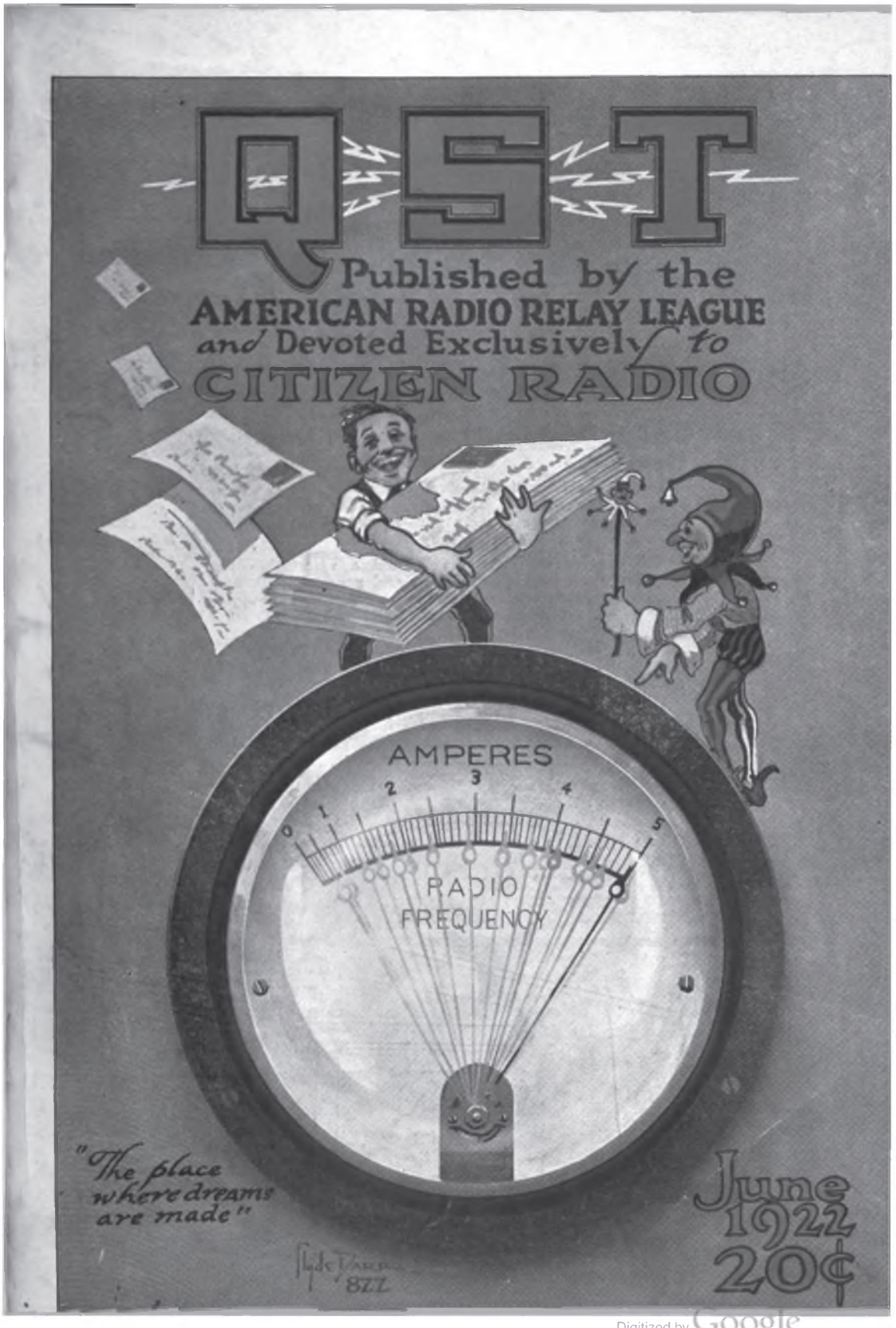

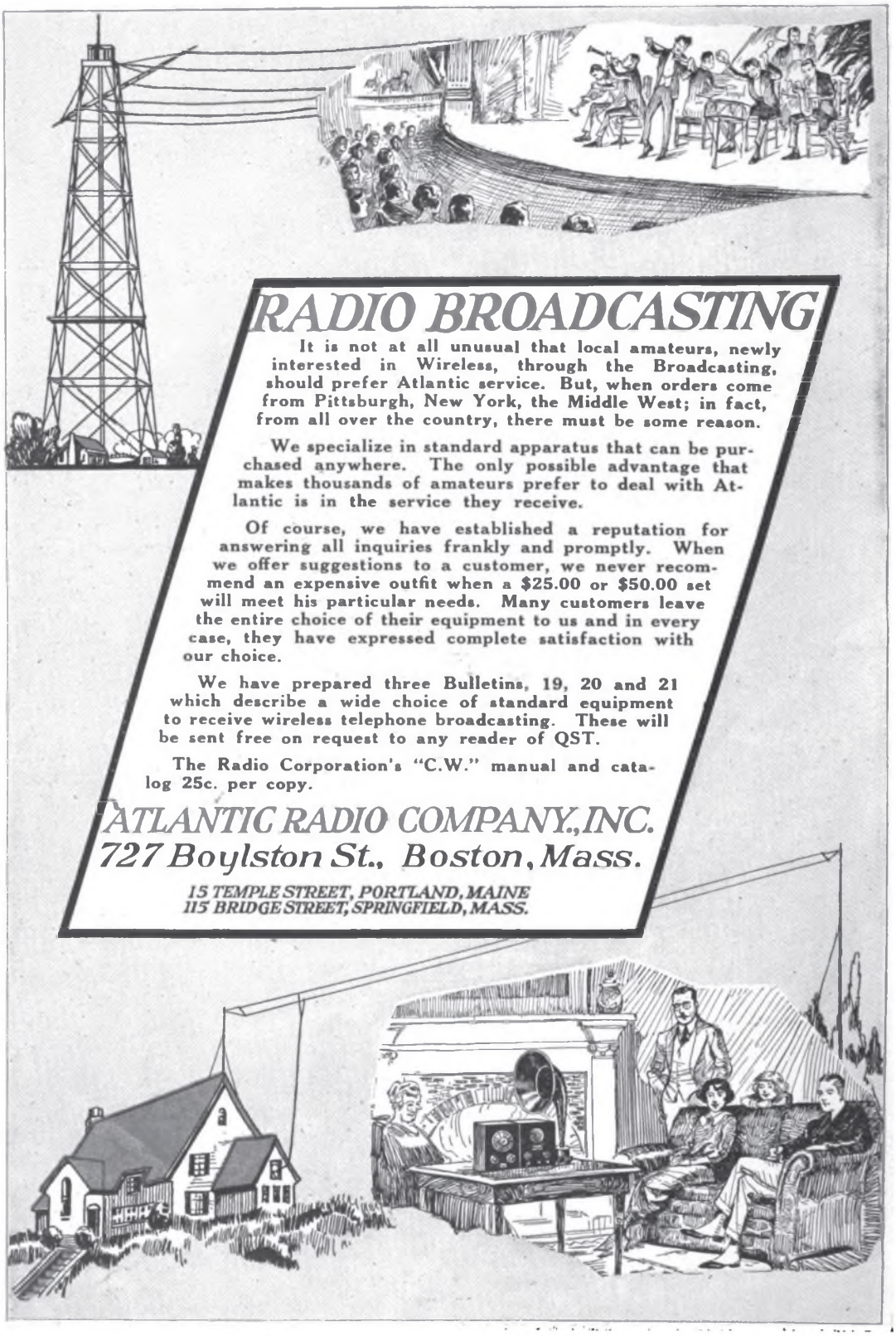

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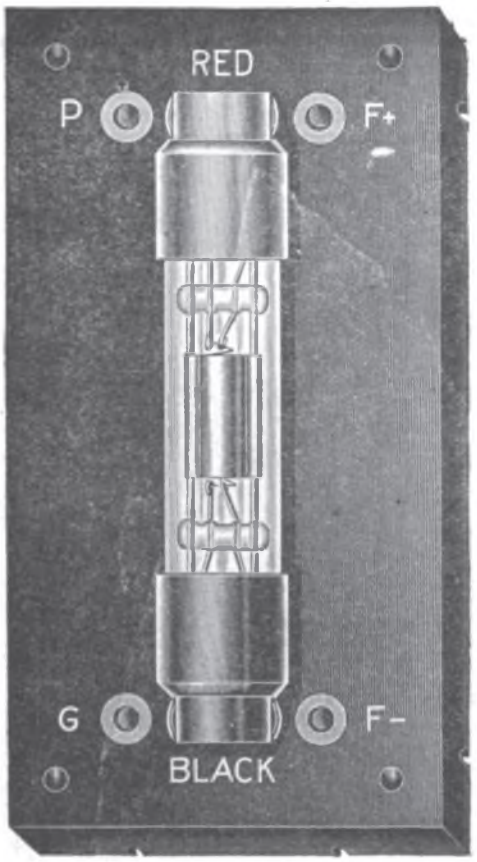

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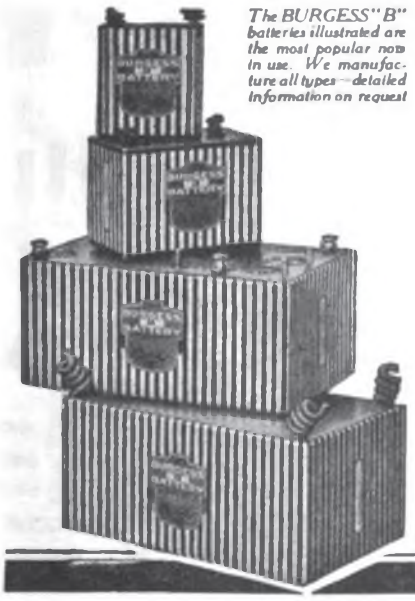

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QST

A Magazine Devoted Exclusively to the Radio Amateur

Power Factor--Some Whys and Wherefores

By F. C. Blake*

QST readers will remember the "Power Factor" argument which has been raging in amateur circles for more than a year, entangling not only us amateurs but many of the engineers who strode in to assist us. Many stimulating conflicts between the "Unities" and the "Zeros" have disfigured our QST pages and still the controversy was unsettled. Now, however, we are pleased to present an article by Prof. Blake which we believe will decide the question for all time.

Prof. Blake is a teacher and consequently has a beautifully clear style of presentation. The article looks fearsome with its "math" but it is not as difficult as it appears at first blush. We are grateful to Prof. Blake for clearing up this subject and feel that every amateur can read his article with profit.—Editor.

HAVING been asked by the Editor for an expression of opinion on the discussion concerning power factor in wireless circuits originally raised by M. West (QST, Feb. 1921, p. 21) I gladly comply in the hope that possibly I may render the situation somewhat clearer. I have read the whole discussion with considerable interest, primarily because I believe it is my business as a teacher to help if possible those who are not trained to think in mathematical symbols to understand the physics of the things they deal with especially when as here it would appear that the books say one thing (power factor unity) and every radio operator knows (?) another.

What the books say is that when we have a coil and a condenser in series with each other and with an *impressed* sine-wave electromotive force (Figure 1), when the capacity and inductance of the circuit are so chosen as to balance each other and thus produce resonance—the so-called "voltage resonance" whereby the current in the circuit is in phase with the *impressed* voltage—then the power factor is unity, the value of the current at resonance being a maximum, viz., $\frac{E}{R}$.

