evident that a large proportion of the energy delivered to the antenna circuit will be lost in this very imperfect layer of dielectric, which is partially conducting as was the case with the damp wood which we previously considered.

If we do not have a piping system available, we must consider that the lower plate of our "antenna-condenser" is at the level of permanently moist ground, which may be much deeper than ten feet, thus increasing the thickness of the layer of earth included, and hence greatly increasing the losses.

In a recent bulletin of the Bureau of Standards, the fact was brought out that in addition to the losses due to the poor dielectric properties of the layer of earth, the presence of trees, buildings, etc., under the antenna had a tendency to produce the same effect, since being in the electrostatic field produced by the antenna, and being of poor dielectric characteristics, they also induced losses of considerable magnitude.

The most generally used method of elim-

inating the first class of losses is by covering the ground under the antenna with a network of wires, either laid on the surface or buried a few inches under it. Thus our "antenna-condenser" system is formed between the antenna wires and the network on the ground, and includes as dielectric the layer of air alone, whose dielectric properties are almost perfect, and eliminates to a very large extent the losses due to the poor dielectric properties of the earth.

As a practical illustration, some tests made on one of the antennae at Cornell University showed that when tested with direct current in the usual manner, the ground resistance to direct current was considerably less than one ohm, it being grounded on a large watermain. Due to its location however, it is impossible to lay a network of wires underneath, and since the earth is dry and rocky, its high-frequency "ground-resistance" runs up into many times its direct current resistance, the exact value depending upon the wave length use. The explanation seems to be that the ground connection is all right but the so called "antenna-condenser" has included in it a layer of very poor dielectric, and the losses in this layer are charged up to the ground resistance.

In conclusion, think of your antenna as a mammoth condenser, and if you would obtain best results, see that the lower plate of the condenser, (the ground connection), has as good conductivity as the upper plate, (the antenna wires), and that it does not include layers of earth, trees, or buildings in its dielectric field when possible to eliminate the same.

AMATEUR SIGNALS HEARD AT SEA.

The following letter was received by Mr. Maxim from Edward P. Diggins, Radio Operator, Marconi Wireless Co. on board S. S. San Marcos, At Sea:—"I am writing you these few lines, and presume you will be pleased to hear that on the evening of March 5th at 9:40 p. m. while the San Marcos was 125 miles southwest of Hatteras, I happened to be listening in on a low wave for a few minutes, and I heard your station while you were in com-

munication with 1ZF at Fall River, Mass. You informed him you would QSR. Your signals were very strong, even through the static we had in the vicinity. Then I had to change my tune for Time and Weather from Arlington, therefore, I didn't hear you any longer. I arrived in New York the 7th, late, so you can imagine how far you were heard south." This indicates that many of us amateurs must be heard by the ships at sea, when they tune down low.

Beware!

IF you ever come out to the shack, let me warn you right now there is one term you want to steer clear of. That is QRM. It sounds innocent, doesn't it; but let it be mentioned and the party doing the talking will automatically become unpopular. And that's no joke either.

You folks in the eastern half of the old U. S. who rant around and rage about that fellow on the other side of town, and the kid next door, may have your reasons for so doing, but if any of you desire to prepare for the entrance examinations at the state insane academy you'd do well to come out West. Honestly there's nothing that stimulates wrath as much as listening "Morse-Continentially" to a bunch of western Hams. And sons-of-western Hams.

Even the "Old Man" himself, were he here, would be in danger of losing his manhood.

It's a crime to ask a perfectly respectable receiving set to respond to some of this bush-wah that is handled around here. Would you blame a poor weak overtaxed audion if it lay down and quit during this nightmare:— bk. bk ham this my night your another I tell you QRT. L. D. in—now pse bk ha ha bk thunder dampfool pse Q. R. X. tit tit tit ta-a-a (this the cities Nemesis Q. S. A. yea Q. S. A.) Hog tit tit tit ta-a-a-a- Q. R. T. my turn Q. R. T. (here a lull in which four different fellows in the immediate vicinity call the same northern station simultaneously). Then:—Get out bk—you act like a kid—give me a chance—cut it—murder—mim—this my nite—shut up etcetera and so on.

To the poor guy with only a receiving outfit, such stuff must almost encourage him to leave for some lonesome spot or to spend the rest of his days playing Napoleon in the Norwalk home for inebriates.

What is to be done anyway? It used to be the worse luck conceived to stay up until 1:30 a. m. for px. only to have the aerial fall down at 1:15. But now! Caramba!

I'd sit up every night in the week just for the diversion it would give me from Q. R. M.

Shall we peacefults organize a sort of Ku Klux Klan in every town and threaten a few necks if the owners of said necks persist in broadcasting ever and anon foolish Q. S. T.'s and double callings. Or shall it be the application of a double row of nice fat barrel staves.

This latter method might at least incite a little interest from those who are indifferent.

I met a young fellow the other day, a real nice boy too. He said he wasn't worrying about Q. R. M. Let the other fellow do it! If they wanted to scrap among themselves and cause interference, he was little Johnny-on-the-spot when it came to rough-housing. OH yes! He should manifest concern.

I sigh for this young man. His downfall is certain. He is the fellow who sends on a decrement of .4, then ties his key down for half an hour while he crawls up on the roof to see if his aerial is leaking! He should be discarded from the wireless game. Out the backway like an old pair of shoes or a dead cat.

The prevailing opinion around this little old burg seems to be to the effect, that everybody acts as they please with the result that we have a circus here each and every night at the expense of a few who mean business.

It gets a fellow up a tree mentally to figure out what to do about it. The more he thinks, the more complicated the problem becomes until it seems the only thing to be done is to develop a great big grouch and ignore the cruel, cruel world.

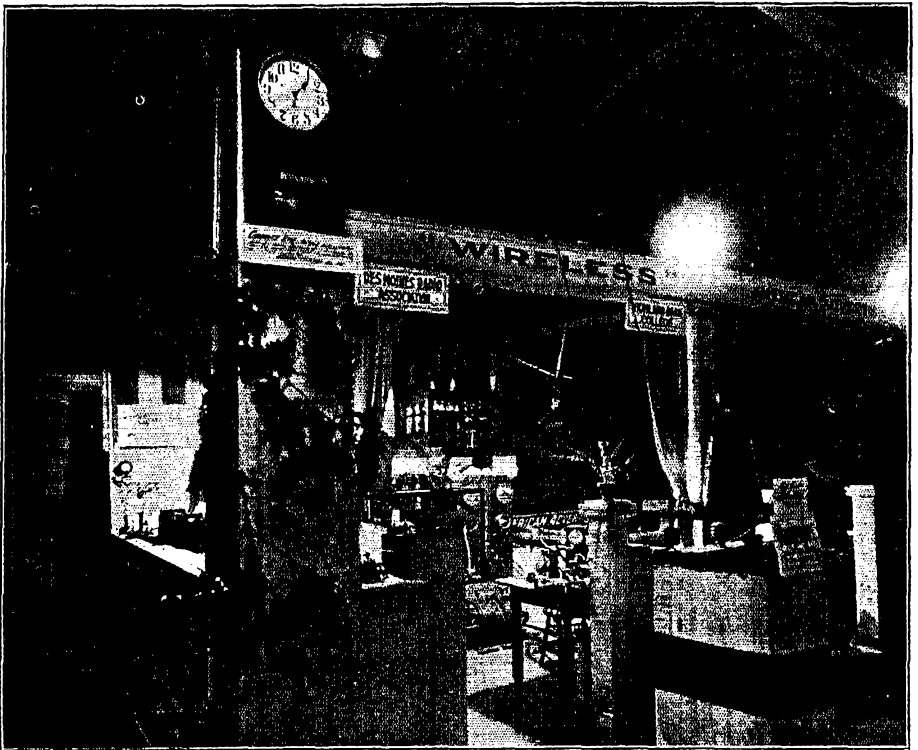
This sounds like yelling "time out" and taking the count doesn't it? Well, I know of one case where such is not the case. It's just the lull before a storm. A storm in the shape of a big tall, four-eyed guy with a nine foot aerial spreader and the

good intentions of chastising a number of small boys upon their tenderer portions until a mighty wrath is appeased.

If by chance anyone should be seriously damaged, I wish to say to the Judge and Jurors before hand, that whatever this

tall guy may do in the future, it will not be his usual pure and noble spirit that caused him to act rashly, but the low incitations received from the numerous boys themselves. So please deal gently with him.

Des Moines Exhibit



The booth shown in the picture herewith was made and shared by the Des Moines Radio Association, and the Highland Park College. The college contributed the one K. W. Marconi set shown in the illustration. This booth attracted a great deal of attention at the Des Moines Electrical show, as messages were sent and received and the station was in constant operation. The transmitting set at the left of the picture was exhibited by the

West High School. The public were allowed to listen to many long distance undamped stations including all the larger stations of the United States. An interesting little folder inviting people interested in wireless to attend the meetings of the Des Moines Radio Association was distributed. This is one of the best arranged and most elaborate exhibitions of amateur wireless apparatus ever shown, and greatly increased the interest locally of that inimitable pastime.



Our Country Calls Us

Most of us have received the circulars sent out by the Navy during the last two months. We have read them in a more or less careful manner. How many of us have really read them carefully, and then tried a QTA and followed this by reading what was between the lines? Here at Headquarters, we have to be wide awake on everything that can be hooked up with radio matters, and these circulars came in for pretty careful study. They required this because it was not easy to get down to brass tacks through the official language used. We ended up by saying, "Here now, what does the Navy want of us amateurs?" The best way to get an answer in straight language was to go to the Navy and ask. We did this, and were fortunate enough to find a certain officer who was thoroughly onto his job and who knew how to say what he meant in few words. We found what we wanted to know and it is worth telling to the rest of you fellows.

The United States Navy wants radio operators on its ships and in its land stations. The supply is not up to the demand and we amateurs who know how to handle traffic represent the material needed. We are offered two forms of service, and it is frankly stated that we are expected to give one or the other of them, provided our personal interests are not seriously jeopardized by so doing. The first alternative is to regularly enlist in the Navy as an electrician, radio. In doing

this, we become an enlisted man, in duty bound to serve out the term of our enlistment, which may be three years. We are taken into a school at one of the Navy Yards, and given a thorough course of instruction, for six months, unless we show before the completion of this course that we are able to handle radio work, and apparatus. We are paid and we are given a dignified standing.

The second alternative is to enroll in the reserve, and agree to give three weeks service a year for four years. We can give any amount more than this that we want, but we cannot give less than three weeks at any one time. We would be put into contact with the Navy personnel in the various Navy land stations and when we were able to do so, would stand our trick at the key and sign in one of the regular Navy calls. Probably some of us would have a chance at the distinction of signing NAA.

That is the story in a nutshell of what the Navy wants. Every one of us who is able to give his service ought to do so. Many of us of course have dependents whose daily life requires us at home, but there are many more who are dependents themselves. To these we say, write to your nearest Navy Yard and ask for information and enroll or enlist within the next thirty days. It will do you no harm but instead, a lot of good and you will be answering your country's call.

If We Are Closed Up

If war comes, it is practically certain that we amateurs would be closed up at least as regards transmitting. Whether we would be closed up as regards receiving also, is not so certain. The chances are, however, that we would.

If we are closed up, it has been suggested that certain of us would be reopened for receiving purposes as a help to the Navy. Any definite information is hard to get, but we have heard enough to make a pretty close guess that in order to secure approval to reopening, we would have to show our ability to receive efficiently both damped and undamped waves, between certain wave lengths and also that we would keep a constant day and night watch twenty-four hours out of the twenty-four. The latter means several operators of course, attached to one station, and all agreeing to positively be on duty for their trick every day in the week or provide a substitute.

Each station reopened would be given a certain range of wave lengths to cover and would confine itself to this range. Daily reports of everything heard would be made. It would mean real business and when once started would probably have to be kept up. The stations reopened would be virtually commercial land stations for receiving only.

But what is to become of the great bulk of us who would not be reopened? If we are closed up tight and compelled to take our aerials down, what are we going to do? The appeal of wireless will not be killed, just because we can't work our stations. Quite the reverse in fact, as the knowledge that it is there waiting will only whet our appetites the more. The thing to do is to accept the opportunity of enforced idleness as regards actual operating and get into the study of the science of the art.

Before very much time is spent at this, it will automatically develop just what it is we need most in the way of improving our sets so as to do better in that particular field where we have been weak. All of us know in our inmost hearts, of several weak spots in our stations, but we are not quite sure what is necessary to improve them. The great opportunity will come when we are closed up, and when we reopen, it will be with a rush which will more than make up for lost time. Our A. R. R. L. and our QST will not be closed up and through them we can all keep in touch with each other to our technical improvement and probably also to our amusement. Regarding the latter, is it not odd how much wit and fun there is among radio men. There will be more, of the latter when we come to be closed up.

Demand for "Wouff Hong's"

Since that QRM classic which our grouchy contributor, THE OLD MAN wrote in a recent number, we have been pestered half to death for wouff hong's. It seems that the impression prevails throughout the land, that a wouff hong is very efficacious in reducing QRM. It also seems to be a fact that there is plenty of QRM judging by the number of people who want to buy and probably wield wouff hong's. We have considered seriously establishing a wouff hong department because there might be a profitable business built up in supplying these weapons. Possibly a patent might be secured and the manufacture let out to wireless apparatus companies. To all those suffering from

QRM, and the blood thirst which it creates, we might hold out the encouragement that we are carefully surveying the wouff hong industry and if the present war conditions indicate that the necessary raw materials can be secured at reasonable prices, we might find that we can arrange to supply the demand. From the name of the instrument we should judge that if properly wielded, a wouff hong might be expected to have a very favorable effect upon that growing ulcer known to the technically informed as QRM. We know we would be very apt to cut out sending if we felt that a certain party we know had placed his order for a wouff hong.

QST on the Newstands

Just one year ago we walked into a certain electrical supply store and modestly hinted to the man in charge, that it might be a very nice thing if he would put a half dozen copies of QST on his counter every month and sell them to the amateurs who came in. He nearly punctured himself, he got so mad at our nerve. We managed to escape with a whole hide, but we considered ourselves lucky. In just thirty days, this man sent in an order for twelve copies of QST. The next month he asked for twenty-five. The next month he demanded fifty, and in ten days wrote in for an additional twenty-five copies. The next month he made it one hundred copies. Today, he takes something over two hundred copies. We don't suppose he ever reads these editorials, himself, so we think we may be safe in telling on him in these columns. This same experience, except not quite so fierce in the beginning, has been repeated in many other places. Our news stand orders from various parts of the country is rapidly approaching our subscription orders. It looks as though it would pass the latter.

There is an important lesson which this teaches. It is the fact that many of us do not seem to be able to get down to subscribing by the year, but instead, get their copy at a news stand. The trouble

with this is that in a good many cases, the copies are all sold and the fellow has to go without unless he can screw himself up to the point of writing in to us. There is a remedy for this condition, however. This is to bring a little pressure to bear upon the news stand. There is no reason why they should not order enough to supply their demand and they will if they are urged to do so. Therefore, every fellow will be helping the game along by speaking up at his news stand and not being afraid to speak loud. QSA very, is what is wanted. And another thing;— Remember that every town and city ought to have QST for sale on one of its stands, and if it is not in your town, you can easily have it by simply asking. If you happen to have a weak spark and you are afraid to signal strong, just drop us a card giving us the name of the electrical store in your town where most of the amateurs go for their supplies. We will then write from here and will put enough power into our signals to ensure that they buy a few copies of QST every month. Once started, nature can be depended upon to take its course. It is one of those things which will help improve the magazine, and this will help each one of us and the A. R. R. L. in the bargain.

An Enlarged A. R. R. L.

For some time past, preparations have been under way for an enlargement of our A. R. R. L. organization. Its object is to make the management representative of the entire country. We at Headquarters have always felt that this was necessary and as soon as we were strong enough that we must bring it about. There is ample evidence during the last several months that our strength has reached the desired point. The result is that several meetings have been held in New York City and the preliminaries to a countrywide representation in the executive management of the A. R. R. L. are now completed. By the time the

next issue of QST goes to press, everything will be complete, and we will announce some very important and interesting news.

It is planned to have the affairs of the League managed by a General Manager acting under a Board of Directions. The latter Board will be made up of members in various sections of the country. This will give a wide representation. Even those from points too far away to make it possible to attend meetings in person will have a voice in the management. Arrangements have been made for taking up all subjects by mail and at intervals meetings will be held in Buffalo, Cleve-

land, Chicago, St. Louis, and even farther west if such turns out to be practical. We expect great things to result from this enlarged organization. It will be one more thing to bring us wireless amateurs together and make available the strength that comes from union. Full announcements will be made in the May issue. A practical plan for the affiliation of the dif-

ferent radio clubs and associations of the country, with our A. R. R. L. as a national nucleus will also be presented. In the meantime, the Secretaries of all Clubs ought to write in to Headquarters and give us the benefit of any ideas they may have which will help us meet the general desires.

The New Price

We were right. We confess we were not at all sure of it in the beginning, but it has come out the way we hoped. Everybody who has written in and mentioned the increased price of QST after April 1st, backs us up and says it is all right. Of course this is a very satisfying thing to us who build QST every month, and incidentally, who have to pay the bills every month also. It means, if it represents the majority of opinion, that we can go ahead enlarging and improving the magazine and the A. R. R. L. It means that we can do more good because we can spread more valuable information and over a wider area. It means that we can increase the resources whence comes this information. This is of great importance to us all because the wider the field which we tap for our information and data, the

more instructive and interesting it becomes.

We notice every week how our mail is coming from more widely scattered sections. It has reached out into foreign lands. For example, a friend pops up in France, and in a recent mail he sent us the most interesting photographs of French radio stations and apparatus which we have ever seen. Descriptive matter accompanies the pictures, and the whole thing will make a story for QST readers when we can find the space to squeeze it in, which will command admiration. This is all the finest kind of stuff, and it makes us feel warm all through. To have the fellows write in and say O. K. to our increase of price and thereby give us the support needed to take advantage of all these splendid opportunities, fills us with enthusiasm to pitch in all the harder.

The World's Amateur Radio Record

Although we are late in reporting it on account of our forms closing on the first of the month, nevertheless, this number of QST tells the story of the Great Transcontinental Record Message. It constitutes the world's amateur radio record and is altogether a splendid piece of work. Everybody identified in it deserves the greatest credit. They can be written high on the table of radio fame and in future years they will be looked upon with more respect than is possible to bestow today, when we know them personally.

The effort was nothing less than starting a message from New York City at 1:40 a. m. on the morning of Feb. 6th, 1917, and relaying it to Los Angeles, Cal., and bringing the answer back into New

York City at 3:00 a. m. the same morning. Just one hour and twenty minutes to send a question across the Continent and bring the answer back. Some record, fellows and it was only a few short months ago that we were dreaming of it as one of the possibilities of the future.

The honor list of stations and the names of the owners which performed this wonderful feat, is as follows:—

2PM, Faraon & Grinan, New York City.

8JZ, A J. Manning, Cleveland, Ohio.

9ABD, Willis P. Corwin, Jefferson City, Mo.

9ZF, W. H. Smith, Denver, Col.

6EA, Seefred Bros., Los Angeles, Cal.

Hats off to them fellows. They are the big bugs of Amateur wireless.

WHO'S WHO IN AMATEUR WIRELESS

We shall publish each month two pictures of amateurs who have become known by call letters. This will draw us all closer together. We are often curious as to just what the other fellow looks like, and here's our chance to see.—Editor



Frank M. Corlett
5ZC

Frank M. Corlett, of Dallas, Texas, operator of 5ZC, was born in Antonio, Colo. in 1890 and moved to Texas in 1898. In 1913 he became interested in radio and since that date he has built and rebuilt as we all do. This summer he intends to reconstruct 5ZC. He first began worrying the other radio "bugs" when using call

CONTINUED ON PAGE 47



Willis Corwin
9ABD

Here is one of the operators who partook of the famous two hour relay from coast to coast. He was one of the chain who handled the message from New York to Los Angeles, and who have now formed a Trans-continental route for the A. R. R. L. Mr. Corwin has earned his place in "Who's Who" from the wonderful work he has been accomplishing during the past winter. 9ABD certainly put Jefferson City, Mo., on the map. Hardly a list of calls comes in which does not contain his name. Let's all work hard to see if we cannot bring our stations up to the efficiency which Mr. Corwin has brought his.

The Passing of the "Old Days"

By Paul Oard

UP in the static room of the big commercial companies, where on an idle day the operators on shore leave, or waiting for an assignment, swap their yarns of the sea and the wireless, more than one passing regret for "the days that were" may be heard. And while the older men—(who are generally about 25 years of age, and therefore rich in wisdom) exchange their reminiscences, the juniors sit with ears and mouths wide open and drink in their knowledge. The old days of the wireless game have passed, the time when each operator carried his own pet hunk of silicon and perchance a dubious looking pair of phones by which he laid great stress, said stress having been accumulated during a trial in his own amateur station before the itch of the seven seas got into his frame; the days when a fellow who pulled down 4000 miles on some Trans-pacific steamer was given a column of space in the metropolitan dailies, and the head operator even was respectful toward him for an hour or so; the time when a chap would sit up all night aboard some little two by four freighter with a sixty foot aerial, straining his hearing and his peace of mind in an attempt to get press down to the "old man" at breakfast the next morning:—all this has passed, and the old remembrances of the wireless of early days are those passed up by the fellows who have stuck to their keys thru the years.

The enterprising and ambitious juice jerker who stored his phones and silicon away until well out to sea, and then brought them forth and guarded them with loving care from the profane touch of the "second man" has been succeeded by the one who twiddles the knobs of his audion, yawns wearily when a station about 'steen thousand miles roars in and wonders what the deuce is the matter with P O Z. The lightning stretcher who would dare now to boast of his record of 4000 miles is laughed to scorn and humbled in the

dust by some one asking him why he was using the magnetic. The knight of the key who balanced on an apple box while the tanker tied herself in bow knots in a nasty sea, and stretched his patience to the breaking point, has faded into the background to be replaced by the one who bestirs himself some fifteen minutes before morning chow, calls up some neighboring ship, and wheedles the obliging operator out of the night's press so that the skipper's grouch may be somewhat appeased.

Once upon a time they tuned the set to any old wave length, just so she'd radiate her best, and each and every operator had his own personal ideas as to what position the helix clip should be in, these ideas being dutifully tested out as soon as the good ship had cleared the three mile limit. Now they call for six hundred meters and woe be the unlucky one who uses his own individuality in shifting clips promiscuously, and no longer does the shore operator say words that make the strands on the aerial curl as he vainly explores the upper reaches of the ether in a vain attempt to find out where the "Bungolia" has departed to from her accustomed wave length.

And say—can you remember when the operator on shore leave was attired even as Solomon in all his glory? The varicolored coat worn by Joseph would have but passed as a vain attempt to compete with "Sparks" when he dolled up in full uniform and strolled down the streets of the little lumber town where the ship was waiting for cargo. Who has forgotten the golden sparks which radiated from his cap, collar and sleeves, yea, even from the cuffs of his neatly pressed pants—creased to an edge that would make a razor blade feel like a broken down hack-saw. It was not to be wondered at why sometimes the passengers thought that the Skipper was awfully young for such an important position. But no more: Only a plain little badge to

indicate his rank. The silver and golden sparks that gave him the appearance of a winged Mercury have gone with the other memories of the days that were.

"Chewing the fat" was then a favorite pastime with the fellows hard put to pass dismal night on watch. Many a witty saying and more or less personal remarks spun their way between aeriels, and—regretful though it may be—personal feuds were started through some unpolitic remark dropped over the air. Especially when some chap with an idea of his own importance "jammed" the ether with a 5 kw. when the other fellow who had a bunch of positions to report despaired of ever hitting his bunk that night and started in to say things about the offending operator's ancestry, his personal appearance, etc., until the hot wire ammeter would start to show signs of registering other things than juice. Now, if there are any remarks to be made, they take the more conventional form of a duly checked off message, or an underscored remark on the log sheet. And what censoring is done, is done in the privacy of the head-operator's office.

Among those who have seen the old days go, with perhaps the keenest regret of all, are the amateurs who were early in the game. Not to be forgotten is the episode of the operator, who when some 3500 miles from San Francisco, thought he heard the familiar tone of old P H, and after some time of nerve racking suspense, when communication was finally established, to learn that he had an operator in San Jose, amat-

eur, 5 kw., "on the air." Yep, those were the good old days. Then the amateurs long distance record depended on the fellow with the heaviest powered transformer, the largest helix and aerial, and the ability to stretch things to twice their normal length. Audions were unknown, rotary gaps were regarded with distrust and with due respect of their ability to sling plugs like a rapid-fire cannon, some fellows still swore by carbonium, and the happy amateur who could scrape up enough wire to make a twenty strand antennae was looked upon as a leading light. The more junk on the table the better, and an amateur with six hundred switches, buzzers, sounders, relays, medical coils, motors, electric lights, ten detectors and five different aerial connections held front rank as a scientist. It looked well, and the uninitiated wondered what it was all about. Alas, no more. Audions replace mineral, the quenched gap has crowded the rotary to some extent, and from the noisy damped spark to the quiet arc is but a short step. The amateur who worked three hundred miles with another amateur in the old days was either a wonder or a liar; now one hardly boasts of three times that distance. Helixes two feet long with fifty turns no longer adorn the average equipment—the radio inspector has seen to that.

So have the old days passed. And probably ten years from now, the wireless art of today will be looked upon as the antedeluvian period, and the ambitious amateurs will be planning a relay to Mars. Who knows?

American men form a Relay League
Manned to outwit and prevent intrigue,
Each doing his best, as in him lay,
Receiving and sending at close of day,
Improving himself and giving news,
Careful to send subscription and dues,
Always remembering that interest will
show
New ways and means that are good to
know.

Radio travels where wires cut down
Arrest and delay from town to town,
Doing a work that is safe and sure
In guarding against the evil-doer,
Offering chance to resist surprise—

Relay stations opening wide their eyes—
Everyone warned in time to prepare.
Let all combine to do their share
A well-lined net to cover o'er
Your country's map from shore to shore.

League work is pleasant pastime, when
Earnest endeavor leads its men,
Accomplishing what 'twas meant to do,
Giving fresh lists who are sure to put
through,
Uniting in bonds that never will cease,
Each and all pledged to preserve our
peace.

Contributor.

Department of Defence

By Edgar Felix

AN analysis of the private radio stations of the United States based upon the Official Call Book, shows with amazing clearness the possibilities of the amateur stations in radio defense.

A compilation of this year's official figures shows that there are now 5,425 licensed first grade and special amateur stations. This includes only the stations that have official calls, and there are numerous low powered stations which can be utilized for military purposes which are not included in this figure.

These stations are distributed as follows:

District	Regular and Special	Special
First	858	26
Second	859	23
Third	813	14
Fourth	104	2
Fifth	124	18
Sixth	655	19
Seventh	208	12
Eighth	996	32
Ninth	808	41
	5,425	189

Regular stations, without special, 5,236.

Stations Where Most Needed

The strategic center of the United States—a triangle reaching from Boston, Massachusetts, west to St. Mary's, Ohio, then southeast to Newport News, and north again to Boston—is most abundantly supplied with private radio stations. This belt, although but 3½% of our continental area, includes 50% of all industrial establishments, 44% of our factories, 42% of our industrial capital, and produces 50.3% of the nation's products.

This region would be the objective of an enemy aiming to cripple the country's resources. The large proportion of our wealth and industrial resources, as well as its military importance, makes the matter

of communication of paramount importance.

In this district there are 3,500 licensed stations, or about 64% of the total of the United States. This invaluable source of communication should not be overlooked by the War Department officials.

Amateur Stations Can Supplement Government Service

The conditions existing in the War Department Radio Service would make amateur stations very helpful. For instance, there are no means of communicating through army stations from New York to Newport, Rhode Island, without relaying through Navy stations.

As for the Mexican frontier, there are several stations of very high efficiency, which could take care of a small volume of traffic under good conditions. The situation is not as promising here as it is in the East, but great progress is being made.

Portable equipment for military operations in this district is especially necessary, because electric power is not available in all districts, and long range work is hampered by poor ground facilities.

The army is not well equipped so far as mobile equipment is concerned. With the exception of the modern two kilowatt automobile tractor (call WS) they consist of small pack stations, operated by man power generators, when other sources of power are unavailable. Most of the communication during the Mexican punitive expedition was carried out, not by radio, but by buzzer lines, one of which was 400 miles long.

The Naval Communication Service

As to the naval stations, a glance at the map shows that all of them are located near the coast, with but one or two exceptions. Without adequate aero defense, they are particularly vulnerable, and there is no 'second line' defense with equipment

of this type. They also require some means of handling overflow, such as is sure to occur in time of stress, and private radio stations are once more able to fill this need.