Furthermore, the books say that when we have a coil and a condenser in parallel with each other but in series with an impressed sine-wave electromotive force (Figure 2), then resonance occurs (the so-called "current resonance") at the frequency given by the equation $\omega' = \frac{L - CR'}{CL'}$ and at resonance the line current is in phase with the *impressed* voltage and the power factor is unity, the value of the current at resonance being a minimum, viz., $\frac{ERC}{L}$. Mr. Anderson (QST, July 1921, p. 16) is right when he says that for either series or parallel resonance the resonant frequency occurs when $\omega' LC = 1$ provided the resistance is negligible but he is wrong when he says that the voltage across the series circuit is zero and the current is infinite at resonant frequency while with the parallel circuit the voltage across it at resonance is infinite and the current zero. Isn't it rather that in either case the voltage *across the circuit* is E, the impressed voltage?

When the books tell us that the power factor is nearly unity in either of the above circuits if R is small compared to ωL or to $\frac{1}{\omega C}$ they mean to have us take the voltage and current both of sine-wave form and they expect us in determining power factor to insert our voltmeter across E and in Figure 2 to insert our ammeter between E and C.

The apparatus referred to by Mr. West in which apparently the power factor was zero was the ordinary closed circuit of a small power spark transmitter with a rotating spark-gap (Figure 3). As in-

*Professor Physics Dept., Ohio State University

dicated an ammeter was inserted at A, and an equivalent spark gap was inserted across the primary of the oscillation transformer at V_s. It is of course well known that an equivalent spark gap is a measure of maximum voltage and not of effective voltage and it is obvious that one cannot determine the effective voltage from the maximum voltage unless he knows the form of the voltage-wave.

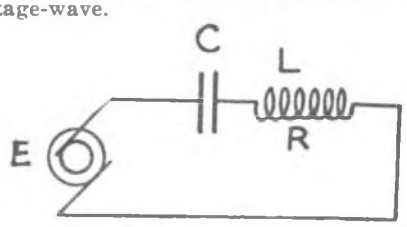


FIG. 1

In the absence of knowledge of the wave-forms of current and voltage I take them as sinusoidal. Now the books tell us (see for instance Morecroft, "Principles of Radio Communication") that the closed oscillating circuit, including the secondary of the power transformer and the condenser and the primary of the oscillation transformer, is in tune at audio frequency with the alternator, while the part of this circuit through the spark-gap, the condenser and primary of the oscillation transformer is also in tune at radio frequency with the antenna.

Now suppose for the sake of simplicity that all parts of our transmitter set are 100% efficient and let us take the power input to be 768 watts, the case cited by Mr. West in his reply to Mr. Stone (QST, April 1921). Call the power factor of our two audio circuits $\cos \theta_1$ and $\cos \theta_2$ and of our two radio circuits, $\cos \theta_3$ and $\cos \theta_4$. Then if e_1 and i_1, e_2 and i_2 are the effective values of the voltage and current in the primary and secondary of the audio circuits, while e_3 and i_3, e_4 and i_4 are the effective values of the voltage and current in the primary and secondary of the radio circuits, we have

$$e_1 i_1 \cos \theta_1 = e_2 i_2 \cos \theta_2 = e_3 i_3 \cos \theta_3 = e_4 i_4 = \theta_4 = 768 \text{ watts} \quad (1)$$

Now the wattmeter inserted in circuits 1 or 2 would read 768 watts. Assuming the radio frequency current in circuit 3 is prevented by choke coils from getting back into the power transformer we can say that on the assumption of no ohmic loss the voltage across the primary of the oscillation transformer is equal to that across the condenser C_3. Moreover, the energy in the condenser C_3 when fully charged is equal to the energy in the inductance L_3 when the current thru it is a maximum.

We have accordingly $L_3\omega = \dfrac{1}{C_3\omega}$ (2)

and

$\frac{1}{2} L_3 I_3^2 = \frac{1}{2} C_3 E_3^2$ *or* $\frac{1}{2} L_3 i_3^2 = \frac{1}{2} C_3 e_3^2$ (3)

where I_3 and E_3 are respectively the maximum values of the radio frequency current and voltage respectively in this circuit, e_3 and i_3 being effective values. Since the spark gap distances are arranged to break down for a voltage only slightly lower than the full voltage across the condenser, in the audio circuit 2 we have the energy in the condenser $\frac{1}{2} C_3 E_3^2$ distributed between the secondary of the power transformer and the primary of the oscillation transformer. Thus

$$\frac{1}{2} C_3 E_3^2 = \frac{1}{2} L_2 I_2^2 + \frac{1}{2} L_2 I'^2_2 = \frac{1}{2} L_2 I_2^2 \quad (4)$$

where I'_2 is the audio frequency current through ammeter A_2 and I_2 the radio frequency current through the same ammeter. It would appear at first sight as if the ammeter A_2 ought to read abnormally high due to this double current but this is not correct for during any one half cycle less than one fourth of the cycle is low frequency current followed by another fourth of damped high frequency current. The actual reading of the ammeter A_2 will be less than the ideal reading I_2 (as read by ammeter A_2) given by the sine-wave form assumed. In other words

$$I_2^2 > \frac{I'^2_2}{2} + \frac{I_2^2}{2}$$

Since the two radio circuits are tuned to each other we have

$$\frac{1}{2} L_3 I_3^2 = \frac{1}{2} C_3 E_3^2 = \frac{1}{2} L_4 I_4^2 = \frac{1}{2} C_4 E_4^2 \quad (5)$$

Now assume a wave length of 600 meters. Then

$$600 = 1885 \sqrt{L_3 C_3} = 1885 \sqrt{L_4 C_4} \quad (6)$$

Take C_4 to be .0001 and C_3 .001 microfarads, then $L_4 = 450$ and $L_3 = 45$ microhenries. If

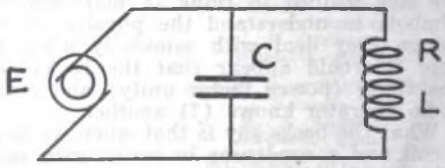


FIG. 2

now $i_3 = 100$ amperes then e_3 would equal 21200 and $E_3 = \sqrt{2}\, e_3 = 30000$ volts which is what the maximum voltage was across the equivalent spark gap used to determine V_s in the case cited by Mr. West.

Now Mr. Stone, in agreement with all the text books, says that in tuning a circuit to resonance the radio operator is balancing the inductive and capacitive reactance against each other so as to produce unity power factor with the Joulean resistance as the only impedance. In that case, as the Bureau of Standards states in its telegram of reply to the Chicago convention, the current is then in phase with the *impressed voltage*. But in radio circuit 3

the voltage across the primary of the oscillation transformer is *not the impressed voltage at all.* The books tell us (see for instance Morecroft, pages 295 and 303) that the two audio circuits 1 and 2 can be replaced by a single circuit consisting of a generator in series with an inductance and capacity (Figure 1 of this paper—remember no resistance assumed). For this circuit the *impressed* voltage is that of the generator, the voltage across the condenser is 90° ahead of the impressed voltage, the voltage across the coil is 90° behind the impressed voltage. But the voltage across the primary of the oscillation transformer is (in the case cited) 21200 volts effective or 30000 volts maximum and it is the same voltage for the audio circuit 2 as for the radio circuit 3.

The books tell us (*e.g.*, Morecroft, page 299) that the power given to a condenser is $\frac{CV^2N}{2}$ where V is the voltage to which the condenser is charged, C its capacity and N the number of sparks per second. If our alternator has a frequency of cycles, then our condenser of capacity .001 microfarad raised to a voltage of 21200 volts would have a power of 225 watts given to it, which is also the power put into the primary of the oscillation transformer, $\frac{1}{2}LI^2N$. But we had 768 watts available according to Mr. West, less than a third of which was needed if our apparatus had been 100% efficient throughout.

Now Morecroft (p. 294) states that the efficiency of a spark transmitter varies from 30 to 60% with the average 40%. That is, the power in the antenna is 40 per cent of the power input in the generator. Assuming our transmitter 40% efficient we would need 563 watts input where we had 768 watts. Had Mr. West's ammeter had a greater range than 100 amperes he would have found that with a spark transmitter 40% efficient his current would have read 117 instead of 100 amperes with 768 watts input.

In the above discussion the efficiency of our apparatus was taken as 100%. On this basis what would have been the reading of an ammeter in the antenna circuit and what would have been the maximum voltage of the antenna wires with respect to ground?

We have $\frac{1}{2} L_3 i_3^2 = \frac{1}{2} L_4 i_4^2$ and we took $i_4 = 100$ amperes. Hence $i_3 = 31.6$ amperes. We have further $\frac{1}{2} C_3 E_3^2 = \frac{1}{2} C_4 E_4^2$ and we found E_3 to be 30000 volts, giving E_4 to be 95000 volts. It is manifest that a ratio of $\frac{C_3}{C_4} = \frac{L_4}{L_3} = 100$ say instead of 10, would have given E_4 300,000 volts and i_4 10 amperes.