Help sometimes needed by the naval portable equipment was well demonstrated in Stamford Harbor, as described by Mr. Sandreuter in March QST. Mr. Sandreuter was able to jump in and relay ship to shore communication for a landing party when other means failed.

It will be noted that both our coasts are well equipped with private stations. The three west coast states, and the eastern coast states, especially those in the north, furnish a marvelous web of second line communication.

Reliable routes between naval stations, between forts and army posts and between industrial and munitions centers can easily be arranged. It only remains to be proven that the amateur is able to take care of important work.

The American Radio Relay League

The American Radio Relay Trunk Lines fill in the space not covered by Government stations, as well as connecting all the naval centers. With the development of the Transcontinental relay, the weak points are rapidly being filled, and numerous alternatives to the routes are being developed. The absence of local interference makes it possible for the stations which have long distances to cover to handle the situation with some degree of reliability, though a great deal of development is necessary before some of the western lines could be reliable enough to be of value in military service. With the oncoming of our enemy, static, they will be rendered even less reliable, although this does not apply to some of the Eastern lines.

With the development of the trunk line system and the elimination of the very long spans now prevalent in certain districts, an increasingly important function can be filled by our League stations. And this fact is not escaping the attention of government officials, who are not only watching developments, but planning tests to be carried out in the very near future.

What Would You Do If:

Answers have been received to the emergency questions, but lack of space only permits the publication of one of especial merit: that of Mr. E. E. House (8NF), Battle Creek, Michigan. Note especially the treatment of an electric shock. Few amateurs know what to do under these circumstances, and here is your chance to learn.

What would you do if your telephone receivers burned out? "Have an extra set of receivers which can be an inexpensive type, as the 3,000 Ohm Murdock at \$5.00."

If your condenser punctures? "Build oil emersed condensers using copper, brass, or aluminum foil and racked so that when a plate blows, condenser rack can be lifted completely out of oil and new plate slipped in. This can be done by making rack large enough to allow the separating of plates by inserting a putty knife."

"I have one of these constructed and am able to replace broken plate with new one and have condenser in operation in five minutes time."

How To Revive A Person Stunned By Electric Shock

"The means of reviving a person shocked may vary some in actual practice but all amount to the same, viz:—artificial respiration, and the simplest means of producing artificial breathing is one used by the Consumer's Power Company of Michigan.

"Place the shocked person on the floor with head on a coat or some means of support to head, and arms straight above head, face down. Taking care to see that no substance such as tobacco, gum or false teeth are in the mouth. Also see that the tongue is pulled out far enough to allow free passage of air."

"Get down on your knees straddle of patient and place hands on patient's sides in region of floating ribs and press and release pressure at about the same speed as you breathe naturally. Continue this treatment until patient is brought to consciousness.

"Caution. Don't give up treatment for several hours as patients have been revived after three hours time.

"The placing of the hands high above

12,000 Mile Limit for New Radio

America's Greatest Wireless Station to
"Talk" Half Around the World.

San Diego, Cal. The Naval Radio Station at Chollas Heights, near here, recently completed at a cost of \$300,000 and now in full operation, has exceeded in many respects the hopes of its constructors. The largest and most powerful on the western hemisphere, it will be able, it is believed, under favorable atmospheric conditions, to communicate with stations 12,000 miles distant.

Shortly after the plant was placed in commission, and before the sending and receiving instruments had been what the operators termed "broken in," aerial conversations were held with the Melbourne, Australia, station, and the ease with which communication was established gave rise to hopes that Chollas Heights soon will be in touch with points half way around the world.

Establishment of a distant control system will enable the operators at any naval radio station on the Pacific Coast, from Darien, Panama, to Nome, Alaska, to operate the sending instruments at Chollas Heights. This is accomplished by a system of land telegraph lines which in time of war would be under the direct control of the Navy Department.

Following are a few of the interesting features of America's greatest radio station:

The receiving room is absolutely sound

proof, the walls and floors being padded with asbestos. There are four distinct and complete controlling sets in this room, enabling any of four operators, or all four simultaneously, to send and receive messages.

The aerial or antennae weighs 16 tons and has a sag between towers of about 100 feet. The aerial is said to be twice as large as that strung from the Eiffel Tower in Paris.

The helix is 14 feet in diameter and 11 feet in height, or approximately 9 feet higher than the helix used in ordinary naval and commercial stations.

The generator weighs 60 tons, and the three 100-kilowatt transformers 2,800 pounds each.

Approximately 25 miles of piping and copper cable have been laid throughout the radio reservation of 72 1-2 acres. A large part of this area will be kept wet at all times to insure a good "ground" for the huge aerial.

The three 600-foot towers are among the largest radio structures in the world, and are placed in a triangle 1,100 feet apart.

Six buildings, of mission style, form the quarters for the personnel on duty at the station, the sending and receiving instruments and the generators.

RADIO TELEPHONE ADVERTISING.

There seems to be no limit to the new things in radio. The latest is a suggestion which has come to us based upon the De Forest Company's nightly radio-telephone concert which is heard by nearly everybody within a radius of 100 miles of New York City. To those of us who are not within reach of these wonderful telephone waves, it might be well to explain that every night the DeForest Company give a radio concert, tell stories, and in some cases

talk with certain amateurs whom they know are listening. On one occasion, Mr. Godley, the designer of the well-known Paragon Regenerative Receiver which so many of us use, was here at Headquarters, and while listening in at the station of Mr. L. D. Fisk, he was told some news by the DeForest operator in New York.

Recently the DeForest Company have made occasional general announcements

Bethenod Single Wave System Radio Telegraphy

By N. E. Holt

DURING the past three years several Radio Telegraph installations of a novel type have been made on Canadian vessels on the Great Lakes, and although they are the first of their kind to be used on this continent practically nothing has been published concerning them.

Reference is made to the equipments of the Bethenod Single Wave System manufactured by the Societe Francaise Radio

to the ordinary inductively coupled mineral detector sets now so extensively used in commercial stations, the only noteworthy feature being that the inductance instead of being of the usual telescoping tube type, is wound on two box frames which are similar in shape but slightly smaller than the receiving cabinet proper. One of these frames can be lowered or raised inside the other by a rack and pinion arrangement, providing coupling

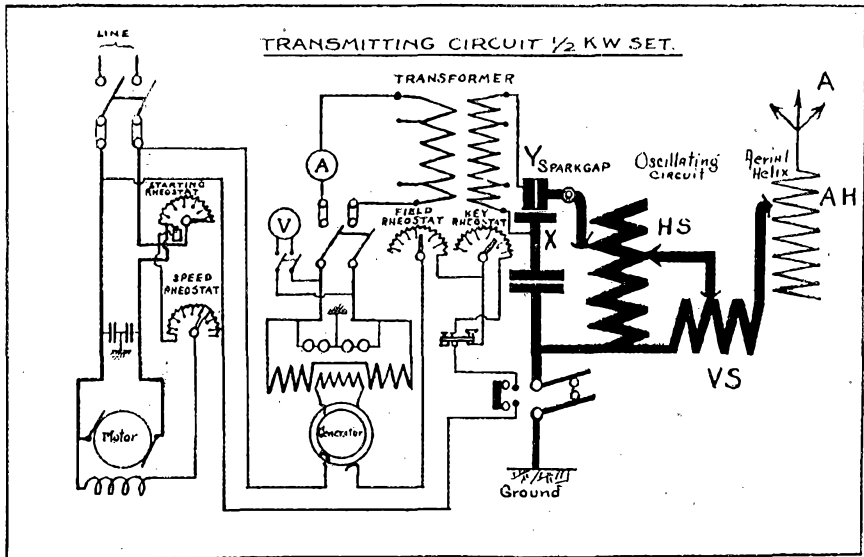


Fig. 1.

Electric of Paris, France. Because of the high efficiency of this apparatus it has been used extensively by the French, Belgian, Italian and other European as well as several South American Governments, and a description of it with illustrations will doubtless be appreciated by the many wireless amateurs and professional operators, in-as-much as it affords material for some very interesting experimental work.

The receiving apparatus is very similar

and the usual taps are taken off the windings to provide adjustment. The transmitting apparatus is however of a very unique design and a more detailed description will be given.

The generating unit, a special 1,000 cycle (Bethenod) alternator is connected through a resistance to an oil emersed transformer having nine variable ratios of transformation. A key is shunted across this resistance and when depressed it is

the combined inductance of the alternator and transformer that enable a resonant

heavy glass and aluminum plates immersed in oil, which in turn discharges across the spark gap and through one spiral of the tuning inductance.

The spark gap is made up of a two inch 18 gauge brass tube placed endwise to a heavy brass plate and the spark occurs from the entire circumference of the nested rigidly as shown in figure 1. This arrangement produces only a single sharp

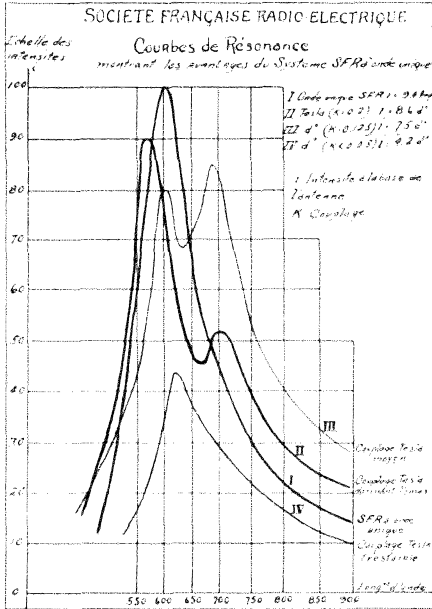
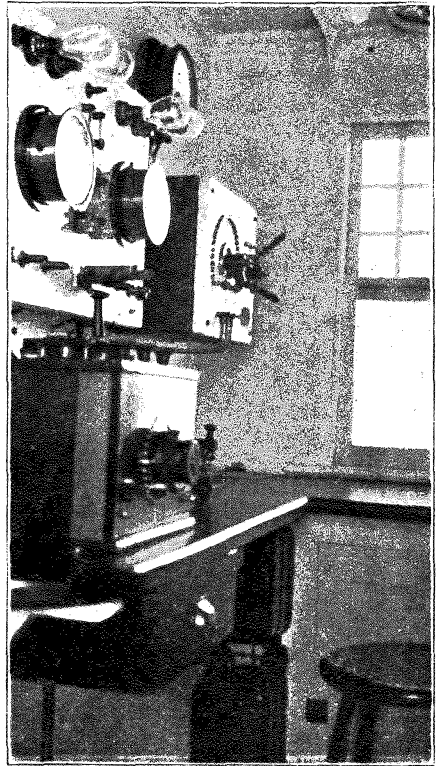
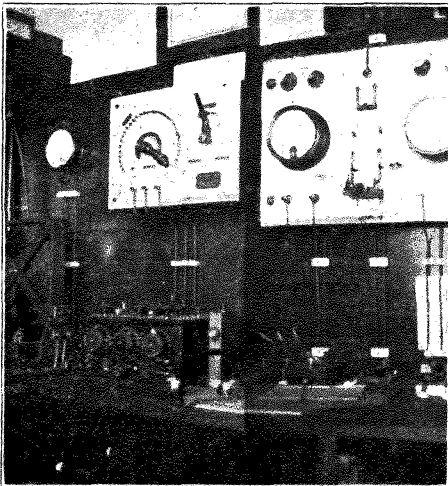


Fig. 2.

signal to be obtained. Proper resistances are provided for both motor and generator fields, and a spark frequency of from 200



Radio Cabin of Steamer Ontario No. 2
Fig. 4.



Practical Installation of the System.
Fig. 3.

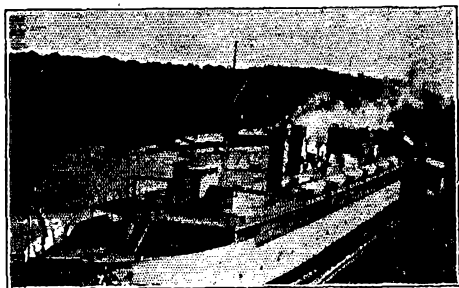
to 2,000 can be had at will. The transformer charges a condenser consisting of

tube to the plate. A motor blower is attached to the opposite end of the tube, and the gases generated at the gap are blown from the gap muffler through a suitable pipe connection to the open air.

The tuning inductance or "Single Wave Oscillator" consists of two brass ribbon pancakes placed at right angles and con-wave, as compared with the various Tesla arrangements (figure 2), and is therefore claimed most efficient.

The necessary meters and switches are mounted on marble panels and a good general idea of the apparatus may be obtained from photos of practical installa-

Feb. 1916 it was only by means of the wireless that help was called and material brought to release the two ferries caught in the ice for two days and two nights.



Steamer Ontario in the Genesee River, N. Y., Port of Rochester.

Fig. 5.

tions as shown in Figures 3 and 4. Photos of several of the steamers upon which installations have been made are also shown, and it is of interest to note that very good results have been obtained on the Ontario No. 2 (Fig. 5) even when lying close up to the banks of the Genesee River with the antenna on a level with the ground. The Ontario Car Ferries have made exceptionally good use of their equipment, and when the Ontario No. 1 on account of an accident had to be towed to the Kingston Dry Dock for repairs in



Radio Cabin of Steamer Rochester

DEPARTMENT OF DEFENCE—continued from page 33

the head is very essential as this brings the chest bones up and causes the victim to inhale while the pressure in the short ribs causes the patient to exhale."

"It is well to have someone hold the wrists to keep hands as high as possible and if no one is available, if a rag or handkerchief can be tied to the wrists and around a table leg to answer the same purpose, is the next best plan."

E. E. House.

One answer to the question regarding the burning out of telephone receivers has been overlooked by those answers received so far. This is the use of the 75 ohm phones used by the Bell system.

Several years ago both sets of phones burned out on one of the smaller transatlantic liners, and the phones from the telephone system on board were used, thus preventing the complete suspension of radio service.

Rotten Tuning

By The Old Man

SAY! Does anybody know anything quite so rotten as the way some of these ginks tune their transmitters? I have been thinking over this QRM business lately, trying to dig out what to do about the blasted thing anyway, and I have come to the conclusion that the big trouble all comes from rotten tuning. For Pete's sake, cannot somebody start something to correct this rotten tuning.

There was a time when my station never had a message stay on the pin longer than two days. When it got to be that long, I used to think it was pretty punk relaying. Nowadays the pin will get choked with messages and ten days will elapse before some of them can be pulled off. I'll be darned if I am not tempted some times to cut out the filing date. It makes me feel like a monkey when I have to send off a message and know for a fact that the fellow who gave it to me to send is listening to me send it a fortnight after he gave it to me. What he thinks of me fills me with concern, to put it mildly.

The other night, I was trying to work a Z station whose wave was on the regular 425 meters, and a certain young squirt some thirty miles away came in practicing the alphabet. That brat sent every letter starting with A and going all the way down to Z, and he followed this with the numbers. He jammed a 425 meter station whose wave was sharp, and absolutely blocked traffic coming my way. This kid's wave was just as loud at 500 meters as it was at 200. After he had splashed the ether all up to his satisfaction, and wore himself out so that he had to listen a while and rest up, I called him and asked him what wave he was using. His reply was, "Blamed if I know O. M., how do I come in?" After thinking it over a minute, wondering what kind of death I should smite him with, I spat on

the cat and told him that he came in all over the lot, that he had busted me for fair and that he ought to get down to his proper wave provided he saw no serious objections.

He asked me what I thought his wave was. I told him he didn't have any such thing, and that it would be interesting from a scientific standpoint to know how he managed to send out such signals. He said to this, that it was a scheme he had worked out all by himself, and it panned out simply great because he had a post-card from a fellow 350 miles away, who said he got his signals QSA. He said the idea was to cut out the oscillation transformer and the helix business, and hook the aerial right onto the condensers. It worked fine, he said.

Gr—r—r! I wish I was a Radio Inspector. I would make it my life's work to ferret that young villain out and after reading him the law about plain antennae and untuned waves, I would make him eat his set before my eyes, and not finish till he had gnawed off his pole at the butt end and swallowed the chips.

When I got through with that little tete-a-tete that night, I took off the phones, put out the bulbs and went down cellar and got the axe, and went at the old boxes. I woke the baby, got into a fight with the wife, and darned near put my eye out with a flying piece of kindling. It seemed to ease me. It's funny how much steam you can work off with an axe and a lot of old packing cases.

When I had calmed down enough to see other colors besides red, I lighted the old pipe and went back to the set. The minute I threw in the bulbs there was 8NH calling me nice and polite like, and putting MSG after her sign-in. Something doing evidently thinks I, and after getting the tune at its best, I went back with a GA. She got me the first clip and started

her No. 1. It was coming clear and fine so I could write it down right on the message blank. I got as far as the beginning of the text when, — CQ CQ CQ CQ CQ CQ from ---- (deleted by censor) over in (some where in North America). He was absolutely killing 8NH, so I opened up the coupling and hurriedly looked for a place where 8NH would come in and he would not, hoping meanwhile I could guess later at what I was missing. But ND. That curmudgeon was loudest everywhere you could tune and all I could do was to tune out 8NH. Well sir, if I could have sent one of those wouff hong things they talk about over in Indiana to that boob and had it timed to explode and knock his block off just as he opened it, I would have done it and smiled an angel's smile at the results. There was a perfectly good msg. coming through in fine shape and addressed to somebody who sounded important, and all knocked endways on account of a rotten tuned spark. Coming on top of what had gone before, it was too much and I spat again upon the cat.

I suppose if you had looked into the situation at that ham's plant, you would have found that a wave meter had never entered the door of his station; that a hot wire meter had taken the same stand in the matter and that the coupling of his O. T. was as close as the construction permitted and that the number of turns of his primary and secondary had been determined by what ever was most handy for the length of leads he happened to find up in the attic. And I'll bet a cooky the spark from his rotary was a long skinny blue thing that ran around three or four inches trying to catch up to the hurrying plugs on his bum old rotor. Dog-gone his pesky set.

I had to swallow it all, however, and when I guessed 8NH must be through, I had to go back for a QTA which I hate and despise to do. It's against my principles to give a long explanation as to why a repeat is needed and this always increases the strain on your temper. After giving a GA from the last word I had been able to get, she paused, and I knew she was thinking it over. Was I good enough or not? But she decided yes, so

back she came. My call all fine, but too many times, maybe, because the air was clear and time precious. Finally she came to the place where I had been QRM-ed before, and by Heck if that gink didn't break in again. Right at the same place! Suffering cat fish!! Of course it was ND, so I lighted the old pipe once more and listened to fourteen rotten CQs and the rest of the hog wash. When he got tired calling and signing and sending DE twice (and darn the man who sends DE twice, say I) he started a msg. Yes, sir, started a msg. on a CQ, and on a wave as broad as the Atlantic Ocean. I was buffalooed for a minute. I thought maybe there was a fire or a flood somewhere and this gink was going to send for help. ND again, however, as was plain the moment he got past his TO. The word which followed was "MISS". That was enough. I knew at once what the message was to be and I wrote it out beforehand. It was: "Greetings by radio. Did you get my letter. Write soon." That's what she was all right, and my log shows it at this minute. I lost the msg. from 8NH and it went some other via, I reckon, because, it never came my way again. And rotten tuning combined with a no account message did it all.

There is no excuse for rotten tuning when you think about it. The trouble is most of the boys do not understand what tuning means. They read Dr. Radio's articles and they immediately go and buy some chicken wire and plant it, and let her go at that. How many of them hustle around and find who will lend them a wave meter, and a hot wire meter? Not one in fifty, by the sound of things every night. And 200 meters? Why man alive, I don't suppose when you get fifty miles from the office of any one of the Radio Inspectors, you will find anyone who ever heard a 200 meter spark. The longest antenna that the house lot will permit and biggest condenser that can be lifted are the rules that govern. And pure wave? You might as well look for pure milk. And decrement? What of those kids want of decrement as long as they can get a post card from the next state telling about how QSA their signals are? Nix on the pure stuff and the de-

crement business. What they want is QSA sigs.

Last week one of these trouble makers called me on a QSR and after unloading something to his girl or his sister or aunt or something or other feminine (it seems to me most msgs are sent to members of the fair sex) he began asking the old guff about how loud he was and what his tone was like. I told him and then he asked for a test. Well, of course, I said yes, I would. Then he began sending 1s and 2s and 3s, etc., etc. 1 was his regular spark, hoarse, windy and ragged like an old played-out foghorn. 2 was ditto, only weaker. 3 was rotten all around. I told him 1 sounded most polite to me, of all the three. Then he said, "Funny O M I can't seem to get my spark good. What can u suggest?"

Well I have a deep sigh, and visions of tuning a set by absent treatment flitted before me. Having been brought up to be mild and meek, with malice toward none, and charity to all, I suppressed a fierce desire to advise a stick of dynamite and instead asked him a few leading questions about his condenser gap, aerial, etc. He explained these and from what he said, it appeared he had a spark frequency about equal to a 500 cycle set, if you went by his motor speed and number of studs in his rotary. His actual tone was a low, hoarse, nameless kind of a thing. I was a bit discouraged, but I kept on. I suggested he might have in too much condenser. He cut some out, and asked how it sounded. It was worse, distinctly worse. I wondered if he had changed his O T turns to match. Then he cut out some more. The result was more awful than ever. Then I suspected that he had not changed his O T after all, and I asked him. No—he had not. Did I think he better? Well, fellows, are you surprised that we have so much QRM when this sort of thing exists in every town and hamlet in the country? I told this young Marconi that his aerial had a natural wave length, unless it was different from any aerial I had ever seen, and that this natural wave should be in his case about 180 meters. Did he know what his aerial was? No, he did not, because

wires and fully four hundred feet long and must be a dandy because it ran from the house to the chicken coop. (Four hundred feet and supposed to be on 200 metres) I never saw his darned old chicken coop and how he thought it made his aerial any better to hook onto it I give up.

His natural wave was probably about 450 meters. How much condenser did he have? 24 8x10 photo plates in oil. Had 30 but they puncture every now and again. Had 24 left. Seven plates would be more nearly what he should have had, to give a wave length in his primary circuit somewhere near 200 meters.

Did he retune every time he changed condenser? Oh, yes, always.

How did he retune?

Asked some of the fellows how he came in.

Did he have a hot wire ammeter?

No.

Did I know where he could buy a second-hand one cheap?

Didn't he ever use even a lamp bulb to get an idea of his radiation?

Yes, but never cud make it wk. O. M.

There is no need to go further. This young scientist did not know anything about transmitters tuning and resonance. He had as much idea of what his wave length was as he had about the design of the upholstering on St. Peter's favorite rocking chair. His knowledge of his primary circuit was about as complete as is mine about the way Solomon in all his glory liked his fish cooked. His idea of how to get his closed circuit and open circuit into resonance and how to tell when they were in and out, was just about as hazy as my ideas on the international code abbreviations used in the hereafter. He needs coaching. He needs kindly assistance with a baseball bat or a wouff hong. He should be made to know and respect the smell of blood and burning insulation. He should have a letter of introduction to some respectable wave meter and he should be left alone some time with a hot wire ammeter. To do these things for him, should be the Golden Wireless Rule of us older bugs. That it will reduce Rotten Tuning and improve conditions is the humble opinion of yours truly.

Reports of District Managers

Mr. A. A. Hebert has resigned as Manager of C and D to become General Manager. Mr. J. O. Smith takes his place. Next month will give details concerning the A. R. R. L. enlargement.—Editor

MONTHLY REPORT OF TRUNK LINES C AND D.

J. O. Smith, Manager.

Although the writer has been handling sections of Trunk Lines "C" and "D" for some time, this is his first attempt to take care of the reports of the entire territory covered by those trunk lines and there may be, in consequence, some shortcomings. Since taking up the work where Mr. Hebert left off (to assume more important duties with the League) the writer has come to the full realization that it is a man's-size job, without much time for play. He intends to work hard, for the American Radio Relay League, first, last and all the time, but he cannot do much alone. He accordingly asks the co-operation of every single League member in the territory under his jurisdiction to help make the League bigger, better and stronger than ever.

It is the intention of the District Manager to appoint District Superintendents, at least one for each state, to represent him in League affairs in the various localities, which will insure closer touch with affairs than would be possible otherwise. The District Superintendents will make reports at least once a month, by the 1st, on the stations under their jurisdiction and supply the material for the general report to be used in QST each month. The District Superintendents so far appointed are as follows: For Boston and Eastern Massachusetts, Mr. Guy R. Entwistle; for Western New York, Mr. Wm. T. Fraser, Buffalo; for Eastern New York, Mr. C. R. Runyon, Jr., Yonkers.

For Pennsylvania, Maryland and Delaware, Mr. Chas. A. Service, Jr., Bala, Pa.

For Virginia, Mr. Wm. T. Gravely, Danville, Va.

The stations in the Second District experienced some very bad conditions during February, but in spite of that a big total in the amount of traffic handled was run up. Traffic arrangements are fast shaping themselves into year-round efficiency, and with the exception of impossible periods it is confidently expected that relay work will hereafter know no seasons.

Mr. C. R. Runyon, 2ZS, reports that his station handled a total of 210 messages during February, 48 of them with 2AGJ, at Albany, some of them during daylight, a distance of about 150 miles. Several First and Eighth District stations were worked. A number of messages were exchanged with 3ED, Philadelphia, about 100 miles, during daylight. A freak condition in the case of Third District stations was noted on the night of Feb. 22, when stations that had never before been heard were easily worked, among them 3SV and 3PC.

Messrs. A. J. Faraon and J. F. Grinan, of 2PM station, report an epoch-making event on the night of Feb. 6. At 1.40 A. M. they heard 9ZF, Denver, call them and say "QRK" and that he was in communication with 6EA, direct and asked for a message. Owing to interference it was necessary to send this via 8JZ, 9ABD to 9ZF, who in turn gave it to 6EA. A reply was received at 2PM at 3.35 A. M. via the same route, and a Transcontinental relay in one night, in fact in less than two hours, over American Radio Relay League

lines, had been accomplished. This wonderful piece of work requires no comment. This great stride forward in amateur relay work over one year ago, undoubtedly due to the regenerative receiving sets now in use and the greater efficiency obtaining in amateur transmitting sets in general, tells its own story. The number of messages handled at 2PM during the month totalled 218. Outside of the Second District, the station worked with 1IZ, 3ATR, 3NB, 3NL, 3ZS, 3WN, 8AFW, 8JZ, 8NH, 8YI, 9ALM, 9DK, 9AU, 9NW, 9WG and 9GJ.

Mr. M. A. McIntire, at 2BO, Brooklyn, kept up the good work during February and handled a total of 124 messages. Some work was done with stations outside the Second District, but most of it was local. Mr. McIntire has been working hard for the League all winter and his efforts are certainly appreciated.

The new line between the First and Second Districts has given two good stations, before this with little to do, a chance to handle considerable traffic.

Mr. Howard L. Stanley's station 2FS, at Babylon, L. I. handled 25 messages during the two weeks of the month, the greater part of it through traffic.

Mr. V. F. Camp, at Brightwaters, L. I., handled 37 messages during the month, also principally through traffic.

Both Mr. Camp and Mr. Stanley have worked hard to make this new line a success and as things are going at present the writer is entirely satisfied with present arrangements. The hard problem of handling traffic between the two districts seems at last to have been solved.

Mr. B. B. Jackson, 2EX, Rutherford, N. J., reports that he handled 29 messages during February. Mr. Jackson brings up the important matter of the use of excessive power by stations when communicating with nearby ones. This practise is certainly a bad one and creates a lot of entirely unnecessary interference. The radio law says that the minimum of power shall be used to insure reliable communication. Some means for controlling this should be part of the equipment of every station.

The new branch line between New York City and Buffalo has been laid out as follows:

Wilkes-Barre, Pa., 8ZS, J. H. Stenger, Jr.

Scranton, Pa., 8TY, Roy C. Ehrhardt.

Binghamton, N. Y., 8WO, Bush Brothers.

Elmira, N. Y., 8ALK, Joel Young.

Geneva, N. Y., 8AJE, Laurens A. Taylor.

Rochester, N. Y., 8ASH, G. W. Finegan.

Buffalo, N. Y., 8VX, William T. Fraser.

Stations at other points will undoubtedly be added to this branch as may be necessary in order to make the gaps short enough to insure dependable communication at all times. There is a large gap to be filled at the Eastern end of the line, between Wilkes-Barre and the Second District stations, and the writer will appreciate suggestions as to how this uncovered territory can be taken care of. Test messages will be started over this new branch as soon as the line is completed between the Second District and Wilkes-Barre.