Let us now get back of the point at issue. Is the power factor of a radio circuit unity or zero? The books tell us that power factor is the ratio between the wattmeter reading and the product of the readings of the voltmeter and ammeter. Since it is very often desirable to know what is the power consumed not in a whole circuit but in some portion of it, no one can criticise if we talk about the power factor of a given portion of a circuit. For instance, if I want to measure the power consumed in a condenser I put the current coil of the watt-

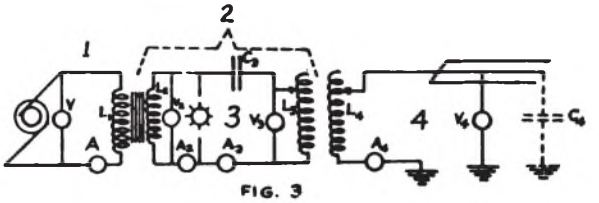


FIG. 3

meter in series with the condenser and the voltage coil across the condenser. If I now put an ammeter in series with the current coil of the wattmeter and an electrostatic voltmeter across the condenser I can determine the power factor of the condenser as $\frac{\text{wattmeter reading}}{\text{volt-amperes}}$ provided the wattmeter reading is corrected at low power factors for the effect of reactance in the voltage coil of the wattmeter. In this case I will find it to be almost zero for a good condenser, which we ordinarily express by saying that the current through the condenser and the voltage across it are in quadrature. Similarly if I want to determine the power loss in a coil of wire I will find the power factor small for a coil having its resistance low compared to its reactance, the current through the coil and the voltage across it being again 90° apart, only this time the current lags. If I now put a condenser in series with a coil and in series with an impressed E.M.F., I can balance the inductance of the coil against the capacity of the condenser so that if I put the voltage coil of the wattmeter across the impressed E.M.F., the current coil of the wattmeter being in series with the ammeter inserted in the circuit (I now have a whole circuit instead of a part of one), a voltmeter also being inserted across the impressed E.M.F., then the power factor of the whole circuit as given by $\frac{\text{wattmeter reading}}{\text{volt-amperes}}$ will be almost unity. Had the voltmeter and the voltage coil of the wattmeter been across the condenser or the coil then the power factor would have been very low (nearly zero) and the wattmeter reading divided by the square of the ammeter reading would have given me not the effective re-

sistance of the entire circuit but of the condenser or of the coil.

Suppose now that I seek to investigate the power factor of all or a part of a second circuit connected indirectly to the first one by means of a transformer. This second circuit (circuit 2, Figure 3) will contain the secondary of the transformer, a condenser and another coil in series. This circuit is tuned to the frequency of the impressed E.M.F. of the primary circuit. I will first put the voltage coil of the wattmeter and the voltmeter across the secondary of this power transformer. In the primary circuit we have the voltage across the primary of the power transformer equal to the impressed voltage multiplied by the factor $\frac{\omega L}{R}$ where L is the inductance of the primary and R is the resistance of the circuit. At resonance this is known to be many times the impressed voltage provided L is large and R small. The voltage across the secondary of the power transformer is stepped up from that across the primary, hence it is of the order of 10000 volts on open circuit. But on closed circuit the voltmeter when placed across this secondary of the power transformer will read not the induced voltage in the secondary but this quantity minus the counter E.M.F. of the secondary due to the current flowing in the circuit. Now the inductance L_1 is always very great compared to the inductance L_2, hence the counter E.M.F. in L_1 is great and the voltmeter reading V_2 may be very low (on the assumption that the radio-frequency currents in circuit 3 are prevented from circulating in L_2 by the interposition of choking coils). Now the ammeter A_2 will read higher than A_1 so we will say it reads 140 amperes. Since the only things in circuit 2 that consume power are the resistances of the different parts of the circuit the voltmeter V_2 is apt to read some value between 0 and 50 volts on closed circuit. For the sake of clarification we have assumed our apparatus 100% efficient, hence the power factor of circuit 2 would necessarily be unity and the voltmeter when placed across L_2 would accordingly read 5.5 volts.

If I now pass to circuit 3, the first of the radio frequency circuits, a voltmeter put across the condenser or the primary L_3 of the oscillation transformer will read 21200 volts and if put across the spark gap it will read only slightly less. Thus the power factor of circuit 3 would then be

$$\frac{\text{768 watts}}{\text{21200 x 117 volt-amperes}} = 0.00031.$$

Passing to circuit 4, the second circuit of radio frequency, our transformer being considered 100% efficient the power factor of circuit 4 would necessarily equal that of circuit 3, viz., 0.00031.

Let us now review our four circuits in the light of equation (1) except that we will now try to allow roughly for the energy losses as we pass from one circuit to another. In circuit 1 we had 768 watts which for convenience we will say gave $e_1 = 110$ volts, $i_1 = 8$ amperes and $\cos \theta_1 = 0.87$. In passing to circuit 2 we will assume the transformation 90% efficient and hence take $e_2\ i_2 \cos \theta_2 = 671$ watts. Now we take i_2 to be 140 amperes and e_2 may well be as low as 8 volts. This would make $\cos \theta_2$ 0.60. For circuit 3 we will take the efficiency of transformation 64%. We have then $e_3\ i_3 \cos \theta_3 = 429$ watts and with e_3 21200 volts and i_3 117 amperes this makes $\cos \theta_3$ equal to 0.00017. Calling the efficiency of transformation between circuits 3 and 4 70% we have $e_4\ i_4 \cos \theta_4$

This hasn't a thing to do with Power Factor—it's the new First District Radio Inspector, Frederick Charles Kolster, who, with his parents, is busily checking up decrements and things. Bad stations had better watch out!

=300 watts. If we take e, 212000 volts and i, 10 amperes, $\cos \theta$, comes out 0.00015. Thus a numerical calculation shows the power factor for each of the two audio circuits to be nearly unity while for each of the two radio circuits it is nearly zero.

Now how do these conclusions check up with the telegraphic information sent the Chicago Convention by the Bureau of Standards? Since a transformer may be thought of as a generator and since in the generator circuit there is often a condenser in series or parallel with the generator, we can say for either of our two audio circuits 1 and 2, Figure 3, that we have capacity reactance and inductive reactance balancing each other leaving the current in phase with the impressed voltage; hence the power factor is unity. On the other hand the two radio circuits 3 and 4, Figure 3, may be said to be "freely oscillating" circuits whereas 1 and 2 were "forced oscillating" circuits, therefore there is no such a thing as an impressed E.M.F. in circuits 3 and 4. Since in these circuits capacity reactance also balances inductive reactance and there is no single unit (coil, condenser, spark-gap, etc.) across which it is possible to put a voltmeter so as to get a low reading, we are forced to say that *for freely oscillating circuits of any frequency, audio or radio, for which the conditions of resonance hold whereby the capacity and inductive reactances balance each other, the power factor is zero or nearly zero.* In this last statement I would beg leave to differ with the Board appointed at the Chicago Convention to consider the telegram of the Bureau of Standards (QST, October 1921).*

One is apt to gather from the above discussion that for circuits of audio frequency the power factor is unity while for circuits of radio frequency the power factor is zero but that would be a mistake. Rather the crux of the situation is this: if a circuit of whatever frequency has an external E.M.F. or its equivalent impressed upon it then the power factor will be high for the voltmeter reading across this impressed E.M.F. will be low on closed circuit; but a freely oscillating circuit of whatever frequency will have a low power factor, for there is no external E.M.F. and hence there is nothing in the circuit (but ohmic drop of potential) across which a voltmeter may be placed so as to give a low reading.

It is hoped that the above discussion will prove of value to some of the readers of this journal and that Mr. Stone and Mr. West will each get what comfort he can from it.

*It must be such circuits that Professor Morecroft has in mind when he says in his text book on radio communication "in some parts of efficient radio circuits the power factor may be as small as 0.005."

Daylight Transcons

By F. H. Schnell, Traffic Manager

SUNDAY July 2nd, Tuesday July 4th, and Sunday July 9th, will mark the first attempts by members of the A.R.R.L. to push a message from Coast to Coast between the hours of 9 a.m. and 6 p.m.