A reorganization of Trunk Line C between New York and Boston has been effected and traffic is now moving in both directions, due to a shortening of the relays between stations. Mr. Entwistle, of 1JJ, deserves special mention for the amount of interest he has taken in assisting in this reorganization and the enthusiasm of the First district station owners in the rearrangement of the trunk line is very encouraging to the officers of the League.

It is of great importance in the general scheme of relaying that all stations, both on trunk lines and branches, make a definite schedule with the nearest stations each side of them for the handling of traffic. This is something which is entirely up to the individual station owners, but of great importance to the League in that it will insure prompt handling of traffic. It is not necessary to work every night in the week, but it is essential that two or three nights be set apart for this work. The League officers are working hard to make the trunk lines 100% efficient. A definite schedule on the part of individual stations will be of great help.

DISTRICT OF PENNSYLVANIA, MARYLAND, DELAWARE AND DISTRICT OF COLUMBIA.

Mr. Chas. A. Service, Superintendent,
Bala, Pa.

A test to Baltimore took place on March 4, from 12.05 a. m. to 1 a. m., all the best stations in Baltimore and Philadelphia being on the job for the occasion. All was carefully arranged on a regular schedule but although we up here called our heads off for an hour at three minute intervals we couldn't hear a sound from any of the fellows down there, though plenty of other long distance was on. It seems to me that it can't be entirely due to poor sending sets of the Baltimore fellows, for they have been tuning up last few weeks and report working New York and some of the Western fellows, so the facts would point to especially poor surface and soil conditions between here and the south. Not only Baltimore seems isolated from us but most of the other good relay stations all the way down the coast, which the Western fellows have no difficulty in working but whom we seldom hear. In view of the trouble we are having in getting this part of "C" open, I have been on the lookout for an intermediate station between 3FR (Pennsgrove, N. J.) and Baltimore, which can work both at any time of the year, the distance between the two cities being only about 75 miles. Mr. Densten has come to the rescue by offering to find some such intermediate station and if the owner is at all promising to collect enough good apparatus from Philadelphia men who are willing to lend it, to equip a real station which will get things through promptly. This is not at all impractical as there is lots of spare apparatus that the boys would be glad to lend in order to get the route to the South open and keep it that way until Baltimore, gets a big station which can bridge the gap direct to Philadelphia.

So much for our efforts in a Southern direction. Time has been limited and have not had a chance to write all the stations I have in mind, but to date have been occupied with lining up stations of 30 to 60 miles distance in order to organ-

ize them into a chain or series of branches running out from Philadelphia to form a reliable means of communication for summer work as well as winter, for the time is soon coming when static will kill the long distance work and shut down through messages to distant points unless there has been some sort of a system of intermediate stations developed.

At present I have two pretty well defined branch routes from "C" at Philadelphia in mind, one to Atlantic City and the south Jersey coast towns via 3NM, 3NB Vineland, Millville to Atlantic City. We experience exactly the same trouble raising Atlantic City as with Baltimore, the only solution at present being intermediates.

The other branch is to Lancaster, York and westward via Norristown, Pottstown, Reading and Pottsville, which is only a matter of organization of the present stations there now as we frequently hear and work them, though there is no reliable system or schedule of relay work as yet. Have the best stations up that way listed and am going after them without delay.

As to stations now engaged in active relay work in and around Philadelphia the best are 3AEP, 3UF, 3ED, 3ZS, 3NB, only on week ends, 3CA a coming long distance man, 3TQ, 3FR now waking up, 3FK Norristown, a hopeful, and 3NG Trenton, a new arrival who seems to be on the job with the relay work pretty regularly. Have already seen or written some of these about consistent relay work and the organization of branch routes and all are more than willing to cooperate.

DISTRICT OF VIRGINIA AND NORTH CAROLINA.

Mr. W. T. Gravely, (3RO), Superintendent,
Danville, Va.

As a whole the month of February has not been a very good one for amateur radio operation, but the stations in my district have done exceptionally well, notwithstanding that fact. 3SZ has been able to do good work with his transmitter, but not much on the receiving side, on account of using only galena. 4CK, Winston, has done good work and so has 4DI.

REPORT OF TRUNK LINES A, E, AND G

R. H. G. Mathews, Manager.

During the month of February, altho from the radio standpoint, the weather was very poor, since static was bad and the nights have been warm, your manager's two greatest wireless ambitions have been realized. The first of these was the perfect working of all routes. This was accomplished during the latter part of February, when 9XN discovered that he could read 9ZN without difficulty, and in fact, with an audibility of 5,600, and when 5ZC succeeded in getting into regular communication with 6DM, at Pheonix.

7ZH and 7ZC are again in working order, and believe us, it gives us great pleasure to announce, that routes A, E and G are all in working order, and are not only successful in handling one or two prearranged test messages, but are doing **regular and continuous message work.**

A list of Trunk Line Stations on these routes, as they now stand, is given below. The branch routes remain the same as announced in previous issues.

Our second ambition, that of being heard on the Pacific coast, as well as the Atlantic was realized when 7EQ, at Baker Oregon heard 9ZN working 5BV on March 3rd, and reported our signals as being QSA.

We think we may be pardoned for this feeling of pride in this matter, as we are so excited over it that we can't keep it to ourselves.

The routes are all clamoring for business, and the stations clear what little they have so easily that the operators are not even kept up late anymore, so let us practice, and relay a few messages via our routes when you get the chance.

Our old faithful Route A, east, has done valient service this winter, and absolutely all A. R. L. east and west message work, and a large amount of independent work has been handled by it, and we want to take this opportunity of publicly thanking all of the members of Route A for their exceptional work. Especial mention is due Hewitt, at 2AGJ, as his station has been the connecting link between the east

and the west for all relay work, since he works with 9GY, 9ABD, 9ZN, 9ALM, and 9XM, direct.

As an example of how sure our routes are we cite the following:

A message was started from Chicago, via 9ZN about January tenth. It was given to 2AGJ, and was directed to a party who was visiting in New York City. When the message arrived, it was found that the addressee had gone to Iowa. The message thereupon started back, by a different route, and not more than two days after its original transmission, it was again in Chicago, this time 9ALM, who relayed it on to the Iowan city.

It's getting pretty good when we can trail a man like that. In this connection we wish to extend our thanks to 9WG, 9AU, 9ALM and 9WW, all of Chicago, who have handled a large amount of A. R. R. L. message work, altho they hold no route appointments. In this way they have relieved the congestion at 9ZN, and as a result, the message work has been greatly facilitated, in every way.

In closing, we again call your attention to the fact that Transcontinental messages are being transmitted over Routes A, E and G, every night, and we are more than glad to handle any business for either coast.

R. H. G. Mathews, "9ZN"

District Manager.

Revised list of Routes branching from 8NH.

St. Marys, 8NH, Toledo, 8ZL, St. Marys, 8NH, Toledo, 8ZL, Detroit, 8AIR, St. Marys, 8NH, Ann Arbor, 8XA and 8JZ, Lansing, 8OT, from St. Marys, 8NH, Ft. Wayne, 9TA, St. Marys, 8NH, Indianapolis, 9JI and 9PI, St. Marys 8NH, Norwood, O., 8ACK, St. Marys, 8NH, Eaton, O., 8ASG, Norwood, 8LZ, St. Marys, 8NH, Eaton, O., 8ASG, Richmond, Ind., 9APM, St. Marys, 8NH, Columbus, O., 8IK, St. Marys, 8NH, Newark, O., 8ARE, St. Marys, 8NH, Mansfield, O., 8HJ, St. Marys, 8NH, Norwalk, O., 8NN.

There is no 9WF any more.

ROUTE A.

2ZL, J. O. Smith, Valley Stream, L. I., N. Y.
 2PM, A. Faraon, F. Grinan, New York, N. Y.
 2AGJ, J. K. Hewitt, Albany, N. Y.
 8NH, Mrs. Chas. Candler, St. Marys, O.
 9ZN, R. H. G. Mathews, Chicago, Ill.
 9XN, Prof. A. H. Taylor, Grand Forks, N. D.
 7ZC, A. C. Campbell, Lewistown, Mont.
 7ZH, O. M. Heacock, Enterprise, Oregon.
 7YS, S. Ruth, Lacey, Wash.
 7DJ, H. W. Blagen, Hoquiam, Wash.

ROUTE G.

9ZN, R. H. G. Mathews, Chicago, Ill.
 9GY, L. A. Kern, Mattoon, Ill.
 9ABD, W. P. Corwin, Jefferson City, Mo.
 9ZK, A. I. Graham, Kansas City, Mo.
 9EP, G. Wilson, Kansas City, Mo.
 9ZF, E. A. Smith, Denver, Col.
 6EA, Seefred Bros., Los Angeles, Cal.

ROUTE E.

9ZN, R. H. G. Mathews, Chicago, Ill.
 9GY, L. A. Kern, Mattoon, Ill.
 9ABD, W. P. Corwin, Jefferson City, Mo.
 6BV, J. M. Clayton, Little Rock, Ark.
 6ZC, F. M. Corlett, Dallas, Texas.
 6DU, B. Emerson, Dallas, Texas.
 6DM, R. Higgy, Phoenix, Ariz.
 6EA, Seefred Bros., Los Angeles, Cal.

Report of February Tests On Trunk Lines B and F.

Feb., 1, 1917. (Thurs)

Local "QRM" bad tonight.

At 10.55 P. M. we broadcasted relay test msg ("Get this as far as possible.")

6KU (Walnut Grove) called and QSL'ed test msg, then sends same to 6SH (Stockton.)

7DQ (Portland, Ore.) received test msg. from 6EA (Los Angeles.)

Feb., 4., 1917. (Sun.)

Local "QRM" bad tonight. At 10:40 P. M., we broadcasted test msg ("Shoot this message thru swiftly.") 6KU called and QSL'ed test msg, then calls 7ZN (Vancouver, Wash.) and gets QSL on msg. 6AU (San Jose) received test msg. from 6FT (Stamford University). "JS" (Lodi) copied test msg from 6EA. 6FT copied test msg from 6EA and QST'ed same which was QSL'ed by 6AU and 6JZ (Berkeley),

and also gave it to 6SC (San Francisco) in person as he met him at the University. 6AV (Reno, Nev.) copied part of test message from 6ABR (Los Angeles) on account of the latter fading badly. He (6AV) broadcasted test msg which was received by 6NL & 6AT of Reno, Nev., who QST'ed same.

Feb., 8, 1917 (Thurs.)

At 10:35 P. M., we broadcasted test msg ("Please QSR & QSL by mail.") 6KU received test msg and sent same to 7ZN. 9ZF (Denver, Col.) calls us and says, "Ur Nr 1 test msg R, OK;" and then QSR's same to 9XM (Madison, Wis.) 6HH (Sacramento) and 6FD (Phoenix, Ariz.) also received test msg direct from 6EA; 6FD states he has copied several of our test msgs.

Feb., 11, 1917. (Sun.)

At 10.40 P. M. we broadcasted test msg ("Remember Lincoln's birthday.") 9ZF calls us and says, "Ur Nr 1 test msg R—OK," and QSR's same to 9XM. 6AV received test msg direct from 6EA and QST'ed same. 6KU and 6FT received test msg from 6EA, and QST'ed same which was QSL'ed by 6JZ and 6AHN (Alameda) who also received it direct from 6EA. 6FT QSR'ed test msg to 6BJ (Centerville) and 6SC. 6CR (Fullerton), 6AT, and 6HH received test msg direct from 6EA. Feb., 15, 1917. (Thurs.)

At 10:55 P. M., broadcasted test msg ("Please report audibility.") QSL'ed by 6OT (Pomona), 6CR, and 6RG (San Diego) Feb., 18, 1917. (Sun.) At 10:35 P. M., broadcasted test msg ("This is a test for efficiency"), which was QSL'ed by 6OT, 6CR, 6NL, and 6AV. 6NL broadcasted test msg to 7ZN. 6JZ & 6AU got msg from 6FT and later on direct from us when we QST'ed it at 11 P. M. 6PJ (Lemon Grove) received it direct, also 6HH.

Feb., 22, 1917. (Thurs.)

At 10:30 P. M., broadcasted test msg ("Birthday of our first President.") QSL'ed by 6OT and 6CR. 6AU received test msg from 6BJ. 6HH copied same direct from us.

Feb., 25, 1917. (Sun.)

Broadcasted New York Mayor's msg

which was to San Francisco and Seattle, at 11:30 P. M. It was QSL'ed by 6KU, and 6BY (Richmond) who broadcasted same to 7ZH and 7ZN. Also QSL'ed by mail from 6RG.
P. S.

6DM at Phoenix, Ariz., informed us that that he copies all of our test msgs direct from us.

Our relay test msg of Thursday Feb. 1, 1917 was received by 1UN at Middletown, R. I., on Feb. 7, 1917, at 7:30 P. M. (Eastern time), via 6EA, 9ZF, 9ABD, 8NH, 2AGJ, and 1UN.

7AU at Baker, Oregon, reports that he has heard quite a number of our test msgs.

2FS at Babylon, N. Y., reports that he received our test msg of Feb. 1, 1917 on Feb. 8th, at 11 P. M. (Eastern time), via 6EA, 9ZF, 9ABD, 8NH, 2AGJ, 2VZ, 2ZL and forwarded at once to 1PK at Norfolk, Mass.

Seefred Bros., Trunk Line Managers.
543 South Fremont Ave.,
Los Angeles, Cal.

TRUNK LINE "B"

Los Angeles, Cal.6EA
Denver, Col.9ZF
Jefferson City, Mo.9ABD

The following stations are on branch lines from Trunk Line "B".

Pomona, Cal.6OT
Richfield, Utah6AL

BRANCH STATIONS.

Salt Lake City, Utah6ZV
Phoenix, Ariz.6DM & 6FD
Colorado Springs, Col.KIY
Dallas, Texas5DU & 5ZC

TRUNK LINE "F"

San Diego, Cal.6RG
Fullerton, Cal.6CR
Los Angeles, Cal.6EA
San Jose, Cal.6AU
Stanford University, Cal.6FT
Centerville, Cal.6BJ
Richmond, Cal.6BY
Lodi, Cal."JS"
Walnut Grove, Cal.6KU
Sacramento, Cal.6EH
Reno, Nev.6AV & 6NL
Baker City, Ore.7AU
Portland, Ore., ..KDP, 7LF, 7AF, 7DQ and 7PD
Enterprise, Ore.7ZH
Vancouver, Wash.7ZN
Lacey, Wash.7YS
Hoquiam, Wash.7DJ

The following station is a branch off from Trunk Line "F".

Kuna, Idaho7ZR

TRUNK LINE "F"

Rev. Sebastian Ruth, Assistant Manager.

Following is monthly report from our assistant manager for Trunk Line "F", Rev. Sebastian Ruth. It isn't very large, but this is his first one, and the next ones will be still larger each month, at least we hope so. Our first report was just as small.

The stations heard by Rev. S. Ruth of Lacey, Wash. (7YS) are: In the sixth district, 6KU, 6AV, 6RZ, 6SH, "JS", 6AG, 6GT, 6ZV, 6BJ, 6BY, 6WZ, 6FT, 6AU, 6QM, 6FA, 6NO, 6AC, and 6SX. The ones heard the best and are always readable are, 6KU, 6BJ, and 6BY. 6SR was picked up only one evening which was some distance.

In the seventh district the following stations were heard: 7FF, WJ, 7DJ, 7ZN, 7EM, 7DQ, 7DZ, 7WI, 7AG, 7ZR, 7ZH, 7ZC, 7AU, 7AV, KDP, 7GQ, and 7PD.

In the ninth district, 9ZF was copied two different nights.

On the night of Feb., 12th, the Hartford-Hoquiam Relay msg went thru station 7YS (Lacey, Wash.) to 7DJ (Hoquiam, Wash), and otherwise wouldn't have done so if 7YS didn't call 7DJ by long distance phone and get him out of bed and on the job.

During the next few weeks, Rev. S. Ruth expects to make some strenuous efforts to work a line thru from here (Lacey) to Seattle by enlisting a couple of the best Tacoma stations, these with 7ZH who undoubtedly works several California stations will bring the "F" trunk line up to what it should be.

TRUNK LINE "B"

S. Kruse, Assistant Manager.

Abandonment of Tests.

Tests at 10:00 P. M. have been stopped as messages are now being handled in a satisfactory manner with regularity.

The advantage of not tying the line to any fixed time is that more prompt handling of messages is secured as the individual operators may choose their times to avoid local "QRM", and may then work that station which is available at the time,

avoiding tie-ups due to missing stations in a cut and dried system.

Alternate Stations.

For purposes of relaying the following sets of stations act as one station, having agreements whereby interference is avoided.

Group No. 1.

9FW, Cario, Ill., Operators, K. B. Warner and H. F. Moreland.

9NN, Cape Girardeau, Mo., Operator, Harmon Deal.

Group No. 2.

9EP, Kansas City, Mo., Operator Guy Wilson.

9ZK, Kansas City, Mo., Operator A. I. Graham.

9NE, Kansas City, Mo., Operator Wilson Riley.

9LQ, Lawrence, Kans., Operator S. Kruse.

Group No. 3.

9JW, Topeka, Kans., Operator R. K. Trump.

May also be regarded as belonging to this group.

Messages should be given to any member of the group available at the time. If unable to reach the addressee the operator will return the message over to some member of the group whose range is greater in that direction.

Recommended routings for west and south bound messages from eastern points.

West bound from—Ohio and the East—8NH or 8AEZ direct to 9EP, 9ZK, 9NE, 9LQ, or 9JW—thence to Denver via 9JW, 6DM, and 6EA.

Chicago and vicinity—9ZN direct to any member of group No. 2 and west as before, or via 9GY, 9AV, or 9AIM to any member of group No. 2.

South bound from—Ohio and the East—8NH or 8AEZ to any member of group No. 1, thence south as before.

Kentucky and Tennessee to either member of group No. 1 thence south.

Southern route west. During severe QRM, messages may be routed west by first sending south to 5ED at Houston, thence west via 5DU at Dallas, 6DM at Phoenix and 6EA at Los Angeles.

Alternate routings. Messages from Chicago and vicinity may be sent via 9AIM, 9AV, 9GY, or 9UK with certainty, of continuing west or south as outlined above.

Messages to the west coast can be sent via 9JW at Topeka, 6DM at Phoenix, and 6EA at Los Angeles with more certainty, but it is also possible to send them via 9ZF at Denver and 6ZV at Salt Lake City.

Points reached with certainty.

On route proper.	Station.
Cape Girardeau, Mo.	9NN
Cairo, Ill.	9FW
Kansas City, Mo., Kansas City, Kans.	9LO, 9EP, 9NE, 9ZK.
Lawrence, Kans.	9LQ
Topeka, Kans.	9JW
Denver, Col.	9ZF, KIX, 9AMT
Phoenix, Ariz.	6DM
Salt Lake City, Utah	6ZV
Los Angeles, Cal.	6EA
Other points on branch routes reach with certainty.	
St. Joseph, Mo.	9HU
Leavenworth, Kans., & Fort Leavenworth, Kansas	9ALS 9ALK
Houston, Texas	5ED
Dallas, Texas	5DU
Manhattan, Kansas and Kansas State Agricultural College	KS
Points reached with less certainty.	
Wichita, Kans.	9YE
Halstead, Kans.	WB
Receiving. Requests have been sent out to the stations for lists of stations received, but these have not as yet arrived. They will be given in the next month's report.	

Who's Who

Frank M. Corlett

cont. from page 29

letters 5BJ. His signals have been heard in Fargo, N. D., Buffalo, N. Y., Jacksonville, Fla., Puebla, Mex., Phoenix, Ariz., and Denver, Colo. On the receiving side, he has copied KPH, KET, KIE, NPL, NBA, NAW, NAR, NAA, NAJ, WGG, WSL, OUI, and about everything disturbing ether between these, including a very large number of amateurs.

Radio Telephone Advertising

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over their radio telephone to the amateurs of the East, and this at once brought up the question of conducting regular advertising and news talks by radio. It would be entirely practical. The clearness of the present waves is distinctly greater than in the regular wire telephone. The voice is almost perfect and a good speaker with clear enunciation could easily speak to fifty thousand listeners and have every syllable and accent heard. It is decidedly something to think about.

Radio Communications by the Amateurs

HERE'S SOMETHING TO THINK ABOUT.

Dr. A. Hoyt Taylor of the University of North Dakota at Grand Forks, N. D., writes:

"I think you may be interested in some long distance work which we have been doing lately, and might care to make mention of this in QST, because many other amateurs, particularly in the eastern states, ought to be able to do the same thing.

We have been receiving at 9XN the continuous wave German stations for a long time, almost since they commenced to operate. Recently, since the days of good transmission and these winter months have come on, we have been copying the German press sent out between 6:30 and 7:30 p. m., eastern time on 5000 meters spark by POZ. The time signals which he sends on this same wave at midnight, Greenwich time, which is 7:00 P. M. eastern time, come in with an audibility of about 3,000 at 9XN.

There is nothing particularly remarkable about this, since we use our large aerial, the same one that is used for our continuous wave transmission. What I want to report to you however, is that at my own station at home, three miles distant from 9ZN, I succeeded in receiving the press and time signals from POZ 5000 meters spark on a single No. 14 stranded wire, 200 feet in length and 20 feet in average height above the ground.

My home is located on the banks of the Red River of the North. This wire points downwards toward the river bank and the lower end of the wire, that is, the end away from the station, is actually below the level of the surrounding prairie. The end nearest the set is 20 feet above the level of the prairie, and the lower end is 20

This shows what is possible in the way of long distance reception during the winter months of good transmission, and using a modern regenerative receiving equipment I have no doubt these same signals are heard by many eastern amateurs, but they should be much easier to receive in the east since the path of transmission there will be very largely over the sea.

The shortest route from Nauen, Germany, to Grand Forks, North Dakota, passes out of Germany to the north of England, across the tip of Greenland, and enters Canada by way of Labrador, just crossing the tip of James Bay, and enters the United States about at International Falls, Minnesota. You will see that this route is very largely an overland route, and therefore the transmission cannot be expected to be nearly as good as it would be for a route more wholly across the sea. The Nauen press is, of course, sent in German and the strange extra letters in the code are a little bothersome at first.

Some of the readers of QST may be interested in the performance of this regenerative set, connected to such a simple aerial. I carried this set home from 9XN one evening, and had the aerial up and the set operating inside of an hour.

P. S. Am getting many eastern amateurs on this wire also. 2AGJ, 8YI, 8AEZ and many others; not every night of course, but fairly frequently.

We have arranged with 9ZN to relay to us thru 9XM. Have read 9XM on this set at home with aerial lead disconnected, and lying on the floor 4 feet from set." feet above the level of the ground at that point, but the actual height is lower than the level of the prairie.

DOING HIS BIT.

Mr. Earle Godfrey of Atlantic City, N. J., writes:—"It might be of interest to some of QST's readers to know what happened when 3IF was inoculated with the relay bug. During the winter I always operated my station at my home, being very successful in receiving and doing what transmitting I cared to do about town. Then I discovered 3IF listed on Branch No. 2, so I began to tune up. But no amount of trying would get a peep from any one out of town, and the best I did was to stir up some embryo hams. So, remembering how I used to jam WCY on less aerial than I was then using, I got my machine out one night, and piled all my instruments on the seats and flooring, and started off. Already having a receiving station in the Guarantee Trust Bldg. in the clock tower, seven and a half stories above the street, I made for this place, and in less than a couple of hours I was working. I might add that the whole set comprises of about five different pieces. The transformer, condensers, switches, rotary gap and impedance coil as one unit, receiving set, storage battery and oscillation transformer made up the other. So with aerial and current at hand, things were soon flying.

3UZ, Wildwood, was the first one I heard and I went after him. To my delight he came back and said I came in very good on 200 meters. I was told to bk while he answered 3CY, Delaware, who reported I came in there fine. This was very encouraging indeed, as these stations are on my branch.

The only remaining gap is now from the shore to Philadelphia to connect us with the rest of the world. To this extent, we are no better off than before, excepting the possibilities for success are better. 3UF, Philadelphia, is the only one from there that I can hear, but I am sure I will be able to make it with him. A great drawback in Atlantic City, is the WGG station. While he sends on very long wave and with an arc on 100 meter to 200, he makes a wonderful 60 cycle quench. To say nothing of trolley line outside, dynamos and telephones about the building.

My operating hours are from eleven to twelve p. m. most every night. This for two reasons: to get clear of spark coils and avoid clashing with Bell Telephone Co. which has phones in the six hundred and some offices. To make matters worse, I have to walk down seven and a half flights of stairs, as the elevator does not run after twelve. Then begins the half mile walk home in the cold morning air.

By unanimous request, I now give the high power signal (- - . . - -) although I only have $\frac{1}{4}$ k. w. F. B. Chambers make. This was occasioned by the fact that two members of our association had their detectors burned out. Although silicon, they were killed. If I can only discover a way to take all this local fuss and make it reach Philadelphia, all is settled.

I would greatly appreciate it if any one hearing 3IF would drop me a postal as it will assist me in determining the results of my tests."

GOOD RESULT FROM REGENERATIVE SET.

Mr. Monte Cohen, 2AAR, of New York, writes: "I am writing to let you know I have constructed one of the short wave regenerative sets as described in December QST, and I find that it works very well. Before making this set, the most I heard with my audion was 3WN and 3JE. Now I hear many more three and one stations, but still cannot hear the eight and nine stations. This might be caused by the fact that I made the secondary of the set with thinner wire, No. 28. On the whole, I get wonderful results with the new apparatus, and think it is worth any one's time to make it. QST is fine O. M."

Since the above, we have received the following from Mr. Cohen:—"Since writing you, I have heard a few 8 stations, 8AAK, 8NH and 1IZ, 1BA, 1ZL, 3WN, 3NG, 3AFA, 3KG, and many others. 2ZH and 2SP can be heard forty feet from the phones. I also hear WST and Tampa very good and KLC can be heard five feet from the phones."

FROM KANSAS CITY.

Mr. Guy E. Wilson, 9EP, Kansas City, Mo., writes:- "You speak of the special licensed stations and others being authorized to report unnecessary interference. I have been corresponding with Mr. Mathews, and he and I agree that it might be well to place this authority in the hands of our trunk line stations who are not using "Z" calls, as the special license stations by virtue of their special license, have some authority, or rather they command respect where others do not, and by making the number of stations that will command respect larger, we will naturally eliminate more interference than otherwise. This is just a suggestion, but you may know of some reason why it should not be adopted. Out here we are having good success with local QRM, and now from 10:00 p. m. on, we have very little trouble. But there are a few who persist in talking family affairs and things of no earthly interest to anyone else but themselves. The strange thing too about it, is that most of the offenders are fellows who go to school and get home early in the afternoon, and who talk all afternoon and evening. The fellows who are in business rarely ever do local work at late night.

I am glad to hear that the League will be open to wider possibilities soon, and if the present policies are continued, (and they are what makes the League successful) and we can reach a greater percentage of the amateurs, it will not be long before we will soon have all the amateurs where they will all be spoken of as accomplishing great things, rather than as useless QRM, as they might well have been spoken of four years ago. I can see the growth of the amateur begin with the advent of the A. R. R. L., and more so since QST entered our homes. In the magazines of no other organization do you read of their members accomplishing what we do. They print pictures of sets whose owners point with pride to the fact that they hear NAA time signals and which is no achievement at all. But when a fellow turns in a list of 100 to 150 amateur stations, some of whom are 1,000 or even 1,500 miles away, I would say that is an accomplishment that is worth while and comes only after long time spent in work and in studying how to get the best results."

HOW MANY HAVE TRIED THIS?

Mr. T. J. M. Daly, care of Gulf Compress Company, Memphis, Tenn. writes us:-"You have no doubt heard the joke about wireless being received on an aerial composed of a tack sticking in the wall, and a wire running from it to the receiving instrument; with a flower pot filled with earth for a ground. The joker did not realize he was predicting a near possibility. The flower pot for a ground, of course, is absurd; the tack aerial is not so bad.

I have designed and built a receiving instrument, which, with the use of only one vacuum valve, I am able to read stations from a distance of 600 miles and more, without any aerial whatsoever. In fact, there is nothing connected to the aerial binding post, neither is there an aerial within a mile of my residence. All I use is a ground which is connected to a small piece of iron rod sticking in the ground.

As evidence of the work I am doing with this instrument, I give below a list of the ships and land stations from which I have received signals,—on the night of Feb. 7, 1917—the signals being sufficiently loud to read every word. The stations are: NAS, WIH, LDH, WPD, WIV, KSB, XXB, KIC, WHK, WNU, KDD, WHA, WRU, KWM, and others whom I did not hear sign. On the night of the 6th, I was able to read WRU with the phones two inches from my ears. On the night of the 8th, I was able to read NAR on his undamped set, who is about 900 miles from me, and the signals came very plainly without any aerial. Last night, I heard several additional stations to the ones included in the list, and among them was an amateur station, 9YA.

You will agree that it takes very delicate work to even get a commercial station without an aerial, when covering a distance of over 600 miles, but to get a station with such small power as amateurs usually have, it is much harder, therefore I do not get many of them when not using an aerial.

I will be glad if you will inform me if work of like character has been carried on by any one else."

EDUCATE QRMers

The way the last couple of issues have thrown it into the "poor kid with a spark coil" has aroused my sympathy to a great degree. I'm all worked up over it. Also, I realize the necessity of exterminating the QRM he causes. Therefore, a plan:

Why not, instead of planning to wipe the poor "Kid" or other QRMers off the map, try to extend the League so as to take them all in. While it may be argued that this is a league organized for the purpose of relaying only, there are a good many stations and operators now enrolled who never have, and never will perhaps, relay a message, and whatever we do toward bettering the QRM condition is all in the interests of relaying. So, why not arrange matters so that these stations could be a part of the regular League machinery; helping its work as much as the mainstays of the trunk lines.

This could be done in a number of ways, my suggestion being to divide the league stations in three classes, in some such way as this:

1. Trunk Line Stations, as appointed by the manager, as usual.

2. Stations with fair power and fair operators who could act as seconds when the main stations were not on the job.

3. Spark coil amateurs and poor operators, who, when once enrolled, and inoculated with the germs of the relay bug, would be willing to give the relayers full sway after a certain fixed hour. They could also handle local work, thus giving the others a chance to concentrate on long distance stuff. The membership of the League should do all they could to help each other in perfecting their operating and efficiency, and make it interesting to all.

Trusting that this may be useful to you, and that I am not boring you terribly by not practicing what I preach, and QRMing your mail, I beg to remain,

David G. Carter.

REGENERATIVE SET

Mr. W. P. Ostrehout, Manager, Pittsburg Wireless Equipment Co., Ridgway, Pa., writes: "I have just come in from the testing station, after being out there for possibly an hour, in which time I have heard the stations listed below. These were received in about a half hour's time, as the rest of the time I spent in making a test with FH at St. Mary's, Pa.

This receiving was done on a short wave regenerative set, which is constructed after dope in the Feb. QST. I want to tell you that before we put in this set, we could not do a thing after 5:30 p. m., when the arc lights came on, as the new power plant here uses a Mercury Arc Rectifier, and the induction is bad. With the new set we have no induction at all, and the air is as clear as a bell, except for the continual jam of amateurs.

In your last issue, I noticed that Mr. Tilley of Austin, Texas, with whom I am acquainted, has the same trouble from arc line induction, and I am of the opinion that a statement to the effect that it may be eliminated with this type set would prove of value to QST readers.

We have built our set into a panel with a three step amplifier. But we used no amplifier this evening to copy the stations listed.

1PC, 2VF, 8IQ, 2DA, 9BM, 9UH, 9KC, 8TD, 8ARN, 9AWI, 9AN, 2FL, 9KQ, 8RE, 8OT, 8TD, 8CS, 8MZ, 9ZL, 9KV, 9XN."

FROM 9AAR

Mr. Harold Burton, of Indianapolis, Ind., writes:

"Enclosed you will find list of stations I have heard. It may interest them to know they are being heard outside of their home town.

IZL, 2JU, 2LK, 2ABG, 2AGJ, 4AC, 4CL, 4DG, 4ZI, 5AM, 5BV, 5DU, 5AX, 5BB, 5ZC, 8CL, 8AEZ, 8AOI, 8QR, 8CR, 8QK, 8XA, 8AWA, 8JA, 8ACK, 8YL, 8YO, 8CS, 8GL, 8PA, 8AOK, 8NP, 8NH, 8ARH, 8AEH, 8AHK, 8EM, 8VX, 8JX, 9GJ, 9LR, 9HY, 9DB, 9ABD, 9JC, 9MY, 9MQ, 9NT, 9RD, 9AHR, 9ZL, 9ZN, 9ME, 9UK, 9NU, 9SP, 9EP, 9AMY, 9DM, 9BA.

If anyone hears 9AAR, please let me know it."

AGREES WITH THE OLD MAN.

Mr. Robert Leary of Buffalo, N. Y., writes:—"Having received both the January and February numbers of your magazine within the last few days, I have recovered to a great extent over the initial "Peeve" at not getting them. Of course, you realize that when someone has something good coming to them, they ARE apt to get peeved when delayed in getting it. I can only add my word of praise to that of other writers in complimenting the editors on the Purely Amateur Magazine, which is filling a long looked for desire.

I was especially interested in the article of Mr. Vernilya, as I am a Western Union employec, breaking into the telegraph game through the medium of Wireless back in 1910. I became discouraged at the passing of the radio laws, long distance work then being confined to listening to Cape Cod and Hatteras, Atlantic City, and Norfolk. Working amateurs outside the city was an unthought of possibility. Since coming back to the fold and finding QRM conditions such as they are, I am sure all amateurs who attempt to do any relay work at all are doubly grateful to QST for the efforts being made to regulate this trouble.

It would seem that "The Old Man" has the right solution for the trouble in hiring a Plug Ugly, and a crabby letter writer to quiet some of the QRM, though I fear that letters would have little effect on some of the "Spark Coil" stations. Nor is the trouble confined to coils.

FOR CRYSTAL USERS.

Mr. Harold B. Rex, of Bethlehem, Pa., writes: "There are many amateurs who have not enlisted in the army of audion users who may find that after using the same hook-up for a week, or a month, or year, they do not get signals as well as at the start. This applies to those whose crystals are exposed to dirt and dust from the atmosphere, and washing in carbon bisulfide is a good way to clean them. However, I have found that an ounce of prevention is worth a pound of cure

(washing). I simply run the catwhisker through a small piece of absorbent cotton and let it touch the mineral in the usual way. The extra added weight will cause no difficulty in operation. With one of Bunnell's crystal detectors, signals come in as strong today as they did a year ago."

BALTIMORE RADIO ASSOCIATION.

We trust the following suggestions may be of some use to you and our readers in the most serious and important question of local QRM.

After going over the ground thoroughly, our Association and its Board of Directors, have set forth a few good rules, which up to the present time, have been followed out with much satisfaction. We have set aside two nights a week, for serious relaying and long distance communications, from 8:00 p. m. on, and any member, willfully or otherwise, operating his set on these nights, except for relay work, should be and will be rejected from the Association.

After considerable discussion on this matter, it was decided that Wednesday and Sunday nights would be set aside for this work, also every night after 11:00 p. m. This gives the fellow with the spark coil, and the man with the inefficient transformer, a chance, as they have from 8:00 to 11:00 every night except Wednesdays and Sundays. This rule allows any station to attempt long distance on any night other than the two nights mentioned, but at all times, stations working long distance, shall give the signal "C" for "clear," when he has finished his work with the station with whom he has been working.

We think we could have made no better rules than the above, as it gives all an equal chance, and for the past week, the scheme has been working with promising results for the future.

We sincerely trust that these suggestions will be of some benefit to the amateurs and readers of our magazine, and hope you will allow us to benefit by any suggestions which you or your co-workers may have in mind or have actually carried out.

FROM ONE OF THE PRIZE WINNERS.

Mr. F. F. Humphreys, 2ADC, of New York, writes: "I am writing a late acknowledgment for the receipt of my prize, a type "T" DeForest Tubular Audion. I received the tube in fine condition, and am very much pleased with it. Having now both an Audio Tron and a DeForest Tube, I shall rig up an Audion Amplifier, which will improve my set a great deal.

Allow me to say, that it was not the thought of the prizes as much as the interest of QST for which I worked. All of the subscribers you have obtained through me are apparently well satisfied with the publication, and I feel confident that they will renew their subscription when it expires.

Thanking you for the splendid opportunity which you afforded and wishing you success with future contests and enterprises, I am"

FROM BEYOND BOSTON.

Mr. W. C. Kohl of Melrose Highlands, Mass. writes: "Received my first copy of the QST today and must say it is some magazine. It beats all other wireless magazines on the market concerning amateur news. I especially like the pictures of the amateur radio stations but I would like to see more articles on constructing instruments.

I notice that most of the amateurs who are receiving long distant stations are using bulb detectors. I use a simple galena detector with the ordinary type loose coupler and following are some of the most distant stations I have heard during the past month: 1CM, 1JO, 1ZM, 1IZ, 1ZL, 1ABF, 2VZ, 2PM, 2JU, 2ABG, 2AGJ, 2LK, 2ZK, 2ZV, 3AI, 8AEZ, 8YI, 8YL, 8ZW, and 8KS. 2AGJ comes in the loudest of any having been heard with the phones off.

Wishing the QST the greatest of success I remain,"

Y. M. C. A. RADIO CLUB.

Under the leadership of Mr. E. Hineline the amateurs of Springfield, Ohio, recently organized a radio club which promises to be one of the most successful organizations of that locality. Widespread publicity was given in the local newspapers and it is reported that there are a large number of men and boys who are taking interest in wireless telegraphy. They have erected aerials and provided instruments, but so far have been working at cross purposes with few people to talk to and no organization to further the work, so there is a definite need for a progressive club of experimenters. The members of the club have planned a sending set, capable of sending two hundred miles, and a long distance receiving set to receive all high power stations in this country and Europe. In organizing the club, Springfield becomes a center of activity for amateur wireless. One of the principal objects of the Club will be to teach its members the use of the Continental Code, and Mr. Hineline hopes to interest the Young Mens' Christian Association in the new club and in this way get a large number of boys to participate. The temporary organization which was effected at the second meeting placed: Harold Steadman, President; J. W. Fenton, Vice-President; E. J. Grieb, Secretary; Mr. Baldrige, Treasurer; J. W. Wright, Assistant Treasurer.

MOUNTAIN STATES RADIO ASSOCIATION OF DENVER.

The amateur wireless operators, who form the Mountain States Radio Association of Denver, Colo., met in their Club rooms on January 19th, 1917, and elected the following officers:

President, D. L. Clark; Vice President, B. Cawkins; Recording Secretary, R. E. Robinson; Corresponding Secretary, C. F. Neumann; Treasurer, A. E. Winterer; and Chief Operator, E. R. LaDake.

Meetings are held in the Club rooms on Friday evening of each week to discuss static and other aerial topics.

BALTIMORE RADIO ASSOCIATION

The Baltimore Radio Association was formed about one month ago, the membership is limited to men over 16 years of age holding a First Class Amateur Operator's license or over. The membership to date is 35. We meet every other Saturday night at the rooms of the Southern Wireless Institute, 22 St. Paul St., Baltimore. The object of this association is to promote and advance the science of Radio Telegraphy and Telephony. The officers for the year 1916-17 are; Pres. D. L. Primrose; Vice-Pres. E. B. Duvall; Secretary, C. E. King; Treasurer, R. M. Hart; Board of Governors in addition to the Officers, N. B. Falconer, Wm. Bernhard, J. Nolloway and C. R. Lamdin. The Association embraces all the men in Baltimore at the present time who are anything at all in wireless, and it is a lively, up-to-date concern. We realize that Baltimore has been slow in the development of Radio work, but at the rate we are going she will be on the map in a very short time. A Relay Committee is hard at work developing trunk lines with the west, north and south and in the past week has made fine progress.

Our meetings are devoted exclusively to discussions and lectures by various men of prominence who are inclined scientifically, particularly as to wireless. At the meeting on November 25th, we had with us Mr. O. E. Curtis, senior operator on the SS "Kershaw," M. & M. Transportation Co., who lectured on and demonstrated to us the reception and recording of wireless waves through a mineral detector by means of his "Ionic Relay," an invention of his own. This instrument was demonstrated as a call bell and also reported time and weather from NAA on a recorder. We expect to have a gentleman with us later to talk on the tuning of sending sets and the construction and operation of regenerative outfits.

FORT WAYNE RADIO ASSOCIATION.

The Fort Wayne Radio Association of Indiana began the New Year with the installation of their new officers as follows:

President, G. W. Carter, 9WF; Vice President, Ross Parnin, 9TA; Secretary, D. W. May, 9UH, and Treasurer, F. Hall, AF.

Some very successful meetings have been held since the inactive months of summer. Our best and most looked for talks, are by our President, who, besides giving good talks, has formulas worked out which enables us to find out if we are getting the most out of our transmitters.

In the effort to lessen QRM, a QRM Committee reports at every second meeting, all QRM. Some of our members have long distance work to their credit, 9PC, 9WF, 9VY, 9TA, 9KG, and 9UH.

We will be glad to correspond with other Clubs, to exchange ideas. Address all communications to D. W. May, 9UH, 3021 Hoagland Ave., Fort Wayne, Ind.

THE LOWELL RADIO CLUB.

The Lowell Radio Club was organized, Saturday, Jan. 6, 1917, at the home of Everett E. Taylor, 156 Winthrop Ave., Lowell, Mass. The meeting was well attended and the following officers were elected:

President, E. E. Taylor; Vice President, W. A. Fernold; Secretary, W. H. Carney; Treasurer, C. F. Rogers; Associate Directors, C. H. McMaster, David H. Hanson, W. R. Entwistle, E. A. Scott, and Franklin S. Coppen.

The Club was organized to meet the needs of the rapidly increasing number of amateurs in Lowell, who hitherto have not been represented by an organization, and so have not been able to secure recognition which only such unified standing can bring. The plans of the Club are progressive, and the hustling spirit which is already evident among its members, argues well for its future success.

Correspondence with other Clubs is invited and all interested should address the Secretary, 156 Winthrop Ave., Lowell Mass.

MORE ROTTEN QRM.

Mr. Stuart M. Briggs, of the Brookline Radio Club, Brookline, Mass. writes:

"I wish to report the following as having been received at 1UR; 1DK, 1CM, 1IZ, 2AGJ, 2DA, 2FS, 2ABG, 2DM, 2ZL, 2ZH, 3AVF, 5BV, 5CE, 8AX, 8XE, 8NH, 8IZ, 8XA, 8HQ, 8AEH, 9PC.

With a 1 inch spark coil I have been heard by 1ZJ in Hudson, Mass., 25 miles distant. QRM from spark coils in this vicinity has been so bad of late that undoubtedly I have missed the call letters of many two's and eights. I would just hear the two or eight, and then in would bang some local; call me six times, sign off six times, and then wait for me to answer. I can hear him fifteen feet from the phones as it is. I have yet to miss a night that he does not ask me whether he is QSA. Talk about abbreviations, instead of saying "QSA?" he says "Are my signals strong." I agree with the O M entirely. Rotten QRM.

We have started the Brookline Radio Club and soon hope to have QRM under control. All of those hearing 1UR, 1BA or 1QN, please write to us."

FROM KANSAS CITY, MO.

Mr. Lucas Tylekens, 104 S. White Av., Kansas City, Mo. writes: "The following stations are outside of 125 miles, and were heard in the fall and winter months, QSA:—

5YG, 5AX, 5DU, 5BV, 5QC, 5ED, 5ZC, 8AEZ, 8NH, 8CS, 8JZ, 8YL, 8PZ, 8JA, 9AHO, 9ABO, 9ABD, 9AIM, 9AMI, 9AHR, 9HX, 9GY, 9GJ, 9LR, 9YO, 9CN, 9ZS, 9LM, 9YC, 9YI, 9VY, 9PC, 9NU, 9IK, 9XE, 9CN, 9NN, 9HQ, 9YG, 9MK, 9ZL, 9DV, 9WI, 9RD, 9XN.

Any station over 200 miles hearing 9AGB will do me a favor if they send me a card."

DROP SAFE A LINE.

Mr. E. Windham, 8AFE, of Port Huron, Mich. writes:—"I am sending you this list to please put in the QST. The underlined stations are ones I have either worked or been heard by:—

1ZP, 1VN, 1ZM, 2VZ, 2ABG, 2IB, 2UB, 2AGJ, 2CB, 2PM, 2RL, 2AR, 3SZ, 2JD, 3RO, 3NB, 3TQ, 3RS, 4AA, 4AM, 4DO, 4BE, 5AX, 5BV, 5DU, 5EX, 8CO, 8AOE, 8JZ, 8OM, 8LS, 8QK, 8ARH, 8NH, 8AEZ, 8AOI, 8AHI, 8AOM, 8PK, 8NN, 8ZN, 8KI, 8OT, 8AM, 8ASC, 8BX, 8ABE, 8AEH, 8UP, 8ASG, 8KS, 9TA, 9ZN, 9WW, 9HX, 9GY, 9AAB, 9WG, 9JI, 9BB, 9UK, 9BJ, 9JE, 9AIM, 9PF, 9AAB, 9HQ, 9AEH, 9APK, 9AMI, 9WT, 9ZG, 9DH, 9AAK, 9RD, 9AU, 9BU, 9ANO, 9EG, 9UC, 9ZL, 9PC, 9RC, 9AAR, 9SD, 9MK, 9GC, 9AFE, 9DU, 9ABU, 9LW, 9WF, 9LQ, 9NN, 9VH and many others nearer. Use regenerative audions. Anyone hearing 8AFE please notify me.

FROM INDIANA.

Mr. L. C. Young, 9PC, of Fort Wayne, Ind. writes: "I received the first copy of "QST" and it is now a regular and welcome visitor every month. I think it the best magazine out for Amateurs, and would not miss a copy of it.

The following stations have been copied within the last few months, using a Grebe Short wave Regenerative set.

1ZM, 1ZL, 1ZD, 1ZS, 1ZF, 2AGJ, 2ZV, 2JD, 2PM, 2LK, 2PH, 2RL, 2ABG, 2ZK, 2ZP, 2WB, 2IB, 3ZS, 8AMP, 3SZ, 3RO, 3ZW, 3XC, 3UF, 3NB, 4AA, 4CL, 4AC, 5DU, 5BV, 5ZC, 5AM, 5AX, 5DM, 5AP, 5AB, 5ZM, 3CS, 3KS, 3ADL, 3IQ, 3CL, 8AOI, 8NF, 8VX, 8IF, 8JY, 8AEH, 8YI, 8CO, 8XL, 8XA, 8ASG, 8AMG, 8AAK, 8ZW, 8AFE, 8DN, 8EG, 8HJ, 8ZA, 8PK, 8ZP, 8GV, 8AIR, 9EP, 9NW, 9GY, 9ABD, 9JI, 9GJ, 9ZN, 9WG, 9MK, 9YO, 9AHW, 9ACS, 9MQ, 9GE, 9MG, 9DB, 9EG, 9CF, 9UC, 9MQ, 9AAB, 9IC, 9FW, 9ADT, 9PI, 9AHO, 9BA, 9HX, 9AMI, 9ZL, 9BJ, 9JB, 9PF, 9RD, 9EN, 9DM, 9JW, 9DK, 9LR, 9CP, 9QK, 9TR, 9ZI, 9ZO, 9WH, 9AIK, 9NH, 9XM, 9XN, 9YI, 9YS, WS, LBL.

Have only been on the job about twice a week this winter or would have heard many more stations."

HEARD ON GALENA.

Mr. Alex Lawson, Box 371, R. R. L., Mt. Washington, Mo. writes: "The following long distance stations were heard at 9AMG on Galena;— 9AAB, 9ABD, 9AHO, 9AMI, 9DM, 9FA, 9HU, 9HQ, 9LQ, 9NN, 9QJ, 9RD, 9UK, 9YO, 8AEZ, 8AES, 5AP, 5BV,

5DU, 5YG, 5ZC, 5ZM, KEK, KES, KSG, KNX, KUM, WUJ, WUK and WRU. All are QSA."

REGENERATIVE SET HELPS.

Mr. Albert McKurtey, 825 N. State St., Marion, Ohio, writes: "Following instructions given in the December QST, I have just finished one of the regenerative receiving sets. The first night I used it, I heard the following:—1ZL, 1ZM, 2AGJ, 2YM, 2ZK, 3WF, 4AA, 5BV, 5ZC, 5ZM, and a large number of 8s and 9s.

The following list are some of the other stations which I have heard this winter: 2ZP, 2WB, 2ZV, 2ABO, 2PM, 2JU, 2VC, 2GS, 3RO, 3SF, 4CL, 4CK, 5DU, 5EX, 8VP, 8AOI, 8EG, 8MF, 8CS, 8CL, 8JQ, 8AFI, 8KS, 8SK, 9VY, 9HR, 9LI, 9PC, 9KG, 9UK, 9AAB, 9UC, 9VG, 9RS, 9JI, 9HQ, 9VH, 9WT, 9GJ, 9ABD, 9ACM, 9XM, 9YO, 9ZL, 9ZN, 9ZC and 9PY.

Hoping that these calls might help some in knowing they are heard here, I am,"

HEARD AT 8JZ, CLEVELAND, O.

9XM, 9XN, 9ZI, 9ZN, 9ZD, 9WT, 9AR, 9AAL, 9AH, 9PI, 9AW, 9QR, 9JW, 9QK, 9BJ, 9PC, 9EG, 9WW, 9VP, 9GY, 9DK, 9LO, 9UM, 9WG, 9AFE, 9AAR, 9ABD, 9AU, 9ALM, 9NN, 9AMI, 9PF, 9GJ, 9AKP, 9QY, 9AEZ, 9NH, 9AKM, 9OT, 9ALE, 9QB, 9IW, 9JQ, 9EX, 9DU, 9BC, 9BV, 9ZC, 9CL, 9BY, 9PC, 9UF, 9NB, 9YM, 9PM, 9RL, 9ZL, 9ZK, 9ZV, 9AGJ, 9ZZ.

Signals reported heard at Jacksonville, Fla., by 4EL.

Heard at 9ZN, Chicago, Ill., during February.

1IZ, 1ZM, 1ZD, 1ZL, 2ZK, 2AGJ, 2IF, 2ZL, 2PM, 2ZV, 3NB, 3SZ, 3PC, 3UF, 4AA, 4DI, 5DU, 5AX, 5BV, 5ZC, 5ED, 7ZC, 6DM, 8YI, 8YL, 8VX, 8VP, 8ASC, 8AEP, 8ARH, 8AEZ, 8JZ, 8NH, 8AOI, 8ZJ, 8XA, 8AAK, 8ABE, 8CS, 8AIR, 8JY, 8YO, 8JW, 8LT, 8OT, 8CL, 9GY, 9MQ, 9ZK, 9XM, 9FW, 9ZL, 9TA, 9ZF, 9HX, 9XN, 9ABD, 9JI, 9BI, 9BJ, 9PI, 9WS, 9GU, 9EN, 9KD, 9AMI, 9NN, 9PC, 9VP, 9PF, 9AHO, 9EG, 9ZI, 9EP, 9DK, 9TZ, 9RP, 9LQ, 9DC, 9NW, 9AAR, 9BV, 9WT, 9PJ, 9AOF, 9HN, 9JW, 9SN (Lincoln, Neb.), 9CV (Houston, Tex.) 9PB (Ohio.)

Record sending distance was made with 7EQ, Butler, Ore., March 8, 1917.

HEARD AT 2AGJ, ALBANY, N. Y.

1ZM, 1IZ, 1ZD, 1ASE, 1ZF, 1ABF, 1WE, 1AAR, 1VW, 2ZL, 2VZ, 2PM, 2JU, 2CB, 2XJ, 2IM, 2PH, 2RL, 2FS, 2DA, 2ZK, 2ZV, 3AFA, 3NB, 3UF, 3AEP, 3PC, 3NG, 3SZ, 3ZS, 3FK, 3RF, 3RS, 3ATR, 4CL, 5ZC, 8NH, 8JZ, 8AEZ, 8FZ, 8ZJ, 8AKM, 8JG, 8VP, 8YI, 8YO, 8XA, 8AIR, 8AAK, 8PC, 8AMG, 8ASG, 8NN, 8CL, 8KF, 8ATW, 8CO, 8HJ, 8OK, 8JQ, 8ACK, 8AFE, 8LE, 8ALE, 8AEH, 8YL, 8NF, 8XE, 8NQ, 8QK, 8GB, 9ZN, 9GY, 9ALM, 9WG, 9WW, 9XM, 9LR, 9PF, 9HS, 9DK, 9PC, 9ABD, 9PI, 9VY, 9BJ, 9AH, 9AKP, 9WO, 9QY, 9TM, 9ACM, 9ADL, 9PS, 9XV, 9ZF, 9SZ, 9NN, 9LT, 9MK, 9AFE, 9VK, 9LX, 9HQ, 9QR, 9AU, 9AAB, 9AAR, 9EG, 9NU, 9NW, 9HX. 175 messages handled during February.

Heard at 9RW, Sheboygan, Wis., in addition to those previously reported: 2PM, 5AB, 8ABE, 8AKB, 8OT, 9AAR, 9AR, 9BJ, 9ET, 9HK, 9NK, 9LO, 9PI, 9XN, 9RH. 9RW has worked with 2PM, 9AAR, 9BJ and 9LO this month.

OVER 125 MILES DISTANT.

Heard at 9ZK (old 9MQ) at Kansas City, Mo., during February 1917:

2PC, 9AHO, 9HK, 9WG, 5AB, 9ZI, 9PJ, 9ALM, 5BT, 9ABD, 9VW, 9ABM, 5BV, 9HX, 9FY, 9JI, 5AX, 9ND, 9YA, 9AMT, 5ZC, 9FP, 9ZN, 9TM, 5DU, 9AIM, 9MN, 9AAR, 5ED, 9ALE, 9AAU, 9PF, 5YG, 9YI, 9VP, 9AFE, 6DM, 9ZL, 9JA, 9HS, 9XA, 9GJ, 9XR, 9UZ, 9NH, 9ZF, 9NW, 9MK, 8YL, 9XM, 9BJ, 9AAU, 8CS, 9EN, 9ACS, 9ZO, 8AEZ, 9CP, 9VH, 9OF, 8AOI, 9HQ, 9AMY, 9JO, 8ABE, 9WO, 9AAB, 9ACM, 8AAK, 9AKP, 9RP, 9SN, 8ARH, 9EG, 9KD, 9CB, 8JZ, 9NN, 9YG, 9CH, 9XN, 9UK, 9XE, 9YJ, 9AMI, 9AGJ, 9GL, 9YO, 9RD, 9JH, 9ZS, 9GY, 9PC, 9AGE. Greatest distance covered by 9ZK (9MQ) during Feb. was 6DM, Phoenix, Ariz., 1,100 miles distant.

Stations more than 100 miles distant heard at 8NH during month of February:

1IZ, 1ZM, 2AGJ, 2AR, 2CB, 2PM, 2RS, 2VZ, 2XA, 2ZK, 3NB, 3PC, 3RO, 3TY, 3UF, 3ZS, 4AA, 4AT, 4BD, 4BY, 4CL, 4CY, 4DI, 5AP, 5BV, 5DU, 5ZC, 8AAK, 8AEH, 8AF, 8AGR, 8AIR, 8AKM, 8AMG, 8AOZ, 8ASC, 8ATW, 8CO, 8CS, 8HJ, 8JG, 8JQ, 8JZ, 8KF, 8KT, 8NQ, 8QB, 8VJ, 8VP, 8WY, 8XA, 8YI, 9AAB, 9ABD, 9ACM, 9ADL, 9ADV, 9AEP, 9AFE, 9ANO, 9AIH, 9AIM, 9AKP, 9ALM, 9AMI, 9ARS, 9BA, 9BJ, 9BU, 9DK, 9DV, 9EG, 9EN, 9EP, 9FF, 9FW, 9GY, 9HQ, 9HS, 9HU, 9JI, 9JQ, 9JW, 9KD, 9LO, 9LQ, 9LX, 9NU, 9NW, 9OL.

9PF, 9PL, 9QF, 9QY, 9RD, 9RW, 9TM, 9TP, 9UC, 9VH, 9VK, 9VP, 9WG, 9WH, 9WN, 9WO, 9WT, 9WW, 9XD, 9XM, 9XN, 9ZI, 9ZK, 9ZL, 9ZN, BCH (Battle Creek, Mich.)

Greatest distance communicated during February, Dallas, Texas, 5DU and 5ZC.

During one night alone, February 24, 25, fifty-one of the stations given above were heard.

Mrs. Chas. Candler.

A GOOD SHOWING.

"Stations heard at 8WO Binghamton, N. Y., during last few months.