We are optomistic and do not anticipate electrical storms, but three days were selected to overcome such disturbances as would prevent our working.

Hardly can it be expected that each message will go through to its destination, but we want to see just how far we can reach by amateur radio in daylight.

Several reasons for attempting daylight relays prompt this severe test for us amateurs. QRN and QSS are practically nil during the day and should not cause any trouble. The increased number of stations makes for short jumps within the normal limits of the range of transmitters. Daylight routes are in operation in many parts of the country. So why not, fellows? What is there to prevent daylight "Transcons?" Let's try it!

Here is an opportunity to see what your outfit will do in daylight, whether it be spark or C.W. There is plenty of room for everybody to participate in the affair and here's how it will start.

Promptly at 9 A.M. Pacific Standard Time, on each of the above dates, a station in California will start an eastbound message addressed to our President, Hiram Percy Maxim, 1AW, while at 9 A.M. Eastern Standard Time a station in Maine will start a westbound message addressed to a station in California. Each of the messages on each day will go via our three routes, Northern, Central and Southern—against time. The idea is to put the eastbound message as far EAST as we can and the westbound message as far WEST as we can during the hours of the tests.

All transmission will stop at 6 P.M. your local standard time.

It is of vital importance that you keep an accurate log designating your local standard time, with call letters of stations from which you received the message and to which you transmitted the message. Without an accurate log from each station it will be impossible to determine just where each message stopped at 6 P.M.—

be sure and keep a log, and immediately after each test send a copy of your log to the Traffic Manager, A.R.R.L. 1045 Main St., Hartford, Conn.

Remember the dates—July 2—4—9th.

Stick to your guns, men, and let's write another page into the history of Amateur Radio.

1QP-An Interesting C.W. Transmitter

JOHN L. REINARTZ of 1QP, originator of the justly famous "Reinartz tuner" for the reception of C.W. telegraph signals, has now produced a transmitter at his station that makes use of much the same principles as the receiver and is quite as novel.

1QP's set is a panel using four U.V.202 Radiotrons with 700 volts of rectified but unfiltered A.C. on the anodes, antenna currents up to 3½ amperes being obtained. Photographs with this article show front and rear views of the panel, about which there is nothing particularly unusual except the two spider-web coils, one at either end of the main inductance.

This brings us to the wiring diagram, Fig. 1. L_1, the main tuning inductance, is a helix of 8" x ½" edgewise-wound copper strip. L_2 and L_3 are the spiderwebs, respectively in the plate and grid circuits, both wound of No. 24 D.C.C. wire on 2½" centers. L_3 has a total of 75 turns, tapped

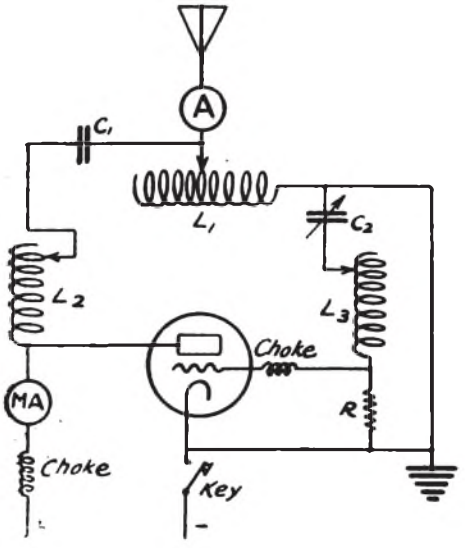
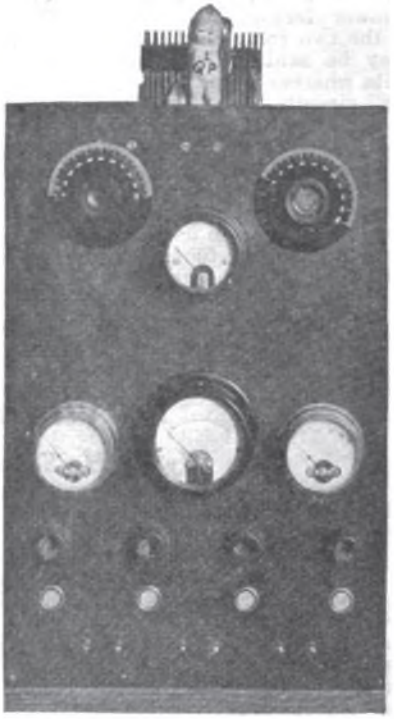


FIG. 1

every 15 turns, while L_2 has ten taps of 5 turns each. C_1 is a fixed mica condenser, high-voltage type, capacity .002 mfd. or thereabouts, while C_2, the grid condenser, is an air variable of 7 plates widely spaced to stand the voltage, built up from a 13 plate of ordinary construction, with movable plates to ground. C_2 is operated at very low values of capacity but must be variable. The grid leak R has a resistance of 10,000 ohms and the same value is used for any number of tubes from one to four, correction apparently being got by adjusting the value of C_2.



It will be remembered that in the Reinartz receiving tuner the aerial circuit is untuned and shocks the tuned secondary circuit into oscillation at the latter's period, reducing tuning to one control. (Because of the loose coupling afforded by the fact that the aerial circuit consists of but a turn or two of the coil, the tuning is much sharper than in the usual single-circuit tuner.) Rather naturally, the transmitter observes the reverse of the receiver performance—over a considerable band of wave lengths the grid and plate circuits operate aperiodically and the radiated wave length is determined solely by the position of the antenna clip on L_1. Thus 1QP has a wave length of 174 meters when

but one turn of aerial inductance is used, climbing to 212 when 6 turns are used, and the antenna current remains constant regardless of the shortness of wave.

It is a little puzzling to trace out the theory of the thing from Fig.1, so let us turn to "A" in Fig. 2, which shows the same thing. Immediately we recognize the circuit recommended by 1QP for his receiving tuners, except that the location of the grid condenser has been changed. Compare this with "B", which is the

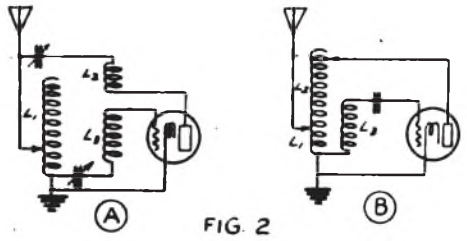
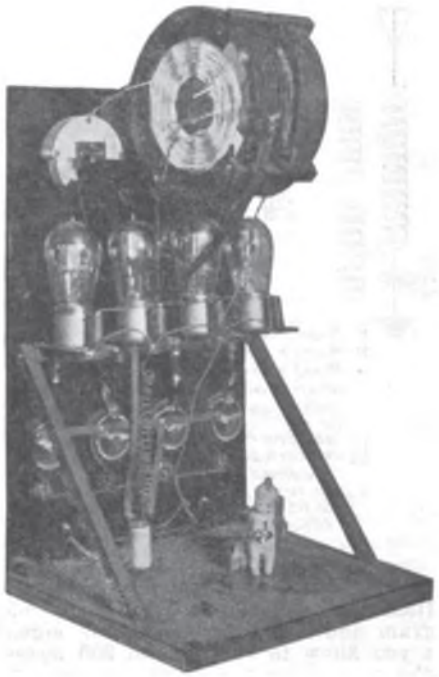


FIG. 2

popular "1DH-9XI-Stanley-British-Aircraft-G.E.-reversed-feedback" circuit giving such excellent results in many amateur stations. L_1 and L_4 are the same and the only difference is that where "B" uses the unused turns of the main helix for the inductance L_2, circuit "A" uses a separate winding L_2. It is quite permissible to have this inductance separate; it is a reactance for the adjustment of the output impedance of the tube and does not even have to be coupled to L_1. In fact in the Reinartz set neither L_2 nor L_3 need to be coupled to the main helix and are placed at the ends of the winding merely because it was convenient structurally to stick them there. When so coupled, however, the polarity is important of course—in one direction they work well and in the other they don't. Fig. 1 shows no coupling between them.