1ZD, 1ZL, 1DK, 1EC, 1IL, 1MG, 1ZF, 1ZM, 1WJ, 1NG, 1IZ, 1VN, 1ANR, 2YM, 2ZK, 2ZP, 2ZV, 2ZW, 2JD, 2RL, 2CE, 2PM, 2ML, 2UF, 2JU, 2MA, 2NR, 2OJ, 2NC, 2CB, 2IF, 2PH 2IM, 2AIJ, 2IZ, 2AGJ, 2LK, 2ABG, 2KL, 3ZD, 2ZS, 3ZW, 3TO, 3PY, 3NZ, 3NC, 3RO, 3SZ, 3UF, 3IQ, 3AI, 3GS, 3AEP, 3WE, 3RS, 3NA, 3ATR, 4DI, 5DM, 5DU, 8XA, 3XT, 8XU, 8YL, 8YO, 8ZW, 8AOR, 8AGS, 8AHN, 8AIF, 8AIR, 8ALE, 8AOF, 8ASC, 8ASG, 8AW, 8CO, 8ED, 8EG, 8FL, 8GL, 8HJ, 8JA, 8JO, 8JR, 8JY, 8JZ, 8KA, 8KS, 8LE, 8LT, 8NF, 8NQ, 8NH, 8AEZ, 8OU, 8PA, 8PK, 8QE, 8QK, 8SU, 8AAK, 8AJE, 8TY, 8MC, 8PC, 8AQA, 8AEZ, 8HB, 9XM, 9ZM, (9IK), 9XA, 9XN, 9AAK, 9ACM, 9ADF, 9AGF, 9AIK, 9AIM, 9CF, 9DK, 9DK, 9EG, 9EM, 9GE, 9GY, 9HI, 9HQ, 9HS, 9KG, 9NZ, 9OF, 9ON, 9PC, 9PF, 9PX, 9RF, 9TA, 9UC, 9UH, 9VY, 9RC, 9VP, 9GN, 9VX, 9JL, 9ABG, 9HX.

Most of these stations are heard quite frequently and they have to be QSA on account of bad induction and street cars which are very troublesome and last but not least the little spark coils."

FROM ILLINOIS.

Mr. R. J. Iversen of Maywood, Ills., writes: "The following stations have been heard at 9AU since Dec., 20, 1916.

1ZL, 800 miles; 1ZM, 775 miles; 2VZ, 750 miles; 2JU, 750 miles; 3UF, 675 miles; 4AA, 585 miles; 4AC, 675 miles; 5AM, 580 miles; 5ZS, 600 miles; 5BB, 650 miles; 8VX, 450 miles; 9JW, 425 miles; 9AMT, 900 miles; 9ZF, 900 miles.

These stations have been heard in addition to those already published.

9AU has worked 5ED (900 miles) 2AGJ (750 miles).'

Heard at 9ADL during the month of February. 1IZ, 2AGJ, 2PM, 2PH, 2RD, 3PC, 3RO, 4DI, (3CB), 5DU, 5ED, 5BV, 5AK, 5AZ, 5ZC, 8AEZ,

8ARH, 8AIR, 8AAK, 8RS, 8VP, 8NH, 8PA, 8YL, 8YO, 8AOM, 8AEH, 8ASR, 8ASG, 8JZ, 8JX, 8XA, 8ZJ, 9AAB, 9ACO, 9AFE, 9AMI, 9AMY, 9AKP, 9ABD, 9ACM, 9ALR, 9ALM, 9AIM, 9AU, 9CM, 9BJ, 9BA, 9DB, 9DK, 9EM, 9EN, 9EP, 9FW, 9FK, 9GY, 9GV, 9HU, 9HL, 9HS, 9HQ, 9HX, 9AHO, 9JB, 9JL, 9KS, 9KU, 9LE, 9LX, 9MM, 9NN, 9NC, 9NW, 9PC, 9PA, 9PF, 9QY, 9RW, 9RD, 9RP, 9SD, 9TA, 9UC, 9UK, 9VH, 9UT, 9VP, 9VY, 9WW, 9WC, 9XA, 9XM, 9XN, 9XV, 9ZF, 9ZG, 9ZI, 9ZN, 9ZS. All these were heard on a 55 foot aerial using a single bulb.

Sig.

Clarence F. Bates,
Milwaukee, Wis.

HEARD AT 5BV, LITTLE ROCK, ARK.

1ZL, 2AGJ, 2LK, 2PM, 4AM, 4AT, 4BY, 4CL, 4DD, 4DG, 4DI, 4EC, 5AM, 5AP, 5AX, 5BB, 5BG, 5BP, 5BT, 5CQ, 5DU, 5DM, 5EB, 5ED, 5EF, 5EP, 5ES, 8AAK, 8AAR, 8ABE, 8ACK, 8AEH, 8AEM, 8AES, 8AEZ, 8AIR, 8AKM, 8AOF, 8AOI, 8ARH, 8ASG, 8ATW, 8CL, 8CO, 8CS, 8JL, 8JY, 8JZ, 8KS, 8KA, 8LJ, 8LT, 8NF, 8NH, 8NN, 8NP, 8NQ, 8OH, 8OT, 8OU, 8PA, 8TT, 8UT, 8VP, 8VX, 8WY, 9AAB, 9AAS, 9AAR, 9AAU, 9AAZ, 9ABD, 9ABM, 9ABU, 9ACE, 9ACK, 9ACM, 9ACS, 9ACR, 9ADW, 9AEF, 9AEG, 9AEH, 9AET, 9AEV, 9AFE, 9AGB, 9AGH, 9AHA, 9AHO, 9AIH, 9AIK, 9AIM, 9AIT, 9AKJ, 9AKM, 9AKP, 9ALD, 9ALE, 9ALR, 9AMT, 9ANO, 9BJ, 9FP, 9CP, 9DR, 9DC, 9DG, 9DH, 9DK, 9DM, 9DV, 9DW, 9DY, 9EG, 9EL, 9EM, 9EN, 9EP, 9FF, 9FI, 9GJ, 9GP, 9GR, 9GY, 9HQ, 9HS, 9HU, 9HX, 9IF, 9JI, 9JO, 9JS, 9JW, 9KG, 9KS, 9LO, 9LQ, 9LR, 9LW, 9LX, 9ME, 9MK, 9MQ, 9MR, 9NC, 9NE, 9NN, 9NW, 9ON, 9OT, 9PC, 9PF, 9PI, 9PJ, 9QG, 9QM, 9QN, 9QY, 9RD, 9RG, 9RP, 9SD, 9SI, 9SP, 9TA, 9UH, 9UY, 9VH, 9VM, 9VO, 9VP, 9VS, 9VW, 9WF, 9WG, 9WI, 9WO, 9WT, 9WU, 5YG, 5ZC, 5ZM, 8XA, 8YI, 8YO, 8ZJ, 8ZP, 8ZW, 9XM, 9XN, 9XV, 9YA, 9YE, 9YG, 9YI, 9ZF, 9ZI, 9ZL, 9ZN, 9ZG, 9VY, CV, BCH, GH, SN.

The following is a partial list of the stations heard at 3RO during the month of February:

1ZM, 1DM, 2SZ, 2WB, 2DN, 2PM, 2RL, 2IZ, 2AR, 2ZL, 2RS, 2ZB, 2AGJ, 2RR, 2ALD, 2IG, 2ZC, 2ZK, 3UF, 3PN, 3OZ, 3ALA, 3GE, 3SZ, 3TV, 3ATR, 3KU, 4AC, 4AA, 4CY, 4BE, 4BY, 4EI, 4FB, 4BD, 5EX, 5HB, 8NZ, 3ZX, 8XA, 8CO, 8AEH, 8ASG, 8VP, 8CL, 8AEL, 8ANO, 8NH, 8AML, 8CD, 8OT, 8NN, 8TD, 8ACU, 8GV, 8ABE, 8JZ, 8CS, 8AMN, 8AJ, 8NQ, 8AHR, 8XE, 8LJ, 8AEZ, 8GY, 8PA,

8ME, 8DO, 8YV, 8YI, 8ZX, 8MY, 9EG, 9ASG, 9FN, 9ZL, 9XM, 9HX, 9ZR, 9PC, 9OC, 9ZL, 9VS, 9LX, 9AIM, 9ARS, 9ABD, 9NN, 9BA, 9ACM, 5ZC, 9ZL, 9VS, 9LX, 9AIM, 9ABD, 9NN, 9BA, 9ACM, LST, PB. Worked with or exchanged signals with the following: 5EX, 8ZX, 8AEH, 4AA, 2AR, 8CS, 8VX, 8SZ, 8TV and several others.

Report of stations heard up to February 25th at 8SZ; 2RD, 2RL, 2AGJ, 2ZK, 2PM, 2CB, 2ZB, 2DA, 8SE, 8UF, 8ZK, 8RO, 8NB, 8RS, 8XJ, 8NK, 8WP, 8AF, 8IB, 8VZ, 4CL, 4IZ, 4CK, 4BY, 4AC, 8AEZ, 8AMG, 8AEH, 8JZ, 8NQ, 8NH, 8SG, 8ASG, 8YL, 8CS, 8Y, 8CL, 8AEV, 8AEH, 8YH, 8AIO, 8YI, 8NG, 9EG, 9JI, 9GY, 9PC, 9UH, 9WG, 9AIO, 9NN, 9ABD, 9AIM, 9XM, 9PI, 9ANO, 9AAC, 9MG, 9VD, 9AAR, 9ZN.

RADIO CLUB OF AMERICA.

A meeting of The Radio Club of America was held Friday evening, February 16, 1917, at 8:15 P. M, in Room 402, Engineering Building, Columbia University, Morningside Heights, New York City.

Professor L. A. Hazeltine of Stevens Institute of Technology presented a paper on DIELECTRIC LOSSES AND CAPACITY OF MULTILAYER COILS. These exceptionally important and interesting subjects have been given most careful study by Prof Hazeltine.

Following the presentation, discussion was opened, both on this paper and on that presented by Professor Morecroft at the January meeting.

Decision has been made to hold the meetings of the Club regularly on the third Friday evening of each month, July and August excepted.

President, Edwin H. Armstrong; Vice-President, David S. Brown; Treasurer, Ernest V. Amy; Corresponding Secretary, Thomas J. Styles; Recording Secretary, Walter S. Lemmon. Directors, L. Gerard Pacent (Chairman of the Committee on Papers); Frank King (Chairman of the Committee on Affiliation and Cooperation); T. Johnson, Jr., (Editor of Proceedings and Chairman of the Committee on Publications); Paul F. Godley, Harry Sadenwater.

Office of Corresponding Secretary, Room 2121, 165 Broadway, New York City.

Office of the Editor of Proceedings, 17 Third Street, Woodside, Long Island New York.

"LONG DISTANCE WORK"

Mr. Clarence Bates, 9ADL, at Milwaukee, Wis., approximately two thousand miles from Los Angeles, reports that he has heard station 6EA. Quoting from his letter he states: "Although I cannot state exactly when I heard you, I can swear to it that I heard you very clear and distinct, it was some night in the first part of January." "I was surprised to hear your sigs. should carry all that 2,000 miles." "I am using a 200 meter regenerative set, and my antenna is 85 feet high and 55 feet long—"T" type—4 wires.

WHO HEARS 6EA?

During February, station 6EA has been heard by the following stations:

KIY (Colorado Springs, Colo.), KDP (Portland, Oreg.), 9AMT (Denver, Colo.) KPM (Eureka, Cal.), 7ZH (Enterprise, Oreg.), 7AU (Baker, Oreg.), 7DQ and "DN" (Portland, Oreg.), and by the WIM (Str. Northern Pacific) off St. George Reef 250 miles north of KPH, or 600 miles from Los Angeles. Communicate with 9ZF and 7ZN quite often. Also heard by 6AT and 6AV at Reno, Nev., 6FD and 6DM at Phoenix, Ariz., and many others much closer. In the month of February, we have heard and copied 6KU, 6RG, 6SH, 6FT, 6JZ, 6BY, 6PJ, 6BJ, 6FD, 6AV, 6NL, "JS", KDP, 7ZH, 7ZC, 7ZN, 7ZF, 9AMT, 5ZC, and 9XN Communicated with 9ZF one night very easily while only using a straight gap on quarter K. W. We have worked many others, namely, 6NL, 6FT, 6RG, 6KU, 6BY, "JS", who are much closer to us. If anyone hears 6EA drop us a card.

NOTICES.

Station 8ANU, formerly of Buffalo, N. Y., is now located in Washington, Pa. Anyone hearing the above will kindly drop a card to Luther J. Jensen, 114 West Beaux St., Washington, Pa.

Communications for 9PC in the future should be addressed to L. C. Young, High School Bldg., Fort Wayne, Ind.

Contest Scores -- March 20th, 1917

In the two weeks that the March issue has been out, great interest has been shown in the Contest. Entries have come in steadily and a number of the contestants have made good starts.

We would hate to mention the number that have promised us that they would get the Paragon Set. It certainly is worth a lot of hard work and the sooner you get started, the more chance you stand of getting it. "Well begun is half done". Make your beginning now. If you have not been entered send your name in now. Start piling up "safety factor" for the fast work at the end of the Contest. Read over the conditions once more, make up your mind to win a prize. Hard Work does it.

C. Folger Oudin,	Schenectady, N. Y.	246	Leo F. Graveline,	Bridgeport, Conn.
Hoyt S. Scott,	N. Fairfield, Ohio.	96	Geo. W. Greenwood,	Topeka, Kans.
Wm. H. Rocheleau,	Lawrence, Mass.	72	Russell Hall,	Washington, Pa.
G. F. Tompkins,	Hasbrouck Heights, N. J.	66	Oscar Hanger,	Haledon, N. J.
Wm. V. Polleys, Jr.,	Bristol, R. I.	50	Wilbert S. Higbee, Jr.,	Atlantic City, N. J.
Theo. O. Wohlson,	Lancaster, Pa.	48	A. Hirnke, Jr.,	Cleveland, Ohio.
Conant Manning,	Montclair, N. J.	48	George D. Howsare,	Eaton, Ohio.
Justus Agnoll,	Long Island City, N. Y.	48	Clayton Hunt,	Urbana, Ill.
David G. Carter,	Grosse Point, Mich.	36	John E. Icenhour,	Jacksonville, Fla.
Justin Gilbert,	Oklahoma City, Okla.	24	Mosese Jaffe,	Keyport, N. J.
Harold D. Perry,	Brooklyn, N. Y.	24	Ellsworth Johnson,	Minneapolis, Minn.
Alexander Brothers,	Grove City, Pa.	12	Armstrong L. Kern,	Mattoon, Ill.
Gerald Bullock,	Kansas City, Mo.	12	Howard Kerstetter,	Toledo, Ohio.
Stewart E. Carter,	Hollywood, Cal.	12	Howard Klang,	Erie, Pa.
Fred Caldwell,	Cincinnati, Ohio.	12	C. A. Lamont,	Tacoma, Wash.
U. Davallo,	New York, N. Y.	12	W. Leathe,	Larchmont, N. Y.
Fred W. Huff,	Kansas City, Mo.	12	Charles P. Leonhard,	New Orleans, La.
Donald H. Jackson,	New York, N. Y.	12	Maxwell Lester,	Summit, N. J.
F. C. Potts,	Sharpsburg, Pa.	12	Carl J. Linxweiler,	Dayton, Ohio.
Francis R. Pray,	Somerville, Mass.	12	Roy Loebe,	Orland, Ill.
Joseph Skliar,	New York, N. Y.	12	R. E. Mather,	Excelsior, Minn.
John F. Tennison,	New Orleans, La.	12	Leo. Niedzielski,	Bay City, Mich.
R. J. F. Freeman,	Southampton, N. Y.	6	H. S. Ogden,	Plymouth, Ind.
Robert W. Cushman,	Brattleboro, Vt.	4	Fred L. Patterson,	Portland, Ore.
Richard Anthony,	Lewiston, Me.		William Perrett,	Pittsburgh, Pa.
Norman Arndt,	Tacoma, Wash.		George J. Pollock,	Philadelphia, Pa.
William Beeken,	Fanwood, N. J.		Donald H. Queeney,	Elmhurst, N. Y.
Harold Bennett,	Freeport, Ill.		C. Rasmussen,	Brooklyn, N. Y.
Harold O. Bixley,	Arlington Heights, Mass.		Henry Raymaker,	Minneapolis, Minn.
Arthur Breisch,	Bethlehem, Pa.		R. E. Rehm,	Kansas City, Kans.
James R. Brewster,	Andover, Mass.		Henry Roehrich,	Garfield, N. J.
Harry B. Carpenter,	Montclair, N. J.		H. G. Silbersdorf,	Jersey City, N. J.
C. T. Caswell,	Framingham, Mass.		Frank N. Smith,	Chicago, Ill.
Carl Dolbeare,	Newark, N. J.		Nathaniel C. Smith,	Peoria, Ill.
Nelson Emmons,	Dayton, Ohio.		James M. Sommer,	Indianapolis, Ind.
John J. Felin, Jr.,	Germantown, Pa.		Laurence C. Thomas,	Moline, Ill.
Harry Fitch,	Newton Centre, Mass.		Morris Tuttle,	Bryn Mawr, Pa.
Ralph Foss,	Chicago, Ill.		Leon Wagner,	Philadelphia, Pa.
Dudley E. Foster,	Newark, N. J.		R. W. Waller,	Cambridge, Ohio.
John Fritsche,	Lafayette, Ind.		Roy Ward,	Bardstown Junction, Ky
George Gercke,	Stapleton, N. Y.		K. B. Warner,	Cairo, Ill.
			Lewis D. Ziegler,	Philadelphia, Pa.

QST Subscription Contest

To many of the most enthusiastic amateurs, first class apparatus is an extravagance. With the idea of helping these amateurs, who may become prominent relayers, QST offers a proposition whereby reliable instruments may be earned by a little work at getting subscriptions. QST subscriptions may be had for the asking. Try it and see.

The one who sends in the largest number of subscriptions before May 19th, receives the first prize—The Paragon Short Wave Regenerative Receiver, valued at \$35.00

The one who sends in the second highest number, gets a pair of Amplifone Mica-Diaphragm Receivers, valued at \$25.00.

The third, fourth and so on up to the twentieth, receives the apparatus listed below. Look it over.

The conditions are not complicated. They are simply:—

1. Send in your name and address and we will send you some subscription blanks. To be entered in the Contest, your subscriptions must be sent in on these blanks. Be sure to write your OWN name on the back of each blank so that we may know who to give credit.
2. To be entitled to any of the twenty prizes, you must send in a minimum of 10 yearly subscriptions or their equal.
3. Any one is eligible, whether a subscriber or not.
4. Twelve credits are given for each yearly subscription. Short term subscriptions are counted in proportion. Renewals count the same as new subscriptions.
5. All subscriptions must be in this office before midnight of May 19th, 1917. If received later, they will not be credited.

Scores will be printed monthly in QST so that you will know how you stand compared with the other entries.

We will be pleased to tell you your score at any time by mail, send you more blanks, or help you in any manner possible. We solicit correspondence with the Contestants.

Address all communications to the Contest Manager, QST Publishing Company, Hartford, Conn.

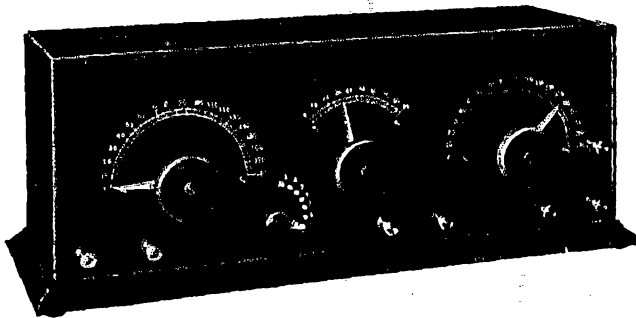
The price of QST is going to be raised to \$1.50 per year starting with the April issue, but subscriptions to be entered in the Contest will be accepted at \$1.00. This fact should aid you in securing subscriptions and renewals, either of which may be entered for any number of years. Use this fact when collecting subscriptions. Every one starts out with an equal chance. The hardest workers will be the winners.

LIST OF PRIZES

FIRST PRIZE.

"Paragon" RA-6 Amplifying Short Wave Receiver. Range 180 to 580 meters—Price \$35.00.

How many times have you had a signal fade out—and tried everything under the sun to hold it just one second longer? How about the stations you have never heard? Stop worrying because the fellow with the big antenna hears them and you don't! A little hard work will get you this tuner and then you will hear everything and furthermore you can "hold" the long distance fellows.



No Tuning Capacities, and No Switches In The Audion Circuits, No End-losses, No "Shorted" turns. Amplifications up to 100 times. Selectivity as great comparatively as the amplification. All amplifications obtained without change of spark tone. Covered by a 2-year satisfaction-or-your-money

SECOND PRIZE.

Mica Diaphragm Radio Receivers, Value \$24.00.

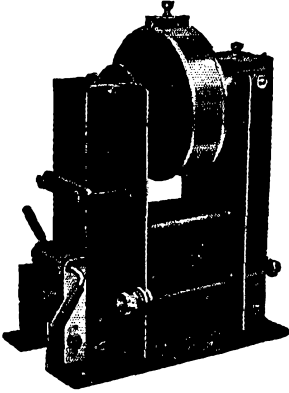
You could not wish for better phones than these—you will not have to wish for them if you have a little pep and a little time.



This receiver is of the watch case form and is especially adapted for service in wireless telegraphy and telephony.

The diaphragm is of thin mica, is very light and sensitive to the impulses from the armature. The diaphragm, armature, link and spring together weigh only a fraction of the weight of the common steel diaphragm.

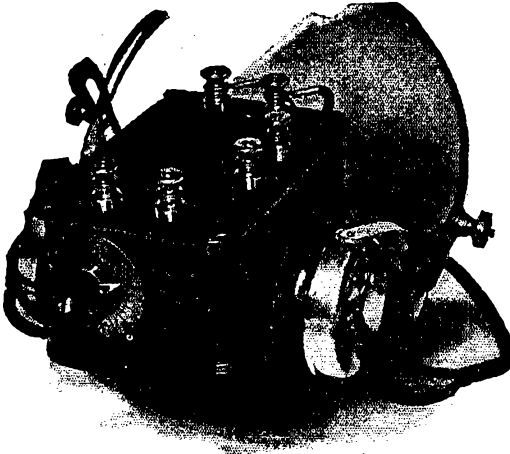
The headband has many special features rendering it self-adjustable so that when placed in position on the head it will remain without slipping.

THIRD PRIZE.**½ K. W. Flexible Wireless Transformer, New Type—Value \$20.00.**

These transformers need no introduction. You could use one. Will you exchange a little work for one?

A Magnetic Shunt Transformer is particularly adapted for wireless work for the reason that it is practically a constant current transformer.

These transformers will make wireless apparatus 200 per cent. more efficient, consume no more power than is absolutely required to produce the best results at the desired regulation.

FOURTH PRIZE.**Multi-Audi-Fone, Value—\$18.00.**

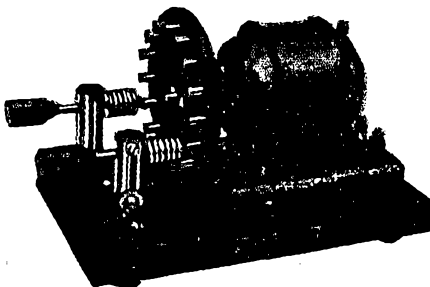
Do you want to increase the weak and inaudible signals?

Do you want to bring in the loud signals with a crash?

If so, you want this M. A. F. Here is your chance to get one. QST subscriptions may be had for the asking. Try it.

The Multi-Audi-Fone is an electro-chemical amplifier that increases damped and un-damped radio signals many times their original audibility with any kind of detector.

This instrument will render audible many stations that you have never heard and wonderfully increases those that are audible but not readable with your present station.

FIFTH PRIZE.**The Radio Rotary Gap—Value, \$12.00.**

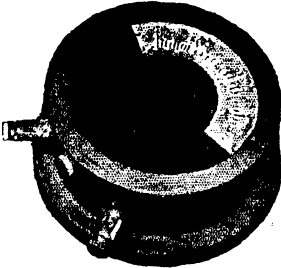
—for use on sets up to 1 KW, sparking points are of brass, aluminum and zinc having been found to wear away very rapidly and also to liberate a gas that is detrimental to its transmitting ability. The parts heavily nickel-plated.

base is of solid mahogany and all metal
A variable speed A. C. 110 Volt Motor revolves the 3¼ inch Bakelite disk carrying 12 studs (16 were formerly used) at a speed of 2,000 to 5,000 R. P. M., producing a clear crisp tone easily read through etheric disturbances.

SIXTH PRIZE.

Precision Hot Wire Meter—Value \$10.00

“What are you radiating?”



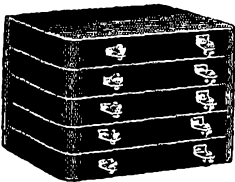
The Precision Hot Wire Meter of the highest grade, the case being of satin finish aluminum, plain glass, black figures on white dial, nickel binding posts, zero scale adjustment of novel design, the case measures 6 inches in diameter by 2 3/4 inches high, and the weight is three pounds. The inductance of the shunt circuit and expanding wire being properly proportioned, the instrument will read correctly on all frequencies. The resistance of the meter is very low in comparison with others of this type. A high resistance meter will so affect your circuit that the fine tuning necessary for maximum radiation and distance cannot be secured.

SEVENTH PRIZE.

Murdock Moulded Transmitting Condenser. 5 Sections

Value, \$10.00.

“Increase your condenser efficiency.”



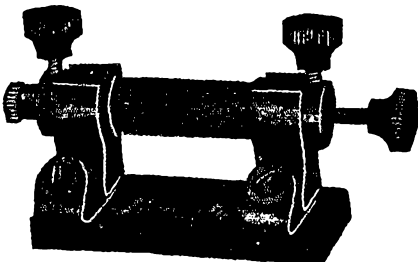
This condenser is made in sections of .002 M. F. capacity each. Size of each section over all, 6 3/8 x 6 1/2 x 13-16 inches. Conductive plates, copper sheet, totally enclosed. Dielectric, special moulded compound. Connection posts, copper terminals with brass nuts. Tunes to 1,600 meters without loading coil, and on a longer antenna to proportionally longer wave lengths.

The strength of the completed section is a decided advantage wherever apparatus is subjected to constant movement or frequent handling. In this connection, it has been found ideal for portable

equipment, where fragile jars or plate glass capacities are frequently found impracticable.

EIGHT PRIZE.

Lenzite Wireless Detector—Value, \$5.00.

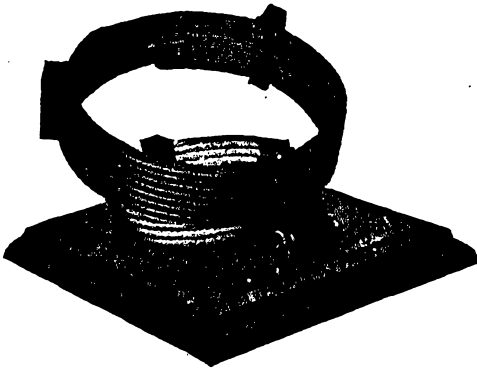


“Lenzite is the best contact crystal detector I have ever tried.” Signed: C. D. Tuska, Editor QST.

Recognized by leading authorities as the most sensitive and most effective crystal Detector existing.

NINTH PRIZE.

Murdock Oscillation Transformer—Value, \$4.00.



This oscillation transformer will afford every private station the opportunity of securing an efficient transmitting tuning device which will permit that sharpness of tune required by radio regulations.

The primary consists of six turns of copper strip and the secondary of nine turns. The secondary is constructed so that it may be moved toward or away from the primary in variometer method. This is a decided improvement over the methods now in existence because this permits almost any degree of coupling.

The base is of mahogany. Size over all 10x7½x3 inches. Four clips supplied with the instrument.

PRIZES. TEN TO FOURTEEN.

Murdock "Fifty-Five" 2,000 Ohms Complete, 5 Double Sets,
—Value, \$4.00 Each.

Detail: standard double pole receivers designed solely for wireless: Receiver cases, moulded hard rubber composition, with exceptionally handsome and lustrous finish, MURDOCK patented SOLID construction, making adjustment correct permanently. Magnets best quality steel in amount sufficient to insure dense and practically permanent magnetism. Spool windings, genuine copper, enamel coated. Diaphragm, wireless type, thin, flexible, non-rusting, correctly adjusted and seated. Cord, five foot length, mercerized finish, best quality. Head band, regular equipment, nickelled German silver, split and adjustable; receivers attached to band by ball and socket joint.

FIFTEENTH PRIZE.

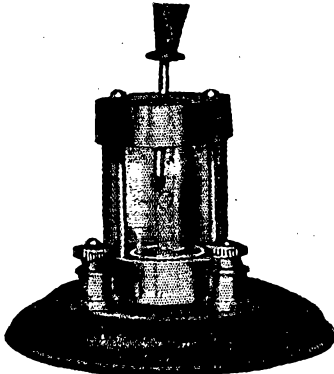
Murdock Rotary Variable Condenser—Value, \$3.00.