The set is easy to adjust. The antenna clip determines the wave length. Grid circuit C_1 L_3 must be set approximately right by selecting the proper tap on L_3 and getting final adjustment by securing the best value of C_r. As in any such circuit, preliminary adjustments are made using all of the inductance of L_2 gradually cutting it down as the efficiency is improved. If the anode voltage is variable it too should be reduced while first adjustments are being



made. As the adjustments proceed increased efficiency will be apparent mainly by a reduction of the input to the tube—a reduction that drops it below the normal safe rating—whereupon the voltage is increased to bring the input up to normal, the output increasing proportionately, with about the same efficiency as before.

1QP's transmitter circuit works F.B.

—K.B.W.

A Weagant Circuit Receiver

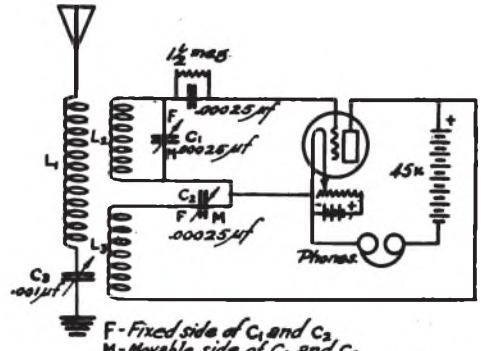
By F. A. Hill, 4GL

I YIELD me to a thousand demands that I write a description of the receiver at 4GL. The circuit is as old as the hills—see Bucher's "Vacuum Tubes in Wireless Communication"—and credit for the hook-up belongs to Roy A. Weagant, engineer for the Radio Corporation of America.

Referring to the accompanying diagram, which should be self-explanatory, this is a set built around a receiving tube. If you use "J" tubes, for instance, your tickler circuit L_4 C, will be of different proportions than for a U.V.200. The set can be made to work on both but best results at 4GL have been obtained by building the circuits to suit a "J" (VT-1) tube. It takes a little patience to get it working right at first. Don't hook it up in a hurry and expect to hear a Ford coil in Honolulu the first night; or write to QST and say it's no good. Save your comments and turn them into inquisitiveness directed at the set itself.

L_2, the secondary, is made from a 35-turn honeycomb coil with turns pulled off to get exactly the right inductance. The tickler, L_4 is wound of No. 36 S.C.C. wire on a card-

board tube just large enough to slip snugly inside the honeycomb secondary. Make sure that all the turns (single layer) fit within the width of the honeycomb, starting with an arbitrary number of turns between 60 and 75. The primary is a 25-turn honeycomb.



F - Fixed side of C_1 and C_2.
M - Movable side of C_1 and C_2. Movable sides go to — of A battery which is at ground potential, reducing body capacity effects on condensers to nil.
L_1 - 25 turn honeycomb
L_2 - 35 turn honeycomb (cut down to required size)
L_3 - 60 turns (approx.) No. 36 S.C.C. on spool to fit snugly inside L_2 and not extending out from each side of L_2.
C_1 C_2 - .13 plate variables.
C_3 - .43 plate variable.

Hitch up these coils as per the appended diagram and listen for some CW signals that you know to be right on 200 meters. If the tube doesn't oscillate, reverse the tickler leads L_3. Note on your secondary condenser the point at which 200 meter CW stations come in, and then cut down secondary inductance by taking turns off the coil L_2 until the 200 meter stuff comes in at about 20 degrees on the secondary condenser scale, with the tickler oscillating any old way.

Then turn your attention to the tickler circuit, winding off or putting on turns on the tickler until with your secondary condenser set at 20 degrees for 200 meter stuff, the circuit will begin oscillating with the tickler condenser set at 10 degrees. The tickler condenser controls the regeneration and oscillation. When you have fixed the tickler L_3 at such point that by setting the tickler condenser at 20 degrees you can run from zero to 180 on your secondary without oscillations stopping, breaking or otherwise missing fire, you have the secondary and tickler all right.

Then turn to your aerial circuit. Monkey with that until the resonant point appears at about 90 degrees on the 180-degree scale of the antenna condenser. This will give strongest 200 meter signals, and leave 90 degrees up or down either for tuning to other waves or for detuning on 200 meters to kill QRM. The coupling between L_1 and L_2 should be about two inches. The range of the secondary when the set is completely fixed should be from 180 to 375 meters with the tickler condenser set at 20 degrees, and picking up CW stations on nearly every degree all the way up and back again. A one-armed man can operate the set with his one hand and write with his feet or his teeth—it's that simple.

The antenna condenser can detune the aerial to such an extent that CW sigs come thru fine and at the same time local CW stations putting out 4 amps. will not prevent reception. All CW signals are tuned in with great ease. Of course you can get signals loud enough to knock your head off if the antenna is tuned to resonance but it also brings in sparks and other disturbances. For traffic work it is better to detune the antenna considerably, keeping primary condenser around 20 degrees, setting the tickler at 20 degrees, and then doing all your fishing with the secondary condenser, running from about 10 degrees all the way up to 180. 4BY and 4GL at Savannah are but a mile apart, yet with this type of circuit neither interferes with the other and the scramble for traffic goes merrily on regardless of the soup in the other fellow's antenna when transmitting.

The writer likes this circuit immensely, but that may be a case of personal taste. The reader after trying the circuit out thoroly should be able to determine. But for the love of Mike, if you can't make it work, don't write 4GL and tell him your troubles—put it away on the shelf and then come back to it after you have become disgusted with other hookups and have really determined to *make* it work. It can be done if you have the patience and tenacity.

Transmission Difficulties.

The Radio Telephony Conference

THE conference called by Secretary Hoover to consider the general questions concerning the regulation of radio communication with particular reference to problems involved in the broadcasting of news and entertainment was brought to a satisfactory conclusion on April 19. All suggestions received were given very careful consideration, and the great majority of comments approved the recommendations of the preliminary report which was issued early in March, and as a result the final report, as amended and adopted, was released on April 29.

This report makes recommendations as to the allocation of waves for particular kinds of radio telephone service. It is expected that at an early date a bill will be introduced in Congress which, if passed, will establish the recommendations of the conference as the general law to govern the operation of radio.

Some of the Recommendations

Some of the more important provisions of the Conference's recommendations are as follows:

That waves for radio telephony be assigned in bands, according to the class of service; that within these service bands a particular wave length be assigned each broadcasting station; that the amateur band be sub-divided into bands according to the method of transmission, sparks on the lowest wave lengths, I.C.W. and M.C.W. next, then phones, then straight C.W. telegraphy, with broadcasting permitted within the amateur phone band; that the present regulations respecting experiment stations remain in effect; that direct advertising by radio be absolutely prohibited; that the power of broadcasting stations be limited and specified in order that as many services as possible may be permitted; that in order to prevent jamming between broadcasting stations the same wave length not be duplicated within a radius of approximately three times the normal day range of any such station; that where broadcasting congestion exists, hours of operation be specified for the broadcasting stations; that when all available wave frequencies in any geographical region are already assigned, no further broadcasting licenses be granted in that region; that the amateur's status and his wave lengths be defined in the new law; that amateur deputy inspectors be authorized.

While the Conference was in recess many comments were received from all over the country and upon reconvening it was found desirable by the Conference to make changes in the recommended allocation of wave bands as originally proposed. The changes for the most part take the form of opening the public band and the private band each to the other in most cases, and in the establishment of additional bands for the use of both of these services. The recommendations are given in the following table:

	Use	Wave Length Meters
(1)	Transoceanic radio telephone experiments, non-exclusive. (See Note 3)	6,000 to 5,000
(2)	Fixed service radio telephony, non-exclusive. (See Note 4)	3,300 to 2,850
(3)	Mobile service radio telephony, non-exclusive	2,650 to 2,500
(4)	Government broadcasting, non-exclusive. (See Note 1)	2,050 to 1,850
(5)	Fixed station radio telephony, non-exclusive. (See Note 5)	1,650 to 1,550
(6)	Aircraft radio telephony and telegraphy, exclusive	1,550 to 1,500
(7)	Government and public broadcasting, non-exclusive	1,500 to 1,050
(8)	Radio beacons, exclusive (See Note 6)	1,050 to 950
(9)	Aircraft radio telephony and telegraphy, exclusive	950 to 850
(10)	Radio compass service, exclusive. (See Note 7)	850 to 750
(11)	Government and public broadcasting, 200 miles or more from the seacoast, exclusive	750 to 700
(12)	Government and public broadcasting, 400 miles or more from the seacoast, exclusive	700 to 650
(13)	Marine radio telephony, non-exclusive. (See Note 8)	750 to 650
(14)	Aircraft radio telephony and telegraphy, exclusive. (See Note 8)	525 to 500
(15)	Government and public broadcasting, exclusive	495 to 485
(16)	Private and toll broadcasting. (See Note 9)	485 to 285
(17)	Restricted special amateur radio telegraphy, non-exclusive. (See Note 10)	310
(18)	City and state public safety broadcasting, exclusive. (See Note 11)	285 to 275
(19)	Technical and training schools (shared with amateur). (See Note 12)	275 to 200

(20)	Amateur telegraphy and telephony (exclusive, 150 to 200 meters). (Shared with technical and training schools, 200 to 275 meters). (See Note 13)	275 to 150
(21)	Private and toll broadcasting, exclusive	150 to 100
(22)	Reserved	below 100

Note 1. The terms used in the above schedule are defined as follows: "BROADCASTING" signifies transmission intended for an unlimited number of receiving stations without charge at the receiving end. It includes:

(1) **Government broadcasting** signifying broadcasting by departments of the Federal Government:

(2) **Public broadcasting** signifying broadcasting by public institutions, including state governments, political subdivisions thereof, and universities and such others as may be licensed for the purpose of disseminating informational and educational service:

(3) **Private broadcasting** signifying broadcasting without charge, by the owner of a station, as a communication company, a store, a newspaper, or such other private or public organization or person as may be licensed for the purpose of disseminating news, entertainment and other service; and

(4) **Toll broadcasting** signifying broadcasting where a charge is made for the use of the transmitting station.

Note 2. A station carrying on two or more of the broadcasting services specified in classes 2, 3 and 4 must be licensed for each class of service.

Note 3. When transoceanic radio telephone experiments are to be conducted the Department of Commerce should endeavor to arrange with other countries for the use of the wave band 5,000 to 6,000 meters assigned for this purpose.

Note 4. The wave band from 2,850 to 3,300 meters may be used for fixed service radio telephony only provided it does not interfere with service using continuous wave telegraphy.

Note 5. The wave band from 1,550 to 1,650 meters is for use of radio telephone communication over natural barriers, but is not exclusive of other services.

Note 6. Radio beacons are radio transmitting stations which transmit signals from which a mobile direction finding station may determine its bearing or position.

Note 7. Radio compass service is here used to signify a direction finding service in which a mobile station transmits to one or more fixed stations which in turn transmit back the bearing or position of the mobile station.

Note 8. The wave band from 525 to 650 meters is reserved for marine radio telegraphy, exclusive.

Note 9. Assignment of waves in band 16 will, in general, involve keeping the zones from 285 to 315 and from 425 to 475 meters open in coastal regions. Furthermore, in border regions, account should be taken of the wave lengths used in neighboring countries, and these should be suitably protected by a locally unused band of adjacent wave lengths.

Note 10. The restricted special amateur wave of 310 meters is for use by a limited number of inland stations and only where it is necessary to bridge large, sparsely populated areas or to overcome natural barriers.

Note 11. City and state public safety broadcasting should in small cities be conducted by interrupting the broadcast service of classes 2, 3 or 4 in case of emergency. In large cities this service will ordinarily have its own stations and will use the wave band, 275 to 285 meters, assigned to such service. Private detective agencies desiring to operate radio telephone broadcasting service should be required to co-operate with municipal or state services in the use of the wave band 275 to 285 meters, assigned to the latter service.

Note 12. By "technical and training school" in this report, is meant a school which in the judgment of the Secretary of Commerce is carrying on sufficient instruction of the proper character for training men for the radio profession to warrant the granting of a station license for that purpose.

Note 13. An amateur is one who operates a radio station, transmitting, receiving, or both, without pay or commercial gain, merely for personal interest or in connection with an organization of like interest.

Note 14. The Conference is of the opinion that broadcast transmitting stations should not in coastal regions be permitted on wave lengths closely adjacent to those assigned in the marine traffic and believe that its recommendations provide for adequate protection of such marine traffic. The Conference recommends the assignment of wave lengths adjacent to those used in the marine traffic to inland stations under such conditions as to avoid interference with the marine traffic.

New Bill Soon

The legal section of the Department of Commerce at this writing is engaged in drawing up an *amendment* to the present radio bill, which will no longer make it obligatory upon the Secretary of Commerce to issue licenses upon application but will give him wide discretionary powers and permit the administration of radio in accordance with the Conference recommendations. The A.R.R.L. reserves opinion on the new bill until its actual appearance.

We hope there will be no undue delay in putting the new bill into law, but we are afraid there will be quite a fight in Congress when it appears. There are some individuals and some interests who are out gunning for trusts and folks that like a good lively scrap are pretty likely to find it in Washington when the new bill comes up. —K.B.W.