This condenser has a capacity of .0005 mfd., and will be found suitable for use as a secondary multiple condenser for the average wave lengths. It is in every way, a handsome, splendidly operating instrument and offers the best value obtainable for the price.

Detail: 11 movable plates, 12 stationary; transparent case; hard rubber, composition top with scale. Size, 4 inches diameter, 2¾ inches high.

SIXTEENTH PRIZE.
M. A. F. Detector Stand—Value, \$3.00.



It is perfectly flexible.
It is air-tight.
It is practically permanent.

The base is of genuine hard rubber and the mineral cup is turned from a solid piece of brass, fitted with our specially designed binding posts, finished in highly polished nickel.

We furnish fuseable metal and an extra sensitive crystal with each instrument. Of course you can fuse in any crystal that you may have if you prefer it.

The M. A. F. Detector Stand is the latest development of a detector stand and has the three essential points desired in a mineral detector, that is an air-tight chamber which will prevent dust from collecting on the mineral thereby detracting from its sensitiveness; also a detector which, while perfectly flexible in its adjustment, is practically permanent when once the adjustment is made.

All of these essential points are taken care of in our new stand.

SEVENTEENTH, EIGHTEENTH, NINETEENTH AND TWENTIETH.
Edelman's "Experimental Wireless Stations" and a one year's Subscription to "QST"—Value, \$2.50.

Edelman's "Experimental Wireless Stations" is written so any amateur can understand it, contains exact dimensions. Tables and illustrations cover all modern Radio Apparatus. Undamped wave sets, audion hook-ups, oscillating and amplifying circuits are all given in detail.

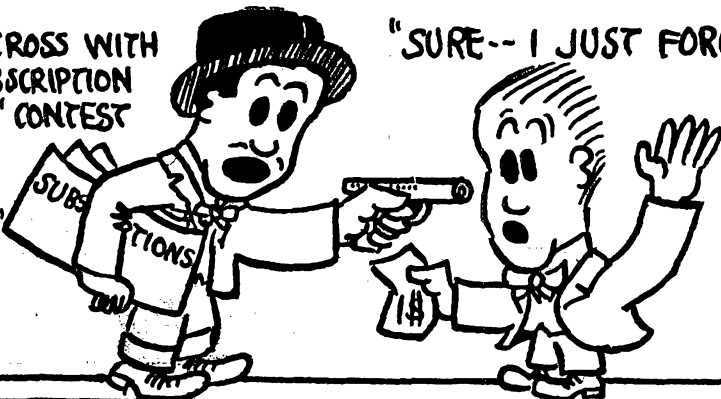


This is the ideal book for the enthusiast, is recommended by us and endorsed by Radio Inspectors. One of the best books of its kind.

"Experimental Wireless Stations"
1916 Edition
272 Pages

Completely Illustrated

"COME ACROSS WITH THAT SUBSCRIPTION QUICK! TH' CONTEST CLOSES TO-MORROW!"

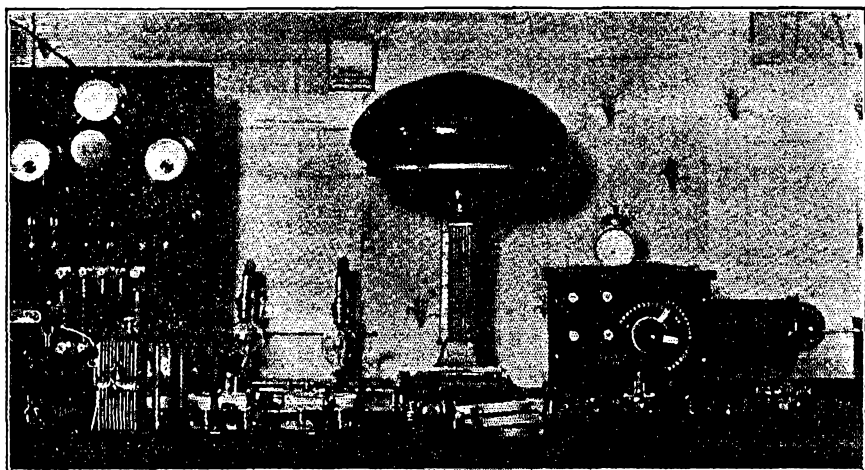


"SURE-- I JUST FORGOT"

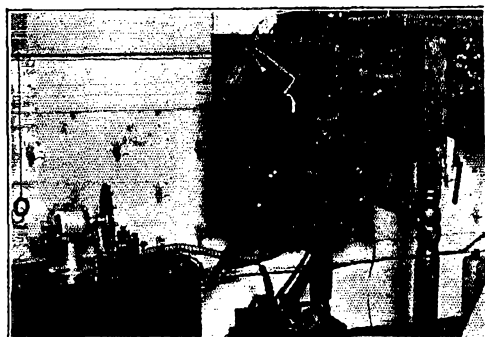
BADU.



A Springfield, Mass., Station



1MO of Springfield, Mass., is illustrated by the accompanying photographs. Mr. Ostrander is the operator. The sending set is a half Kw. Blitzen with eight sections of Murdock moulded condenser. Seventy miles is the present working range. The aerial is only 70 feet long and 36 feet high. One end is fastened to a tree and the other to a peak of the house. 1MO has a new antenna every time the wind blows. The receiving set is made up of a Radio Apparatus loose coupler, audion amplifier and Western Electric Company phones. Mr. Ostrander hears all the western fellows but complains of a lack of first district ones.

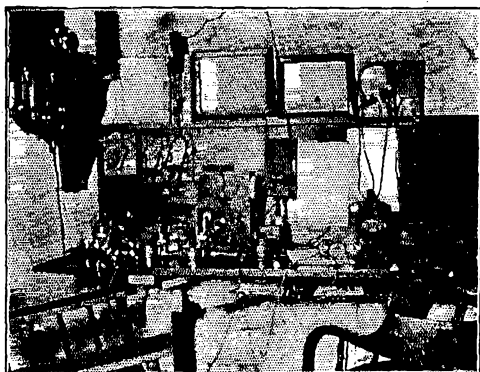
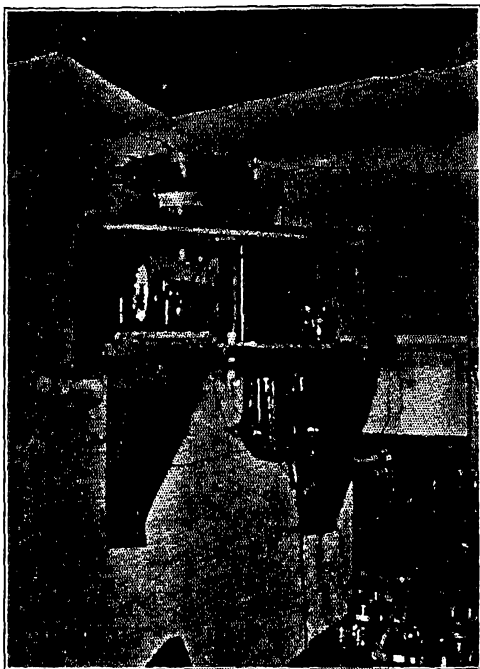


9 A U

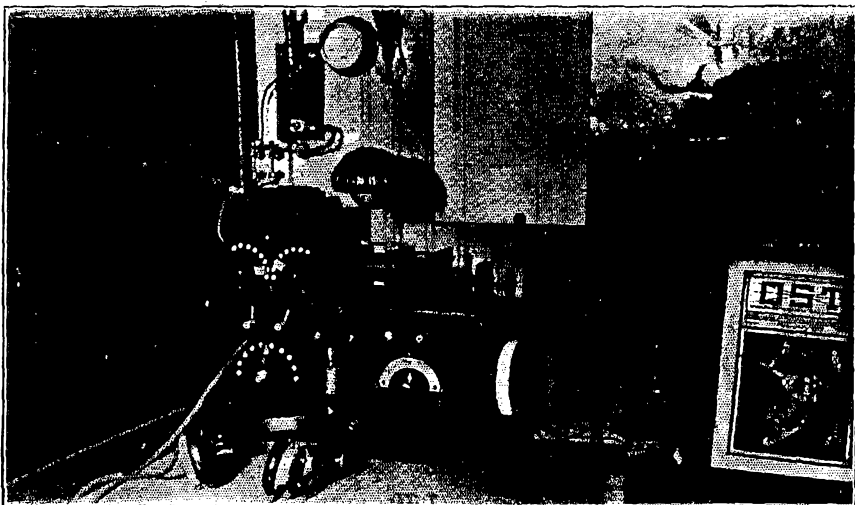
A great deal of relay is handled through 9AU. Mr. Iversen of Maplewood, Ill., is

the operator. His set is composed of the following: Transmitting: $\frac{3}{4}$ Kw. Thordarson, oil condenser consisting of double thickness photo plates and twelve 6x8 copper plates; Klitzen rotary and heavy type O-T. Sending records, 2AGJ, 4AA, 5ED, 5DA, 5BP, or a radius of about 1100 miles.

Receiving: One-step amplifier, Navy type phones, variables, and small 600 meter loose coupler. Changes have been made in the receiving set since this photo was taken.

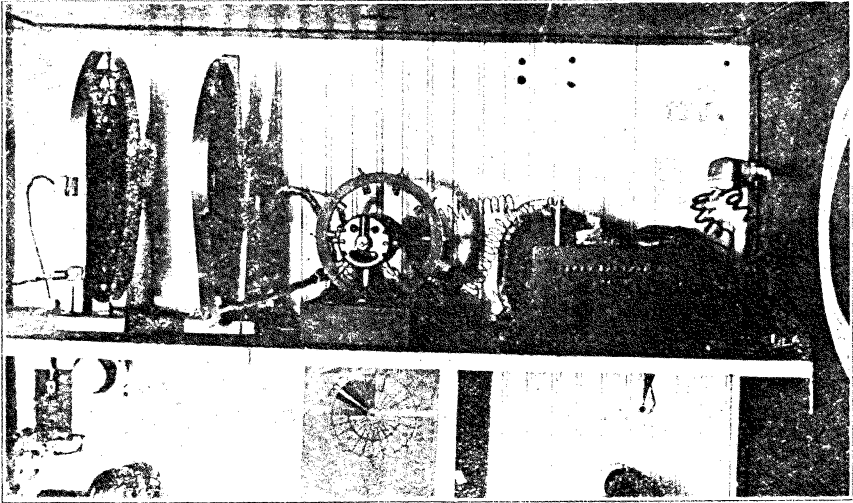


An Indianapolis Station



This illustrates Leo G. Munchhof's station, 9BJ, at Indianapolis, Ind. One cannot help but notice the short heavy leads in the transmitting set primary. This surely has something to do with the 850 mile

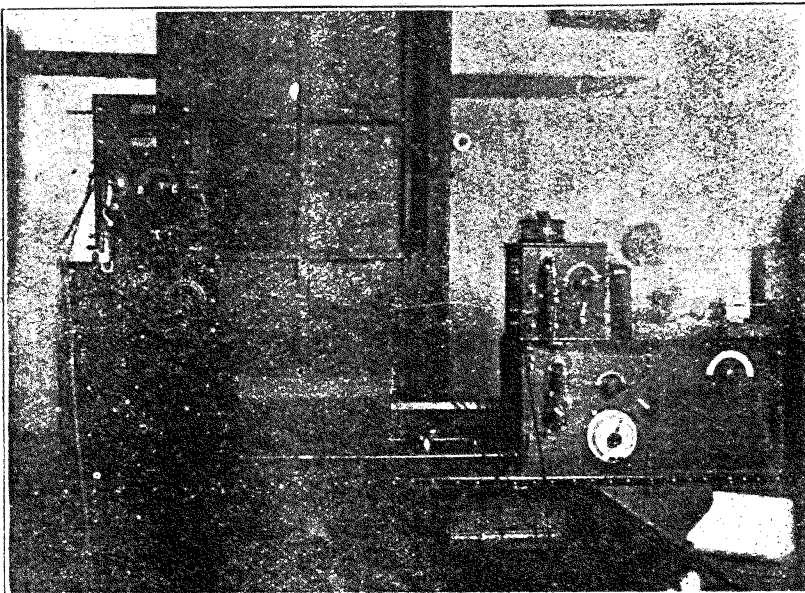
working range which this station has. The transmitting condenser cannot be seen as it is just behind the time chart and under the shelf.



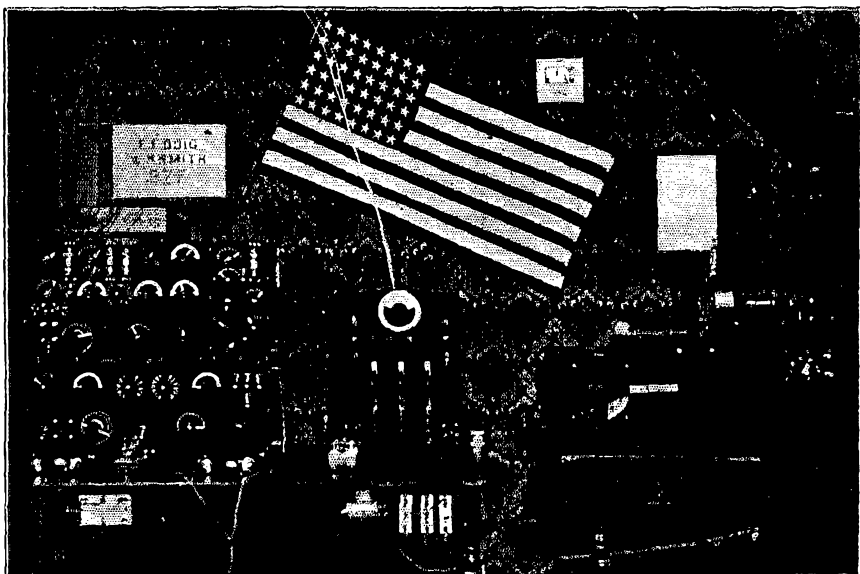
G. L. LaPlant Owns This Outfit

Mr. La Plant of St. Anthony, Ia., has long been a member of the American Radio Relay League. We have been able to follow the improvement of his set and now it has reached a very high state of

development. The apparatus is self-explanatory consisting of a short wave set of the regenerative type and a long wave receiver. The station license is 9KT.



One of the Trans-continentals



This photograph illustrates the link which connects the Atlantic and Pacific Coast by relay. It was through 9ZF that the first A. R. R. L. and in fact, the very first relay reached Los Angeles from New York. A great deal of credit is due the owners of this station. Without them the

message would never have gone through. 9ZF has been heard over a considerable range and we can all get valuable suggestions from the photograph showing the arrangement of this station. The outfit is owned by Smith & Doig, of Denver, Col.

AMATEUR LONG DISTANCE RECORD.

Just as this issue goes to press we learned that J. B. Ferrington of Los Angeles heard 2PM (Faraon and Grinan of New York.) Mr. Ferrington uses an RA-6 Trans-continental for receiving.

Full details of this 3,000 mile record and the apparatus used will be published in the next issue. Watch for it.

One of the Young Lady Operators



Miss Winifred Dow, Tacoma, Wash.
7FG

With a claim to the distinction of being the first and only licensed girl operator of wireless telegraphy in the Pacific Northwest, Miss Winifred Dow of Tacoma Saturday received from the United States Government through the radio inspector at Seattle, the license and authority to operate a second-class amateur wireless station. Miss Dow, though engaged in the study and practice of wireless telegraphy for only a few weeks, has shown such a proficiency in the science that a license was granted her upon her first request.

Of a mechanical turn of mind and displaying an ability to use tools more fitted for a man's hands, she has made a great part of her wireless outfit herself, the efficiency of which is said to show in no

small way her skill in handiwork. The receiving set, which is quite an elaborate affair, is enclosed in a well finished cabinet of slash grained Washington fir. The sending set, though not as powerful as Miss Dow says she would wish it to be, has, however, shown its ability to transmit good distances. The construction of a 1-kilowatt transformer is now her ambition, and with the installation of such an addition to her station her outfit will rank with the best that amateurs are allowed.

Miss Dow became interested in wireless through her visits to a wireless station in connection with St. Martin's abbey at Lacey, Wash., one of the best and far reaching amateur stations in this district, and her insight and understanding of this branch of science, she says, is due to the Rev. Father Sebastian Ruth, O. S. B., operator of that station, who has instructed and helped her in the construction and operation of her station.

Miss Dow is 14 years old and is at present completing the eighth grade in the Visitation Academy. After her grammar grades she will take up a course of science in the high school, in the meanwhile perfecting herself in wireless.

Miss Dow lives with her parents and older sister, Bertha, who has also shown promise of becoming an enthusiastic wireless operator, at 2329 South K street.

The official call assigned Miss Dow is 7FG, the No. 7 denoting the district which comprises the states of Washington, Idaho, Oregon and Montana, and the letters the special ones assigned to her station.



Some Excellent Spark Coil Work in Kansas

By S. Kruse

OF late the spark coil men have not been getting their share of the publicity in QST and as they do not seem to plead their own case I am setting down a few examples of really good spark coil stations.

For the past two years station LEM in North Lawrence, Kansas, operated by Edward McKittrick, has been able to work with 9JW at Topeka at will. The distance is 27 miles and LEM sends with a $\frac{1}{4}$ inch Thordarson ignition coil, input $\frac{1}{2}$ amp at 6 volts or 3 watts, but covers the distance without any particular trouble day or night.

The antenna is a single wire L with the far end 60 feet high and the lead end 30 feet, the top being 140 feet long. Ground connections are made with care to a telephone ground rod, water pipe, and a length of buried wire. Altho a straightaway connection is used the wave is quite sharp and does not cause any amount of interference.

The vibrator is of the usual Thordarson type, having a fixed contact on a short flat spring that is non-adjustable while the moving contact is on the center of the light circular armature. Adjustment is by means of a screw that pries up on the end of the armature spring. This vibrator is as nearly trouble proof as any I have ever seen and operates at a steady high singing tone. At 9LQ $1\frac{1}{4}$ miles away, the signals can be copied with phones 6 inches away, using galena.

Another station in the same class is AT operated by Arno Taylor 10 miles north of Lawrence. This station uses a one inch coil in connection with a sort of miniature NAA antenna hung on three iron pipe masts 60 and 40 feet high respectively. The ground system consists of buried wires. As in the former case the connection is straightaway, and like LEM the gap is set at about 1-30 of an inch and usually less. The spark is hardly visible but the

signals are readable at several Topeka stations, the distance being something over 30 miles. This too can be done in the daytime. This station was erected by the operator about three winters ago and first made itself heard one afternoon when Taylor called HS, 9DM and 9LQ in turn and told us where he was located. The signals are more than readable, they are "QSA very" here. Here too the wave is reasonably sharp tho not as good as in the case of LEM, AT has been heard in Kansas City at 40 miles.

Last year there were in Axtell and Oketo, Kansas, a pair of one inch spark coil sets that spoke to each other at will day or night. Both used L type aerials about 40 feet high and 240 feet long, connected straightaway. The distance is 30 miles.

Some three or four years ago there was a three inch coil in Kansas City which was operated in connection with a commutator in place of an interrupted. It sounded exactly like a perfectly clear quenched gap at 500 cycles and came in QSA here daytimes in July and August. Have never been able to find out who owned the set; possibly some of the Kansas City folks can help on this. The call was "X."

So far all the examples have been of straightaway coil sets. Now an example of a tuned set. About three weeks ago one of the juniors brought a supposedly sick spark coil over to 9DM to have it doctored. I do not believe that much ailed the coil as "HZ" disconnected his Blitzen "ONE" from the condenser, put the coil in its place, called 9EP, got him and worked him without any trouble. This was with the regular .01 mf. condenser and seems to upset the idea that a small capacity must be used. The distance is 38 miles.

It was a Ford coil.

Finally there is the young brother of the spark coil—the buzzer. When I started the radio game there was only one other fellow in town, so far as I know, who had a set. We lived a block apart and the

first transmission was accomplished with buzzers connected straightaway to the family clothes lines. We collected all the dry cells the garages afforded and put them in series. The result at the vibrator contacts was an arc light, but we managed to make our microphone detectors work,

and later when we heard of crystal detectors and began to use Silicon, we were able to work across the town, about a mile or so, with little single wire aerials 25 feet high and 30 feet long. This looks as if a good antenna and an audion ought to enable a buzzer to cover quite a distance.

DeForest Wireless Telephone

ON the evening of January 24th last we asked that those listening to our Oscillion Radio Telephone concerts kindly drop us postals that we might in this way get some idea of the size of our radio audience. The results were so surprising that we believe a brief line concerning them would be of interest to your readers.

About two hundred replies to our request have been received to date, and these represent an actual audience of about five hundred people. With these figures before us we feel that it is conservative to estimate that our nightly audience is in excess of one thousand people.

The replies were decidedly interesting, especially because of the enthusiasm of the writers. There were many letters from lady listeners, and several from those of the gentler sex who have wireless stations of their own. One lady complained because she, at one concert, became so enraptured in the music that she thoughtlessly allowed the supper to burn up on the kitchen stove.

There were many requests and co-operative suggestions, and one of the chief worries was that it might not be our intention to keep the concerts going for some time to come. Some of the replies were from a distance. One operator hears us regularly off Cape Hatteras about three hundred miles away, and several enjoy our concerts even though located between one and two hundred miles from our tower.

That those interested may see the personal frank nature of the replies, we enclose for publication, a copy of one which is more or less typical. In explanation of the manner in which it is addressed to a member of the company we would say

that it appears that the different voices of the operators are recognized each night by the members of our audience, so that they feel they know us quite intimately, and accordingly many of the letters were addressed to the operators personally. It is also interesting to note that although we asked merely for postal-card reports, the number of postals received did not represent ten percent. of the total number of the replies.

A novel request was one from two gentlemen in Newark, N. J., who asked that on a certain evening we play dance music. This, in order that their guests of that evening, to the number of one hundred, might dance to our Graphonola Orchestra furnished us nightly by the Columbia Graphophone Company. We heard afterwards that this dance was a great success, as was the previous one in Morristown, N. J., for which we also provided the music at Highbridge, N. Y., thirty odd miles away.

May we take this opportunity to thank, through your columns, the many kind friends who have thus appreciated our work and have been good enough to say so? We shall be only too glad to reciprocate by radio telephoning them to look for our report in the March number of QST.

Irvington, N. J.
Jan. 28th, 1917.

Mr. Gowan,
De Forest Laboratories,
High Bridge, N. Y.
Dear Mr. Gowan:

Answering your general call of last Wednesday evening, am writing the views of us "Hams" here in this city.

By the way as I am pounding this on

the mill you are playing the anvil chorus from *Trovatore*, am glad you like that selection, I do too, in fact I have it here, also the Sextette you just played.

We get you very well, here, in fact I hear you very plainly while writing this, even though I am temporarily using galena, owing to my DeForest Audion bulbs, I use two—blowing out, one a week ago and one a little over a month back, I have had them something like three years each, which is a little over the average life, using them steadily about eight hours daily with the exception of thru the thunderstorms—you might mention to Dr. DeForest that I think its a longer life than he bargained for, but am sorry I cannot get them renewed as I have a letter over his signature saying that the patent situation temporarily discontinues the sale of them. I think he's mean for that (?)

I have heard some radiophone steadily now for two years but think that the other one I heard was under the direction of Wanamakers as I only heard it from one to two p. m., daily, however, not for some months now. OH YOU POET AND PEASANT, some record that you are playing now!!!

I have a friend in Lincoln N. H., who thinks he has heard your phone, unless there is one nearer him. He also uses a panel amplifier.

There are forty-three members of our club, but as most of them like to sit on their keys and hammer out little nothings, they never hear you. However, the following members are pleased to advise you that they get you very well, in some cases can hear you at arms length:

Herman Enderwoods, Pres. our club, the largest in the state, 144 Linden Ave., Irvington, N. J.

Elmer Diehl, 29 Orange Place, Irvington, N. J.

Mr. Zeilbauer, 87 Union Av., Irvington, N. J.

F. S. Budd, 146 Brunswick, St., Newark, N. J.

Ed. Heims, 113 Third Ave., Newark, N. J.

Al. Mills, 57 Linden Ave., Irvington, N. J.

Al. Oechler, 82 Smith St., Irvington, N. J.

Howard Selvage, Hilton, N. J.

Herbert Schwab, Irvington, N. J.

I regret that is all at this time who have reported to me, yes, that busy Lizzie was a suprise—MIM—

I missed all you said that time—some ham—2ANA has his get tuned at seven hundred and my coupling is now five inches clear between the nearest ends of each of the pri. and sec. coils, some coupling, and fifteen degrees on each sec. variable, but he is still hammering in and drowns you out—sorry I'm missing it all—the reports of the answers too—

I frequently have a whole room full of visitors and by means of a detectophone of my own design and a horn, we hear the music almost as good as the phonograph I have here in the room.

You mentioned stability and advisability of commercial use of the DeForest Oscillation, and from the way I get you, I rather think its beyond any comparison—yes I've had ladies here listening too—but they're too bashful to write to a strange (!!!)

MIM Think I'll go to Long Island and Dance too—MIM those fellows have me beaten, I thought I got you loud—but Holy Smoke I can't dance to my own victrola yet (?)

Sorry I have such a poor mill to write on, but have a better one in the repair shop.

Well I think I have covered all you care to know, I've written rather freely, but then I'm so accustomed to having you talk and you do it in a way that makes it appear rather addressed to each of your audience individually—not collectively—rather a rare talent by the way—that I am taking a chance—yes, you'll hear from many others yet before next week.

I have a small sending set, and a darn good telephone here and so if I should be able to be of any service to you in any way, or any of us other "Hams" here, please command us—we are all at your service, and are mighty glad to say that we have heard you from the very start, and have had people laugh at us and say we fabricated when we told 'em we heard a gentleman talking every night and entertaining us immensely with good music—I

happen to be also a "Ham" professor who plays piano and organ at various small concerts gatherings, not to mention a church, so I know good music, such as Busy Lizzie (???) Sextette from Lucia, (Good Night—MIM NINE P. M.) and other operatic selections—ur whispering tonight was the first I've heard, and the imitation of a screech owl—MIM My dad heard that—he just came on, and hadn't heard you before. He ducked off the phones and stuck his bald head outta the window and thought an owl was surely on the lawn. MIM—HONEST—I told him what it was and he only grunted—HUH.

Well Mr. Gowan, I don't think I could say enough in a year to express the fun, entertainment, and STUDY I, and we all, have derived from your utterly wantonless waste of juice up there keeping that arc going, but anyway I guess its being wasted in an all-fired good cause. We appreciate it more than the whole 43 of us could write—in 100 page letters, and my aged grandfather says he never dreamed he would live to hear anything like it, and

I echo his thoughts—I have a friend at WBU (D L W RR Hoboken) who says they have some wireless telephones there, but I heard them only a few times and they seemed to give it up—it's a cinch they can't begin to compare with the one you are using.

In your comparison recently on micro-phones, your number two was the most satisfactory here. Number three was coarse, and number one too weak.

Well, guess this is enuf. Hope you dont get tired reading it and hope to hear you again tomorrow night and other nights, I am on every evening except Thursdays, Club night.

Wishing Dr. DeForest and yourself, and the company in general the very best of success in your undertakings, I beg to remain yours for the cause, sincerely,

(Signed) W. George Hunt,

Commercial Representative, and Manager Radio Experimental Department W. U. Telg. Co. Main Office, 1133 Clinton Avenue, Irvington, N. J.

Call 2AVM.

QRN in the Head

By 8ADU

WE amateur operators seem to have a faculty for getting sick or hurt every now and then, just like other people. It goes without saying, that this usually happens when we get a new aerial up, or just before a big relay stunt in which we expect to participate.

Of course I have to try every new thing which comes along, and hence this story. My trouble was a lanced ear drum, following a bad cold in my face.

"Now open your mouth," said the pretty nurse, whereupon she would thrust a long glass tube into said mouth where it was in imminent danger of breakage. When half asleep, I would imagine it one of those new fangled bulbs—a "thermo" tron, instead of a thermometer. I wondered if she had the green wire fastened to one shirt button, and the red one to another.

My temperature had a way of hanging around 102 degrees in the shade on general principles.

While lying there day after day, I thought of wireless to forget the pain. On one occasion after memorizing all the "bug" literature I had on hand, I sought further amusement. This was, clicking on a glass topped table beside my bunk with a pair of tweezers for about two hours. Many times I sent out QST DE 8ADU CQ ARK, but got no response.

Just then the nurse breezed in saying it was exactly eleven o'clock and I should "sit up and take this nice (?) medicine."

"Eleven!" I exclaimed, momentarily forgetting the medicine, "Why didn't you tell me before? It's too late now to get NAA time." (We get it at eleven a. m. in Akron, Ohio).

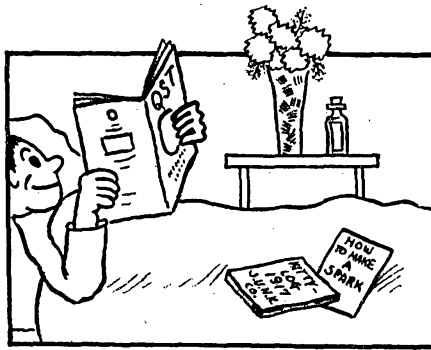
Of course she believed I was delirious. (but I was almost sure I wasn't) and so gave me an added dose of the dope.

I wondered if QST would EVER come. I tried to remember what time it came last month, but it was of no use. Too much QRN in my head, and the only thing I could do was to QRX.

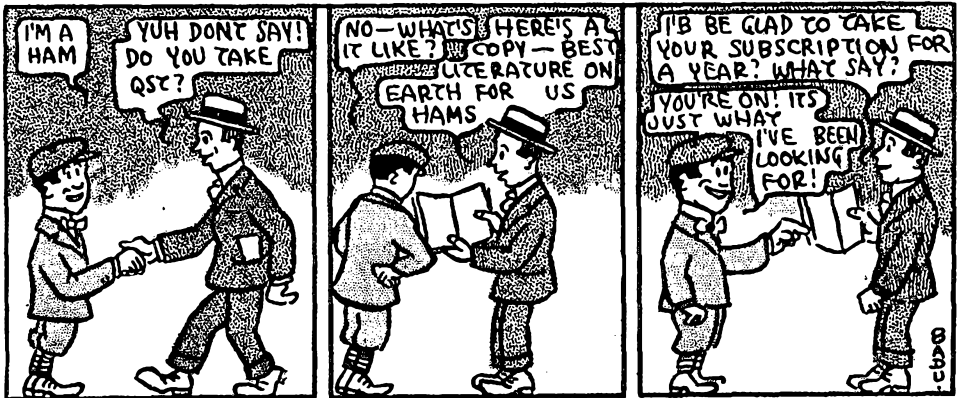
It finally arrived one afternoon. To all appearance, I was no longer sick. In five minutes' time, I had given the ads the "once over," finished the Amateur Radio Stations, and wading in the Old Man's QRM. This was deep stuff. Those "uger-

umfs" and wouffhongs" put me in such a delirium of delight, that I forgot all about the hospital and the things connected with it, and thought I was back in my own lil' outfit hearing the same stuff.

Well boys, I got so excited about relaying and the like that I ordered a Paragon Short Wave Hickey on the spot, and as soon as I get home and get my left "receiver" rewound and a new "diaphragm" grown in, I'll be back at the key. In the meantime I'll have to copy with one ear, so QRO OM, and QRS-----I'm a little out of practice on the code.



A . G . E . N . T . S



Write for our rates of discount. They are very attractive. If you haven't tried getting QST subscriptions, write for our agency proposition also.



**IN ASKING QUESTIONS, OBSERVE
THE FOLLOWING:**

Number each question.

Make an effort to state each question clearly.

Write on one side of paper only.

A. L. Groves, Va., writes:

- Q. There is a spark station that works on about 6,500 meters that sends to EGC, Madrid, Spain, also to EAA and one or two others. All their messages are sent from Berlin or other points in Germany. They also use a wave about 4,200 meters and I have heard them on 8000 meters. The same wave that Glace Bay uses). Can you inform me what station this is? It signs "LP."

There is another spark station that works all the time on about 5,500 meters and never signs and seems to send in German or Russian or some sort of a code with words 15 to 25 letters long. I have a suspicion that this is the English Marconi Station in Carnarvon, Wales MUU sending to Russia. Do you think this is it, or can you inform me who it is?

One more MFT, Clifden, Ireland uses one wave about 6,000 meters and another wave considerably longer than OUI and not as long as POZ. Can you inform me what the wave length of POZ and the long wave of MFT is?

- A. We regret that we are unable to tell you who "LP" is. We, too, have heard him working the "E" stations

but have been unable to learn his identity. We are very much under the impression that "MUU" works only on a wavelength in the neighborhood of 12,000 meters. The wavelengths of "POZ" is, we understand a little under 12,000. There is very little reliable information to be had concerning any of these European high-powered stations. Unfortunately we have no wavemeter which will carry us up quite that far.

Albert M. Lauchlan, Ohio.

- Q. Please give dimensions for good 600 meter loose coupler and good hook-up using galena, variable and fixed condenser.
- A. Primary $3\frac{3}{4}$ inch dia. x 5 inch length wound No. 24 D. C. C. Secondary $3\frac{1}{8}$ inch dia. x $4\frac{3}{4}$ inch length wound No. 28 D. S. C.

For Hook-up see Figure 1.

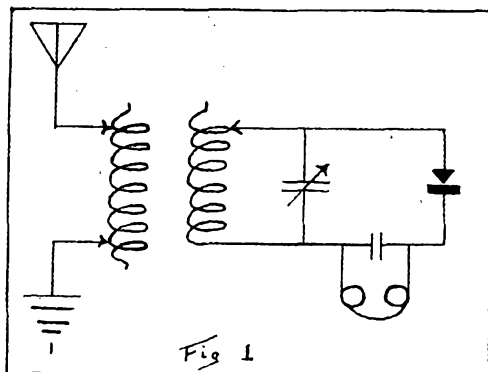


Fig 1

L. Brainard Stratton, N. Y.

- A. The fundamental wavelength of the

coil 4 inches long x $3\frac{1}{2}$ inch dia. wound with No. 24 enamel is approximately 195 meters. The wavelength, which this coil will tune, however, depends entirely upon the capacity and an inductance of your antenna.

You may use any length of antenna from 50 feet up to receive the German stations. Naturally, the longer and higher the antenna is, the better will be the results. The coil above mentioned, is, however, too small to be of much use to you for these long-wave waves.

Max. Hayden, Ogn.

- A. If you cannot provide yourself with a more sensitive type of detector, the only means of increasing your range with what you have is the raising of your antenna.

The inductance of a coil may be calculated and the fundamental wavelength may be measured, but neither the inductance or the fundamental wave length is of any value in determining the wave length to which the coil will tune unless we know the capacity and inductance of your antenna. Your coil 30 inches x 6 inches No. 28 S. C., will serve as a loading coil regardless of what type detector you use. The wire is not exactly too fine. A little larger would be better. With the aerial you mention, you should be able to get up around 10,000 meters with it. We have no suggestions to make in regard to your ticker. If you can provide yourself with a motor to drive it, and make some mechanical refinements, it may give you better service. All signals will always come in however, with a scratch or a hiss.

H. G. Silbersdorff, N. J.

- Q. What is the capacity of an old United Wireless Co., variable condenser built in quadrants, containing 7 stationary and 6 moveable plates?
- A. We presume you mean the condenser such as used in the Type E tuner of the U. W. T. Co. We regret we are unable to get any data on this unit. Can any one help?

Burnice Rutt, Ia.

- A. The antenna 110 feet long and 60 feet high is better than the antenna 90 feet long and 50 feet high for transmitting and for receiving. The same ground may be used for both aeri-als.

A capacity of about .015 Mfd should be suitable for the 2 1-5 K. W. Thor-darson. If you wish to use Murdock sections two banks of 9 each in multi-ple will be required, the two banks to be placed in series.

Harold L. Crosby, N. Y.

- A. The abbreviation O. M. means Old Man The Tesla transformer is used in radio installations. In place of the sec-ondary of many turns, a secondary of a few turns and the antenna with its inductance and capacity is substitut-ed. The open circuit and the closed circuit are tuned to resonance in the same manner.

Hertzian waves may be directed to a greater or lesser degree by using special types of antenna.

C. L. White, Ohio.

- Q. Can wireless telephone and arc signals be received with a two element valve detector?

- A. Wireless telephone signals may be received with any type of detector. The reception of undamped waves cannot be effected with the two element valve in a practical manner.

- Q. What is the advantage of a primary condenser on the receiving transfor-mer?

- A. When placed in series with the pri-mary of receiving transformer and the antenna, a reduction in the wave length results because two capacities (the capacity of the antenna and the variable capacity) have been placed in series. When shunted around the primary of the transformer an in-crease in wavelength results because the two capacities (antenna and vari-able) have been placed in multiple.

- A. Your fundamental wavelength may be determined by multiplying the total length of your antenna in meters by 4.7.

Verne Van Vlear, Cal.

- Q. Please give a formula for calculating the wavelength capacity of coils.
- A. To determine the wavelength to which a coil will respond, we must first know the inductance of the coil in question and the capacity which is to be shunted around it,—if it is to be used in the antenna circuit the capacity of the antenna must be known. The inductance of a coil which is long in comparison to its diameter may be approximated by use of the following formula:

$$L = (m DN)^2 1 \text{ centimeters}$$

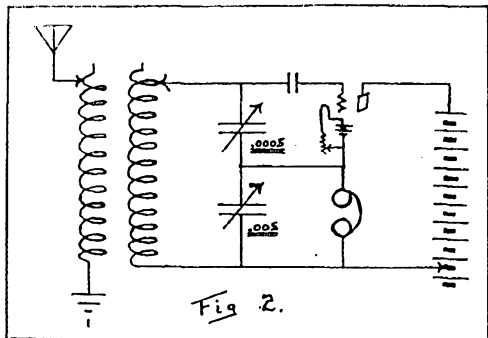
where D equals diameter in cms., N number of turns per Cm., and 1 length of the coil in centimeters. If it is desired to reduce the result from centimeters to millihenries, divide by ten million. The wave length of a combination of inductance and capacity may be found thus:

$$\text{Wave Length} = 59.6 \sqrt{L \times K}$$

- Q. Give size and amount of wire of a 15,000 meter loose coupler.
- A. Secondary 6 inch dia. 12 inch long wound No. 30 D. S. C., $\frac{1}{2}$ lb
Primary 7 inch dia. 12 inch long wound No. 28 S. S. C., 12 oz.
- Q. Which is more efficient, a 20,000 meter loose coupler or a 15,000 meter loose coupler with 5,000 meter loading coil?
- A. Equally good.
- Q. Which is most efficient for 1 or 2 K. W. a rotary spark gap, quenched spark gap or A. C. arc?
- A. We don't quite "get you." The type of gap for greatest efficiency would depend to a great extent on the type of transmitter to be used.

John G Schroll, Ills.

- Q. Which type of rotary gap do you prefer, the rotating arm or the disc?
- A. We believe they are equally good.
- Q. May the regenerative hook-up as shown on page 5 of the Dec. issue be used for long undamped waves?
- A. Not with any degree of satisfaction if at all. A modification such as shown would serve better.



Donald Taber, Mass.

- A. The dielectric losses in the material used for coating wire with enamel is much larger than in silk and cotton. It is not therefore considered the best practice to use enamelled wire on receiving apparatus.

Robert F. Roberts, Ct.

- A. If your lead-in must be 80 feet in length, and if you wish to comply with government regulations as you indicate, the flat top of the T antenna may be only 120 feet in length with lead-in taken out at middle. It may consist of 4 or 6 wires spaced two feet apart.

Melvin C. Lapp, Wis.

- Q. Will a 21 plate variable condenser be satisfactory in connection with the short wave receiver in December issue instead of 10 plate?
- A. The 21 plate condenser will serve.

Noble Smith, Ky.

- A. There is no reason why you should be unable to receive 200 meter waves on your 150 foot antenna. Are you using a variable condenser in series with the antenna circuit? If not provide yourself with one, and your difficulty will be at an end.
- A. A condenser having a capacity of .005 mfd's will serve for your $\frac{1}{4}$ K. W. transformer and your rotary gap having a spark frequency of 350.

Wm. O. Snyder, Mo.

- A. When using a 3-element vacuum detector, it is necessary for good results to tune the secondary circuit very

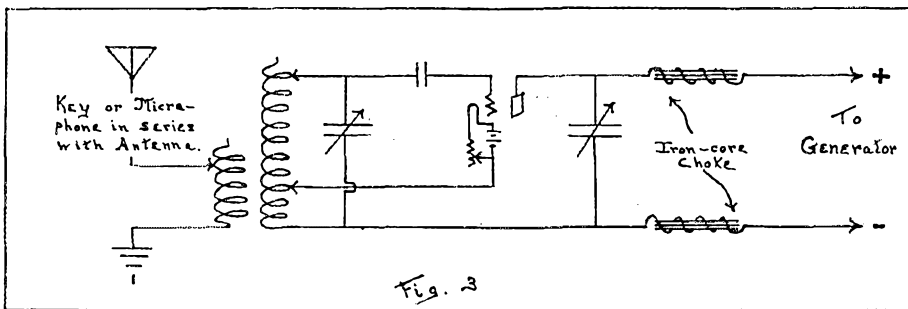
closely. We note from your diagram that you have no means provided for this. The secondary should be shunted with a variable condenser, the maximum amount of inductance and the least possible condenser being used at all times for each wavelength. From the description of your apparatus, we see no reason why your vacuum detector should not now work satisfactorily.

No Name.

Q. What would be the best hook-up to use on a "power" audion? (Filament 25 v., wing 300v.)

a result, the nearby stations can tune you out, and likewise, when the distant stations tune to your one wave, they receive more energy than originally.

A sharp wave is greatly to be desired. Many amateurs make the great mistake of trying to get as great a reading on the hot wire meter as possible. To bring this about, they resort to too close coupling, under which conditions the energy is radiated on 2 or more wavelengths, neither of which gets as much energy as a single wave would were the circuits properly



Q. Where could I get a high voltage D. C. generator for the above bulb?

A. Try the Holtzer-Cabot Electric Co.

Q. How many amperes will this bulb use on wing circuit?

A. Probably about 1/4 ampere, at the most.

A. R. Miller, Pa.

A. The "freak" which you speak of in connection with your transmitter is most likely no freak at all. The glass plate condenser which you have substituted for the sectional condensers is probably more efficient. Originally no doubt, you were radiating your energy on a very broad wave. For this reason the nearby stations would be unable to get rid of you, and too, your signals would seem stronger to them. Since changing condensers you have retuned your transmitter so that now the wave which you emit is more nearly a pure wave. Consequently a greater percent. of your radiation takes place on one wave. As

tuned.

The capacity of your condenser is, approximately, .00033 mfd. per plate (1/4 inch glass 6x8) or a total of .00429—a little over half what you originally had which accounts for the necessary increase in closed circuit inductance. We suggest you increase the value to about .0075 mfd.

S. J. Mallory, N. J.

Q. What are undamped waves and why are they considered superior to damped ones?

A. An undamped wave is one whose successive oscillations are of the same amplitude. A damped wave is produced by the application of energy to the antenna at comparatively infrequent intervals. In between these intervals of application, the waves or oscillations in the antenna damp out due to dissipation of the energy. An undamped wave is produced by the continuous introduction of new energy into the antenna. They are consider-

ed superior because they are less susceptible to absorption while in transit, and of late, becomes receivers of recent and especial design make it possible to receive them much farther than damped waves.

Q. Can an ordinary receiving set, used to pick up amateurs and commercial stations get the small undamped wave stations?

A. Yes, providing the proper form of detector and circuit is used.

Q. How is a horn converted into an amplifier as in a "2-step Multi-audio-fone?"

A. The multi-audio-fone is made up by the connection of a micro-phonograph to the diaphragm of the receiver. A battery and low resistance receiver is placed in series with the micro-phonograph. A horn may be placed on the receiver if desired.

A. You may obtain a list of the amateurs by writing to the Government Printing Office, Washington, D. C., asking for "Radio Stations of the United States," and enclosing 15 cents.

A. The range of your receiving apparatus will depend upon the power used at the transmitter, and the height of your receiving antenna.

A. A loading coil may be made by taking one slider from the double slide tuner which you have, as you suggest.

George Gercke, N. Y.

A. The stranded copper wire will probably serve your purpose best. You may use No. 14 solid if you so desire. There will be very little or no apparent difference, "Electro-se" in insulators are considered best. The single wire will probably serve very well for receiving, or transmitting with a coil.

A. The fire underwriters require a lightning ground outside the building in addition to the instrument ground.

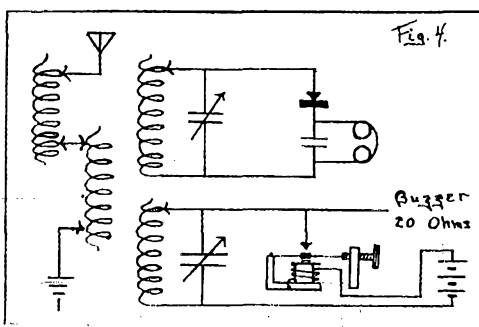
Harold F. Southwick, —

A. The number of wires in your antenna has very little effect upon the wavelength. There would be no advantage to you in the arrangement you suggest.

A. The 17 plate Murdock is O. K. for the regenerative set described in the December issue.

No. Name, New Ringold, Pa.

A. We give below a diagram showing method of reception for undamped waves. Here a buzzer is supplied to furnish a source of local oscillations. Your ability to hear the undamped wave stations without audion or tinker is due to the fact that two of them are going at the same time. Using this buzzer arrangement, the signals will come in with a scratchy sound. For best results, a special buzzer should be constructed, by suspending a fine steel wire, on which a small piece of silver has been wrapped, above the magnet. The pitch of this buzzer should be as high as possible—almost a hiss. See Fig. 4.



M. Liedeker, N. Y.

Q. Kindly give hook-up for reception of undamped waves by the Armstrong method; also sizes of wire used on coils.

A. See answer to Van Vlear and Scroll above.

Geo. B. Smythe, Pa.

Q. Please give good hook-up for loose-coupler, fixed condenser detector, pony condenser, phones.

A. See answer to Lauchlan above. There is no reason why you should be unable to get signals with this apparatus. Try again.

Frederick Fender, Cal.

Q. Please give details for construction and use of a wavemeter.

A. We regret that lack of space will not permit our going into this, as a comprehensive set of details would of necessity be lengthy.

FOR SALE & EXCHANGE



FOR SALE: Brand new double filament Audio Tron bulb, \$4.00; two-inch spark coil in A1 condition, \$4.00; Murdock No. 424 oscillation transformer, new \$4.00; Packard $\frac{1}{2}$ Kw. transformer mounted in wooden box, gives 2.5 amps. radiation on 200 meters, only \$7.00. For sale separately or will apply on 1 Kw. Thordarson or Paragon short wave regenerative receiver. Calvin W. Gilfillan, 603 West 8th St., Austin, Tex.

WANTED: All numbers of 1916 QST, also January 1917. Let me know how many you can supply and price of same. James Hopkins, 91-31st St., Newport News, Va.

FOR SALE OR EXCHANGE: $\frac{1}{2}$ Kw. Thordarson and kickback preventer, \$7.00; $\frac{1}{2}$ Kw. mounted Blitzen, perfect condition, \$10.00; $\frac{1}{2}$ Kw. rack condenser, \$2.00; 30 amp. key, \$2.00; one pair Brandes Superior phones, \$3.00; lightning switch on marble base, \$2.50; 50 ft. No. 4 copper wire, \$3.00; \$6.00 Knapp motor, new \$4.00; fibre rotary disc and electrodes, \$7.75. Want a 1 Kw. transformer of good make. Wesley Bradshaw, 16 Center St., New London, Conn.

FOR SALE OR EXCHANGE: 3,000 meter Navy type loose coupler, silk windings. Want aerial wire or phones. Dwight S. Pursell, 716 S. Randolph St., Champaign, Ill.

FOR SALE: Your chance to get a high grade complete set cheap. Station 9MY must be sold at once. Receiving set consists of 200 meter panel type regenerative set, Stromberg-Carlson phones, 3,000 meter loose coupler, large undamped loading coils. Transmitting set, $\frac{1}{2}$ Kw. Packard transformer, oil condenser, rotary gap, Murdock oscillation transformer, and automatic speed key. Sending radius 900 miles. Will sell complete or separately. Write for particulars and prices at once. Thorvald L. Haines, 202 Fifteenth St., Racine, Wis.

WANTED: At once, single copy of QST, Vol. 1, Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13; in good condition. State price. Chester A. Charles, 420 So. 16th St., Newark, N. J.

FOR SALE: Chamber's loose coupler, \$3.50; Brandes receiver, \$1.00; Knapp motor, \$1.25; J. H. Bunnell Silicon detector, \$0.75. Write for long list of wireless and experimental bargains. All articles guaranteed to be in A1 condition. All letters answered. Write Thomas B. Hannold, Paulsboro, N. J.

FOR SALE: One Klitzen series-parallel sending condenser, \$6.00; one sending helix 10 inches diameter; wound with seven turns $\frac{1}{4}$ inch strip copper, \$1.00; one Radio Apparatus Company of America 2 Kw. rotary gap without motor, \$6.00. All of the above are in good condition. Inquire of Wm. G. Broughton, Crown Point, Ind.

FOR SALE: Clark wireless transformer, $3\frac{1}{2}$ Kw.; large aerial switch. All in first-class condition. What do you offer? Harry S. Siegel, P. O. Box No. 505, Erie, Pa.

FOR SALE: Two pair Brandes Navy type phones in best condition, \$8.00 each. K. Russell, 814 Bath Ave., Niagara Falls, N. Y.

FOR SALE: DeForest audion, RJ9., used about 15 hours. Both filaments are good. First \$10.00 takes it. Stanton E. Nadig, 203 N. 4th St., Allentown, Pa.

FOR SALE: One tuning coil, double slide, crystal detector, variable condenser, high tone buzzer. Make offer. All letters answered. Edw. W. Smith, 305 E. 9th St., New York, N. Y.

EXCHANGE: Three gross of Azo printing paper, size 5x7. Value \$1.75 per gross, in good condition. Will exchange for any audion bulb or offers. Alvin R. Leavitt, 13 Grant St., Natick, Mass.

FOR SALE: $\frac{1}{2}$ Kw. Thordarson transformer, less secondary. Price \$5.00. Address Arthur S. Hughes, 7390 Maple Ave., Maplewood, Mo.

WANTED: $\frac{1}{2}$ Kw. closed core transformer, mount or unmounted; must be of Packard, Blitzen or Thordarson make. State age, use and price. Must be reasonable. All letters answered. Write Wm. Cronin, 61 Audobon Ave., New York, N. Y.

FOR SALE: One large loose coupler tube ten inches long, primary five inches in diameter tapped for single turn adjustment, secondary four inches in diameter with fifteen taps, adjustment secured through rod projecting from end of genuine mahogany cabinet enclosing the whole coupler. Cabinet finished in dark mahogany with nickel plated taps and switches. Must be seen to be appreciated. Is in first class condition. Also a genuine mahogany cabinet for a transformer inside dimensions 23 inches by 12 inches by 10 inches. Sides of one-half inch material, base of seven-eighths inch material. There is a partition near one end as the case was arranged to hold a Packard transformer and a glass plate condenser. Five binding posts on one end are arranged for the primary and two on the other end bring out the secondary. This is also stained dark mahogany and never having been used is in perfect condition. Apply to P. H. Long, 148 West Wayne Ave., Wayne, Pa.

FOR SALE: One pair Brandes Navy phones nearly new \$10.00; 2- $\frac{1}{2}$ Kw., Thordarson transformers slightly used, \$10.00 each; one Adams-Morgan quenched gap, \$15.00; value \$8.00; one $\frac{1}{2}$ inch spark coil, \$3.00; one pair Brandes Superior phones \$3.00; one variable with hard rubber top, \$2.50; one new tuning coil, \$1.00; loading coils, new \$4.00, value \$3.00; coupler new \$10.00, value \$8.50; nicked key large contacts, \$2.00; commercial oscillation transformer, \$3.00; coherer, \$1.00. Immediate delivery assured, excellent value. Pioneer Auto Supply Company, Moriarty Bldg., Kansas City, Mo.

FOR SALE: \$25. Clapp-Eastham de Luxe tuner, perfect condition, \$10.; Adams-Morgan \$15., quenched gap, \$5.; \$4.50 Clapp-Eastham hot-wire meter, 0-5 amperes. Perfect condition, \$2.00. John Dunham, 22 Buckingham Rd., Brooklyn, N. Y.

FOR SALE OR EXCHANGE: One Foote Pierson Double pen self inking automatic telegraph register, value \$82.00. Would like good audion. C. O. Flint, 10 Spruce St., Westerly, R. I.

WANTED OR EXCHANGE: Stop! Look! Listen! Want to buy or exchange any up-to-date $\frac{1}{2}$ or 1 Kw. wireless apparatus, also any good reliable make of vacuum-valve detectors and any variable condensers or Navy type loose coupler. Everything must be in good condition and cheap. Write Harold G. Ackerman, 405 Park Ave., H., Cloquet, Minn.

8ZP TRANSMITTER FOR SALE: This set has a 1800 mile record and can be depended upon to do the work in many locations. Open core Marconi 1 Kw. transformer, large oil immersed condenser of best construction, expensive rotary gap and variometer type oscillation transformer; complete with protective device, cabinet for rotary gap copper ribbon connections, etc., for \$80.00, packed in boxes and F. O. B. Buffalo. The set radiates six amperes here. Will guarantee four amperes and ship privilege of inspection. Photo for stamp. Woodcock, 496 West Ferry St., Buffalo, N. Y.

FOR SALE OR EXCHANGE: Pair Murdock 3,000 ohm phones, used two months. \$4.00; audion cabinet with Roome bulb, \$8.00; 200 meter coupler, \$3.00; Standard key, \$1.50; home-made transformer. 1 Kw., \$8.00. All communications answered. Arthur Brown, 1218 East Erie Ave., Lorain, Ohio.

FOR SALE: Brand new receiving set consisting of Wm. B. Duck's 5AA Navy type receiving 4,000 meter transformer, Mesco 43 plate variable condenser, Duck's 1915 galena and Superior silicon detectors, Murdock's B-55 3,000 ohm phones and two fixed condensers. Make best offer or would exchange for motorcycle in good condition. P. C. Gibert, Box No. 824, Augusta, Ga.

FOR SALE: Complete wireless set. Aerial, 350 feet stranded copper wire and two-foot rubber insulators. Sending, three inch Mesco spark coil with adjustable primary condenser; one section Murdock transmitting condenser; copper ribbon oscillation transformer; key and straight and quenched gaps. Receiving, audion cabinet set, ready to use. Has Blitzen tuning transformer; Blitzen V. C.; Blitzen loading coil with suitable switches, enabling waves up to 3,000 meters to be received, Holtzer-Cabot receivers; two filament Audio Tron bulb; enclosed filament rheostat; ten new flash light batteries controlled by rotary hard rubber switch; enclosed telephone cam switch to change from audion to mineral. This set responds to both damped and undamped waves. Other accessories included. Cost \$100.; will sell for \$35.00 cash. All letters answered. Harold Sachs, 11 East 88th St., New York, N. Y.

WANTED: Audion Amplifier coil of reliable make. Have for sale DeForest audion RJ9, one filament burned out, price \$8.00. Could use reliable storage battery. Address, George Huss, 15 North Clover St., Lakewood, N. J.

FOR SALE: One United Wireless open core 1 Kw., 60 cycle AC transformer, one oscillation transformer, Adams-Morgan make; pancake ribbon wire; six United Wireless Copper coated Leyden jars; one Marconi sending key, one United Wireless aerial switch, marble base. Will take \$41.50 for the set, and if sold soon will include a Vibroplex Bug key in good condition. David L. Cawman, 55 Duane St., New York, N. Y.

FOR SALE OR EXCHANGE: One Duck receiving set, \$5.00, cost \$7.25; one variable condenser, \$2.50, cost \$5.00; one small battery motor \$2.50, cost \$4.00. Address all letters to Myron Barton, 255 East 5th So. St., Salt Lake City, Utah.

WANTED: May, August, September QST. Guibaldo Rangel, Puebla, Mexico.

FOR SALE: AA crystaloi, \$3.50; type O Crystaloi, good as new \$2.75; Clapp-Eastham high frequency buzzer, \$.75. Brown & Sharpe Precision wire gauge 0-36, \$2.50; 1200 meter double slide tuner, \$1.25; Jr., condenser, \$.85; large glass plate con-

denser in case, \$2.00; portable receiving set, \$2.50; Ajax motor, \$.50; telegraph set, \$.75. Want small rotary variable condenser. Write Le Roy M. Baer, Madison, Ill.

BARGAIN: Highest bid over \$2.50 takes C-E variable; over \$4.00 takes Chambers \$8.00 coupler. Both in good condition. Theo. O. Wohlson, 430 W. Orange St., Lancaster, Pa.

FOR SALE: Audion Tron with cabinet, new, suitable for damped or undamped receiving, \$10.00; two brass plate .002 mf. Cambridge variables in cabinet, \$9.00; two sets undamped coupler coils, wound and tapped, \$3.50 and \$5.00. Want Blitzen coupler and good or broken round audion. McMurdo Silver, 264 West 57th St., New York, N. Y.

FOR SALE: Murdock rotary, practically new, \$15.; four Murdock sections condensers, \$1.75 each; Murdock oscillation transformers, \$3.00; and an Arnold audion receiving cabinet, \$25.00. F. J. Horgan, 289 Broadway, Newport, R. I.

FOR SALE: Twenty-two calibre boy's rifle, \$1.50; brand new $\frac{1}{4}$ inch coil, \$2.00; Erector No. 1, \$.75; telegraph sounder and key, \$1.50; pair indian clubs (1 lb. each), \$.75; 25c game lotto, 15c, game checkers, \$.20. Want tuner, two-inch coils, headsets with condensers, etc. Write early if you will buy or exchange. First offer for \$6.00 takes all articles. Paul Jeffries, 2005 Artic Ave., Atlantic City, N. J.

FOR SALE: Seven pounds of No. 34 black enameled magnet wire at \$1.00 per lb., wire in one piece and not less than 3 lbs. sold separately. Perfect condition; home-made closed core transformer coil, 110 v. A. C. will sell for \$8.00; material alone cost over \$10. A bargain but must install more power. Will send goods C. O. D. to first offer. Richard Oram, 172 Grand St., Newburg, N. Y.

WANTED: An E. I. Co. sending condenser (adjustable) and two lightning switches. Must be in A1 condition. All answered. Harvey H. Mitchell, 1352 Oak St., N. W., Washington, D. C.

FOR SALE: Have a sending and receiving set less interrupter and receivers; $\frac{1}{2}$ inch spark coil, \$1.50; two zinc rods, \$.10; 50 ft. of No. 8 brass wire, \$1.00; one key, \$.75; one double slide tuner, enamel wire, \$2.00; one E. I. Co. detector, \$1.00; one E. I. Co. condenser, \$1.25. Will exchange for a pair of 2,000 ohm receivers or first check of \$4.75 takes the set. A $\frac{1}{2}$ Kw. Thordarson, output 5,000 v., one to five amperes, first check of \$10.00 takes it; also have a rotary tuner, values at \$23.00, tunes up to 2,500 meters. First check for \$8.50 takes this or will exchange both for a 1 Kw. transformer. All letters answered as received. Henry W. Briden, Jr., 1304 Myrtle Ave., Jacksonville, Fla.

FOR SALE: First check for \$12.50 will take receiving set in first class condition; will receive up to 2,300 meters wave lengths. Send for picture if interested. Albert St. Cyr, Jr., 319 Harrison St., Marquette, Mich.

FOR SALE OR EXCHANGE: Triple lens, microscope, \$2.50 for type SS Knapp dynamo; typewriter, BlicK; \$25.00. Royal L. Morgan, 308 S. E. 7th St., Washington, Ind.

FOR SALE: One Kw. transmitting set without condenser (set has transmitting record of 900 miles) consisting of one Kw. Edgcomb-Pyle \$40. transformer with five variations of power; Edgcomb-Pyle \$15. rotary 3,000 R. P. M. and \$8.00 oscillation transformer. Bargain, write for detailed description. All letters answered. H. S. M. White, 1523 Jackson St., Sioux City, Ia.

FOR SALE: $\frac{3}{4}$ Kw. transformer in good condition; four primaries, 15,000 v. sec. First \$11.00 takes it. Bargain. John Smith, 1816 Winston St., Shreveport, La.

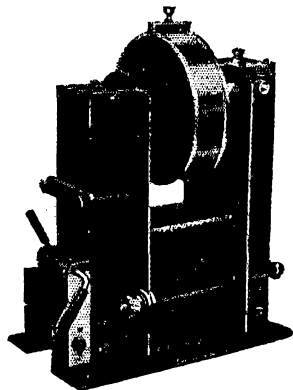
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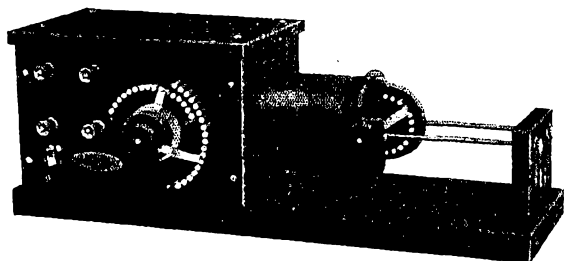
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The Variable Shunt (marked by arrow) is an exclusive Thordarson feature enabling the operator to attain perfect resonance by regulating the air-gap. Locked in position by eccentric cam.

A Modern Receiving Transformer

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Manufactured by its Originators.

latest achievement in this direction. Let us prove it to you, we have convinced others to their complete satisfaction.

ADDITIONALLY MR. EXPERIMENTER, we wish to call your undivided attention to our new:—

TYPE 36 Electron Detector which we have especially designed to operate with any present day receiving set, damped or undamped delivering results that will far exceed your expectations.

And finally—we welcome your critical investigation on our TYPE 93 Undamped wave set. A clever design producing wonderful results. In stock ready for immediate shipment.

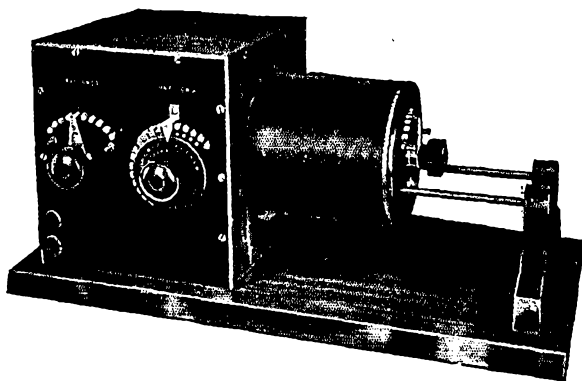
Selected Detector and Amplifier Tubes \$5.00
Send stamp Now for bulletin No. 327 describing our new apparatus and Parts.

THE RADIO APPARATUS CO.

POTTSTOWN, PENNA., U. S. A.

PRICE, \$16.50
WE HEREWITH ANNOUNCE THE LATEST ARRIVAL IN THE FAMILY OF "RADIO" NAVY TYPE MODELS. FURTHERMORE—Mr. Experimenter you surely cannot overlook the fact that we as a progressive manufacturer can assure you of greater values and neater designs than that offered by the usual mail-order house. Keep this in mind when making your future purchases.

The New Model No. 50 is our



TYPE X TUNER

A TUNER of conventional type with many exclusive features for wave lengths up to 3000 meters. Primary dead end switch, plain "units" switch, mahogany and Bakelite throughout, rubber covered binding posts. Complete description in our new catalog X.

REMEMBER--

that while our new catalog X is filled with complete radio instruments of the highest order of excellence. we also carry a complete stock of exceptionally fine electrical fittings, such as switch points, instrument switches, wire (bare, insulated and resistance) dead-end switches. etc, listed in our general catalog. We will gladly mail both books for which we ask the courtesy of 6c in stamps.

CLAPP-EASTHAM COMPANY

140 Main St., Cambridge, Mass.

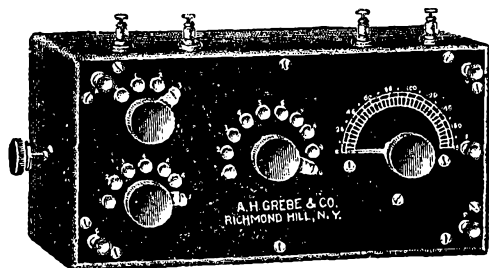
QSA

That's what you'll say to all those fellows you can now barely hear, when you tune them in on a

GREBE

SHORT WAVE

REGENERATIVE RECEIVER



TYPE AGP 101 \$32.50

This receiver will make your station an active unit in the long distance relay game.

We are now supplying this type with binding posts for connecting in loading coils. This makes it possible for you to get all of the high powered continuous wave stations.

Better look into this—today! A 2c. stamp brings Catalog R.

A. H. GREBE & CO.

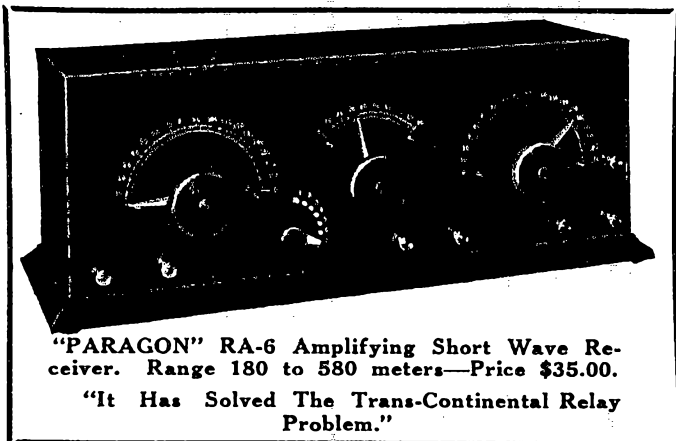
10 Van Wyck Ave., Richmond Hill, N. Y.

Day
Night

TRANSCONTINENTAL

Summer
Winter

THE AMERICAN RADIO RELAY LEAGUE DEMANDS,—
for its complete success—Transcontinental Work, Day or Night, Summer or Winter.



THOSE WHO USE IT will tell you that the "PARAGON" RA-6 has made this possible;

That, its amplifications are marvelous;

That it is extremely selective;

That it does all we claim for it;

That we are behind our guarantees, And,

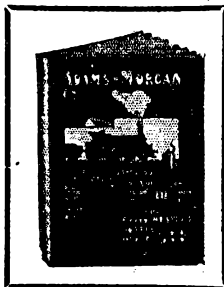
that it so far excels other short wave receivers that there is no comparison.

Here are a few of the enthusiastic users of the RA-6; ASK THEM!

1ZM	2PM	2AFT	5DU
1ZW	2RL	3ZS	7ZR
1VN	2BO	3WN	8JZ
2ZL	2BE	3AEP	9XE
2ZS	2EX	3AFA	9ZN
2ZK	2IM	3UF	9GY
2FS	2AGJ	4EI	9MQ

"PARAGON" INSTRUMENTS HAVE SET NEW STANDARDS

OUR NEW NO. 8 CATALOGUE NOW on the press, contains several pages of tables and information of real value, as well as complete descriptions and prices of all the latest and best wireless and electrical goods. Several hundred parts and sets of parts for building your own instruments also listed. YOU WILL NEED THIS CATALOGUE, SEND 8c. AND GET YOUR NAME ON OUR MAILING LIST NOW.



Send stamp today for Bulletin O. It will interest you. It describes a variety of correctly designed apparatus—apparatus which is unequalled.

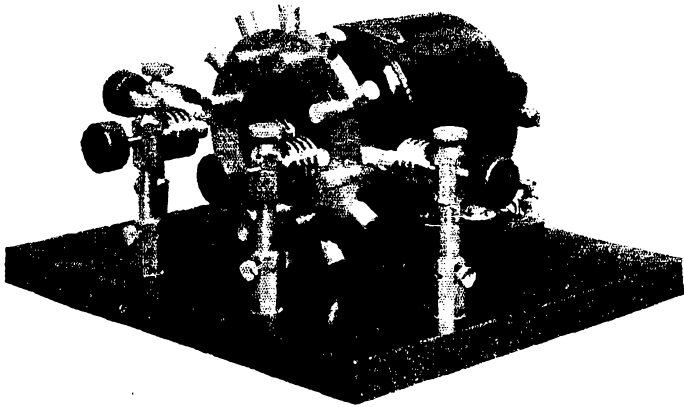
ADAMS-MORGAN COMPANY

16 ALVIN PLACE, UPPER MONTCLAIR, N. J.

She Sure Does Radiate!

Two Gaps
in
One.

Any
Speed,
Any
Tone



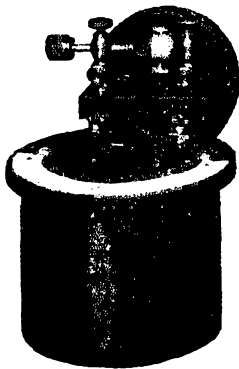
All
Parts
Inter-
changeable

Put One
on and
Watch Your
Meter

\$21.00

DOUBLEDAY-HILL ELECTRIC CO.

719-721 Liberty Avenue
Pittsburgh, Pa.



Q R H ?



If you don't know you should. An instrument for the real amateur. Nothing needed but the phones Condenser can be used in other circuits when not used as a wave meter. Two cent stamp for Bulletin No. 101.

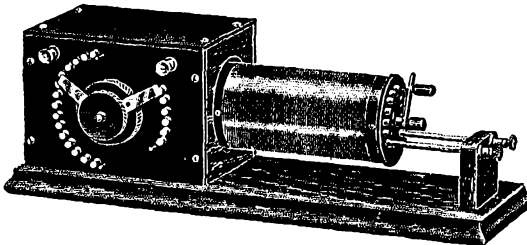
Wireless Experimental Apparatus Co.

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PRICE, \$15.00



This Loose Coupler, while moderately priced, embodies all the features contained in others selling at \$18 and higher. The material and workmanship is the best and is fully explained in my literature. Can make immediate deliveries. If you are looking for an up-to-date Loose Coupler, of stunning appearance, and whose efficiency is its strongest feature, send in your order to-day. I stock hand polished cabinets, the finest line of switch points, rubber knobs and contacts, sold anywhere, special size knobs made to order. A 2c stamp will bring my literature which will be sure to interest you.

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EASTERN RADIO INSTITUTE
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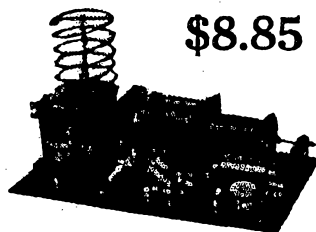


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This Complete Wireless Station

Mahogany Finish

\$8.85



Receives hundreds of miles. Sends 3 to 5 miles. Perfect in every detail. Send your order to-day—we guarantee this outfit.

Unassembled parts of this station \$7.95. Our Catalog gives full particulars of discounts on unassembled parts of all our stations.

Send stamp for our large catalog "Q.S." of remarkable values.

We do special work—wind your coupler for long wave work, wind loading coils and Resonance coils—and can furnish the tubes. Let us quote you on special wireless sets of your own design.

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LENZITE WIRELESS DETECTOR

Patented May 2, 1916



Recognized by leading authorities as the most sensitive and most effective Detector existing. If not satisfied, return same and your money will be refunded.

TO WHOM IT MAY CONCERN:



Following our policy of endorsing the manufacturers and dealers advertisements, we wish to state that the Lenzite Detector has been received and tested at our station. We find it satisfactory in all respects. It is sensitive, easy to adjust, and all that is to be desired of a contact crystal detector.

THE AMERICAN RADIO RELAY LEAGUE, Inc.

To this, Mr. Tuska adds this personal remark:

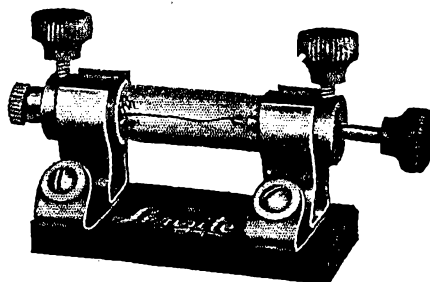
"Lenzite is the best contact crystal detector I have ever tried".

Signed: C. D. TUSKA, Editor QST

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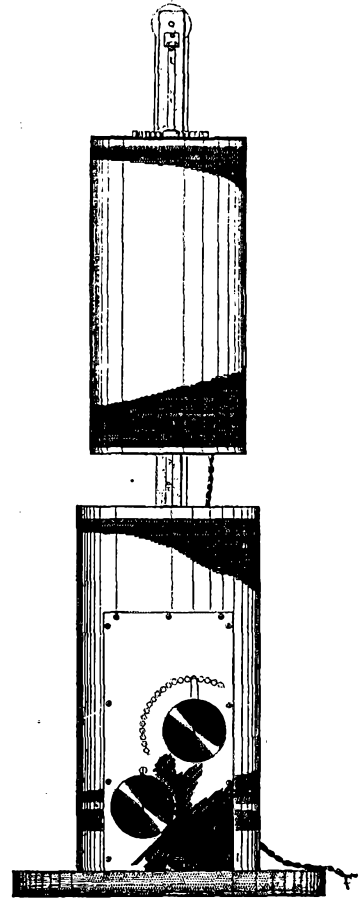


Fig. 19. A 15000 meter-coupler taking a square foot of table space.

THE NEW AUDION SERIES of articles on the use of the Audion for damped and undamped wave reception, undamped transmission, Oscillation telephony has information which YOU want. The series is written by M. B. Sleeper, whose experience in the DeForest laboratories makes the data unquestionably accurate.

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Mount your transmitting set in a panel with all controls on BAKELITE switch-panel.

Little one cent stamp brings BIG catalogue.

WILSON & SMITH WIRELESS MFG., CO.

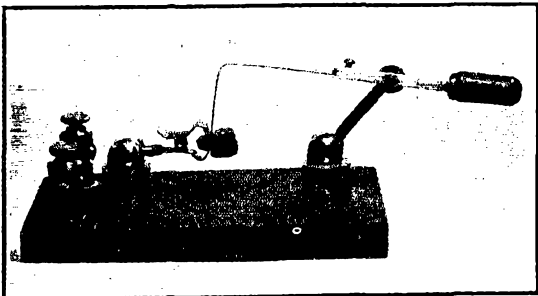
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Look up the newsdealer in your town. If he doesn't keep Q S T, he should. Send us his name.

**THE Q S T PUBLISHING COMPANY,
INC.**

HARTFORD, CONN.



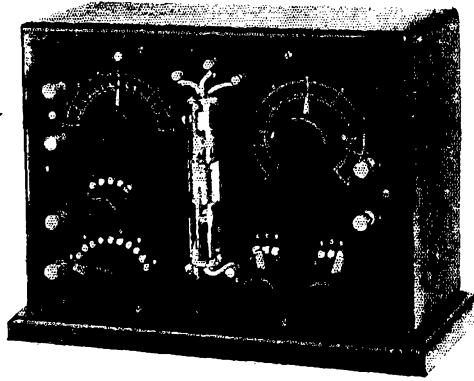
The SENSITIVE SPOT

can be found instantly with the
—JONES DETECTOR HOLDER—

Universal ball joints, permit the Crystal and Needle standards to be moved up, down, sideways or any other way. Unnecessary to remove crystal from holder, to "feel out" any part of its surface. Spring Clip firmly holds large or small Crystals. Non-Slipping slate base. Double Binding Posts for independent phone connections. The most efficient and practical detector made. Patent pending. Price \$2.00 post paid—or through dealer.

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Compact
Efficient
Serviceable**



**Designed
by Experts
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The R 16 Lamp Detector is specially designed for long distance work on both arc and spark signals. It has the latest and most efficient circuit for reception of these signals. It is compact and yet the efficiency has not been sacrificed in the proper spacing of wire and parts. The detector is a result of over a year of experimental work on lamp detectors, and the circuit and spacing employed is the result. The R 16 in connection with an R-13 Paragon Amplifier has broken all records for amateur work. Signals from amateurs on the Atlantic Coast have been copied on the Pacific Coast.

This detector is sold without lamp, but a tested lamp of any make will be put on and adjusted at the nominal charge of Five (\$5.) Dollars. All parts to this set sold separately. Write for price list. The R 16 Lamp Detector (including "Eveready" B batteries) \$30.00

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We are in a position to make apparatus to your specifications and will guarantee satisfaction or money refunded.

Pacific Wireless Specialty Company

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GALENA

Very Sensitive

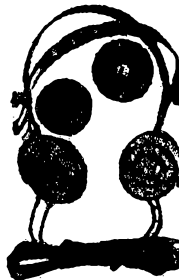
One ounce 15 cents

Two ounces 25 cents

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MURDOCK, DEFOREST
AUDION, CLAPP-
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AN ELEGANTLY FINISHED HIGHLY POLISHED BLACK FIBRE KNOB!**

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Buy a Brandes Head Set ON TRIAL

Brandes "Superior" Head Set Complete with headband, \$5.50. A professional set, within the means of every amateur. 2000 ohms.

Brandes Wireless Receivers

THE RECEIVERS WITH
MATCHED TONE

Test out Brandes Wireless Receivers against any other make. Test them for sensitiveness, clearness and distance. If within ten days you're not only satisfied but enthusiastic over them—back comes your money without a question.

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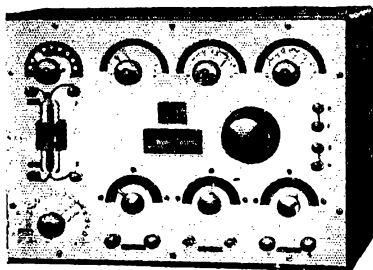
C. BRANDES, INC.

WIRELESS RECEIVER SPECIALISTS

Room 814

32 Union Square

New York, N. Y.



MIGNON UNDAMPED WAVE

Wireless Apparatus

COMMERCIAL and AMATEUR USE

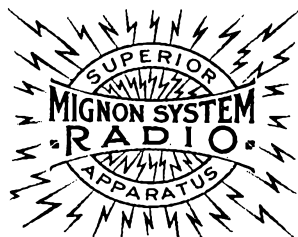
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DISTANCE RANGE UNLIMITED

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Mignon Wireless Corporation

Elmira, N. Y., U. S. A.



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SPECIAL NOTICE.

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

New in design and wonderful in efficiency.

Made in two sizes.

Type "A-D" 150 to 3000 meters\$6.50

Type "A-U" 4000 to 15000 meters \$12.00

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 TWO STEP M. A. F..... 75.00
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 DETECTORPHONE 35.00
 FIXED CONDENSER 1.00
 M. A. F. DETECTOR 3.00
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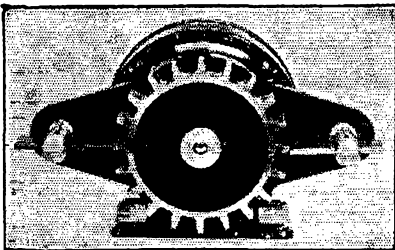
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THE LONG DISTANCE GAP.

The gap used by 9MQ, 9LO, 9NE, 9AGB, 9AET and many others who are successfully transmitting long distance messages.



Send 2c stamp for bulletin or send 10c and receive bulletin, wireless code book and a SENSITIVE PIECE OF MINERAL.

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AN EFFICIENT SENDING SET

Our new sending unit consisting of oscillation transformer, rotary quenched gap of new type, and condenser.

ROTARY: Price \$30.00
 Rotary quenched gap. Operation noiseless;

ANNULAR BALL BEARINGS

Rotor is made of bakelite; rotating electrodes are of new design; stationary electrodes do not burn away; adjustments are made by thousandths of an inch.

ROTOR REVOLVES TO THE ACCURACY OF ONE HALF OF ONE THOUSANDTH OF AN INCH.

Binding posts are designed so as to admit one and one half inch ribbon.

SILVER PLATED COPPER RIBBON IS USED THROUGHOUT

Oscillation transformers; Price \$17.00

Most efficient transformer yet designed.
 Primary ribbon one and one half inch; secondary one inch.
 Wood work mahogany, not mahogany finish.

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Condenser: Price \$12.00

Condenser is of the well known moulded type
 Motor and transformer can be supplied if desired.

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Our new receiving set. New unit differs from the ordinary units in as much as there is room provided for the audion; the resistance switches are on the panel. No switch points; no metal losses;

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Moulded Grid condenser. Mica dielectric Exact capacity for your audion ..35c.

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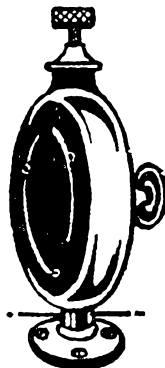


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 Describing positively the finest and most complete line of wireless goods ever listed in any catalog.
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Do you get that distant station? Are you obtaining selectivity? If not, then use our regenerative circuit and be convinced. Range—180 to 580 Meters. Amplification 100 times. High resistance contacts completely eliminated. No tuning capacities, no end losses. Such a receiver is expensive to purchase, but easy to construct with the aid of our blue print of connections and detail drawings. The same circuit as used by 2AGJ and other prominent amateurs.

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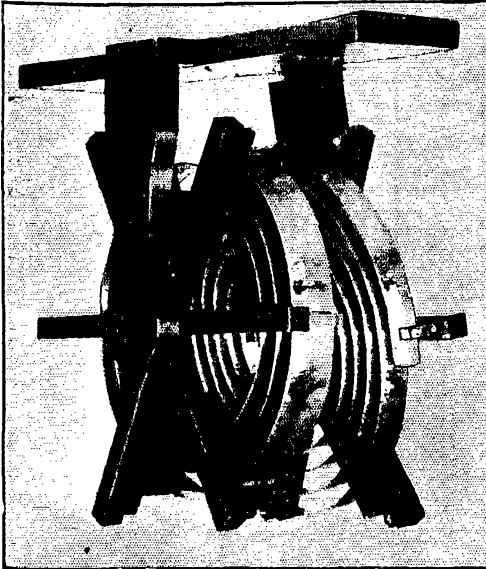
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Efficiency,
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 Silence.

Write for description
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NO LOST ENERGY!



EFFICIENCY!

Don't let the current leak to the ground or between the turns instead of to the aerial. This oscillation transformer has the highest grade insulation—Bakelite. This with heavy copper ribbon insures you against any possible loss of efficiency.

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Holtzer-Cabot

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From Pittsburgh, Pa.

"We received undamped signals from Nauen, Germany, which is outside of Berlin. We merely used large undamped coupler which would tune up to 15,000 meters, three variable condensers and audion detector.

Holtzer-Cabot Phones were used, without any amplifying device."

From Troy, N. Y.

"We have tested out a pair of your 3000 Ohm Receivers against all other makes and have found them superior to all, both in tone and loudness."

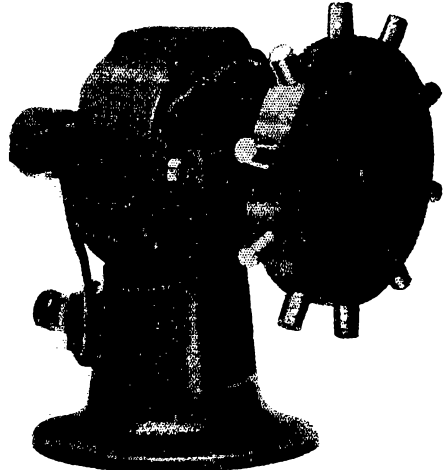
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A-MOTOR

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ALUMINUM ROTOR perfectly machined and balanced, FOR—\$5.25

MOTOR ONLY—\$4.00

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Learn under a United States Government Inspector.

A thorough and complete course preparing for a U. S. Govt. Commercial First Grade Certificate is offered.

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The enormous demand for competent Radio Men make this a field of limitless opportunity.

Expert instruction—Modernly equipped Laboratory, lowest tuition—Dormitories—Employment Bureau.

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After a long period of experimentation, we announce to the "WIRELESS WORLD" that we have perfected a special plate and type of accumulator, having a 60-Volt potential and being very compact, light and portable.

NO RENEWALS NECESSARY

it effectively does away with the expensive and unsatisfactory Flash-light cells, which continually require replacement.

BUY SOMETHING PERMANENT.

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The New Turney Head Sets With Adjustable Pressure Head Band

Patent Applied For



Positive Friction
Adjustment
3000 OHMS
Bakelite Ear
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Weight Nine
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PRICE \$7.50. Mailing Weight One Pound. Made to U. S. Navy Specifications. The popularity of this set has far exceeded our expectations. To see it is to buy it. There is not a head set on the market that can compare with it for Sensitivity—Workmanship—Finish and Design. We have sold over 600 sets in two months. There is surely a reason for this remarkable demand. Order a set today for 10 DAYS TRIAL. You can not fail to be delighted. Full information on request.

Send FIVE CENTS in Stamps for our new catalog.

Eugene T. Turney Co., Inc. 2595-2597 Third Ave., New York City

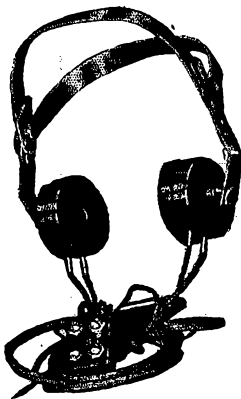
MURDOCK NO. 55

2000 Ohms Complete

Double Set

Only

\$4.00



3000 Ohm Complete

Double Set

Only

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