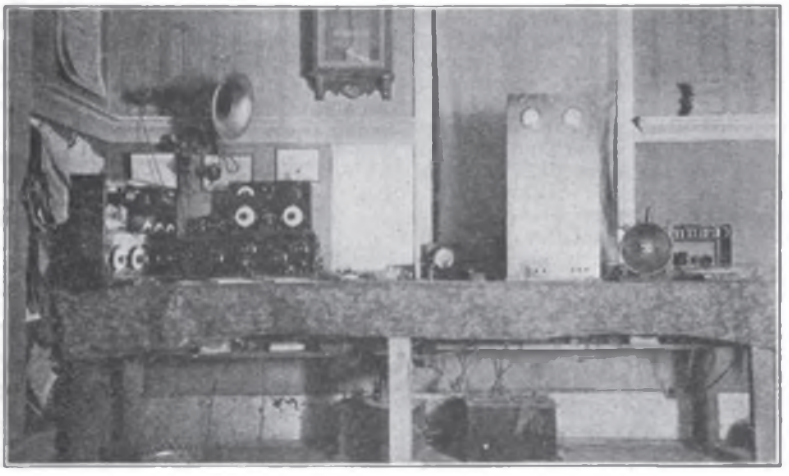
Greater "DX"

By F. H. Schnell, Traffic Manager

WHAT is it that makes an amateur buy pounds and pounds of wire for a good ground connection, stick up poles as high as he can get them and do hundreds of other seemingly unnecessary things about his station?

Distance—greater "DX" traffic handling —that's the answer! That is the prime factor in an amateur's life. He wants to annihilate miles.

Handling traffic on schedule is a method of increasing the distance over which traffic is handled.



Station 6ZZ, Douglas, Ariz.

Bearing in mind some unusual distances over which sufficiently powered stations have been heard, the idea occurred that stations on the Pacific Coast could be heard on the Atlantic Coast providing a schedule of listening periods was adopted and type of transmitter and exact wave length was known to the listeners. Now it does not take a super-station, as 1BCG has been termed by many, to do this, which has been proved by the fact that 6ZZ, H. L. Gooding, of Douglas, Arizona, was copied by four Hartford, (Conn.) amateurs four mornings in succession for one hour each morning.

Having no idea of the transmitting equipment at 6ZZ except that it was CW (can't seem to lay off that CW) did not deter us from our idea. A night letter was sent to 6ZZ and 6ZF asking them to transmit for one hour, three to four A.M. Eastern Standard Time, beginning April 8th, and continuing through April 12th. 6ZZ was asked to advise the wave length he would use, and which we found was about 365 meters.

The alarm clock did not disturb the operator at 1MO for the first morning's test, but fortunately nothing was lost as 6ZZ got his dates mixed and did not transmit. On the morning of the ninth and tenth signals were quite steady and

could be copied with the detector alone, while with two steps of audio frequency amplification signals were audible fifty to sixty feet from the phones. Upon examination of the logs of Hartford amateurs, 1BHW, operated by our editor K. B. Warner, was the first station to log 6ZZ, the time being 3:01 A.M. At 1MO, 6ZZ was logged at 3:08 A.M. This was April 9th. Radiations set up by the various receiving tuners caused some interference. Static was moderately heavy during this period, but 6ZZ was heard until 3:55 A.M. when he stopped transmitting.

The success of hearing 6ZZ brought out more receivers and the morning of April 10th found perhaps three more ops on the job, but with all the squealing and beating of receivers it sounded like dozens. In spite of this handicap four amateur stations logged 6ZZ for a solid hour. Messages were sent and about sixty percent. of them were copied through interference.

Having noticed the slight increase in signal strength as daylight broke on the tenth, we popped a wire to 6ZZ and asked him to transmit from four A.M. to five A.M. on April 11th. Nope, not for the purpose of fooling the other listeners, O.M. They were there to stick from 3 A.M. till sunup. The morning of April 11th greeted us with moderate static and it sounded like every receiver in Hartford was feverishly combing the ether for 6ZZ, who started calling 1MO at 3:59. This brought a lull in the tuning as apparently each receiver was hearing 6ZZ. Four messages were copied and signals increased amazingly after daylight, while the static was almost nil.

Evidently other Pacific Coast amateurs were getting the "DX" fever and wanted to horn in on the tests as 6EN at Los Angeles logged by 1BHW, calling 1AW.

An amateur takes great pride in his equipment, especially his rectifier, and will go to any means to protect it, as is shown in one of the messages copied from 6ZZ which read as follows:

Corona Typewriter Co.,
Groton, N. Y.
Was Corona worth fixing? Threw it at my dog when he caught his tail in rectifier.

H. L. Gooding.

The increase in signal strength which occurred after daylight prompted a wire to 6ZZ asking him to transmit from five A.M. to six A.M. on the morning of April 12th. We also asked him to listen for 1BGF (1 fifty-watt tube) from three to four A.M. 6ZZ reported hearing 1BGF at 3:40 a.m. but unreadable through heavy static.

At five A.M. on the morning of April 12th it was broad daylight and signals from 6ZZ were unusually QSA. Everything was copied until the sun came over the hill at 5:27 when 6ZZ faded out completely, thereby ending one of the thrills we enjoy now and then.

The Receivers

1BGF—Three circuit regenerative, detector only, antenna 4 wires 60′ high, 60′ long.

1BHW—Reinartz single circuit, 2 steps, antenna 1 wire 100′ long, 20′ high.

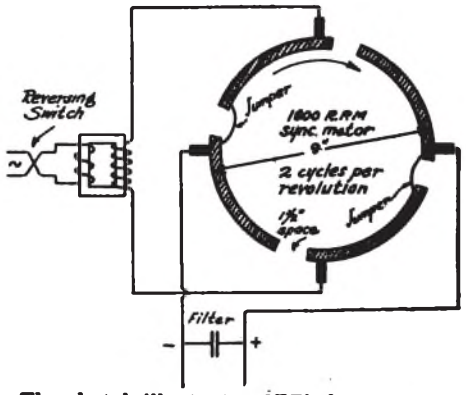
1HX—(Boyd Phelps, formerly of 9ZT) antenna 40′ high, 225′ long, single circuit, 2 steps.

1MO—Three circuit regenerative—2 steps, antenna 1 wire 135′ long, 24′ high.

The CW transmitter at 6ZZ uses two 50-watt-tubes on a synchronous rectifier with 1000 volts on the plates, space current 210 M.A. On a wave length of 365 meters the antenna current is 7.5 amps. A spark set, which has not been used recently but which is always ready for action, consists of a 1 K.W. Thordarson transformer; .007 M.F. condenser made of ¼″ glass in oil built according to 9ZN's article in QST; Hyrad non-sink gap; and pancake O.T. The antenna current at 200 meters is 4.5 amps.

The antenna at 6ZZ is of the inverted L type with an 8-wire cage, 60 feet long and 60 feet high. The counterpoise is 165 feet long and 15 feet above ground. Receiving equipment comprises a "Reinartz" tuner, short wave regenerative receiver, and four steps of A F. amplification.

Editor's Note—The high-voltage synchronous rectifier finds a new role in amateur C.W. operation. Altho almost unknown in the eastern states many west coast amateurs, notably 6ZZ, 6JD, and 6EN, are using them with good results.



The sketch illustrates 6ZZ's layout, which consists of a 9-inch bakelite disk ½″ thick carrying four copper segments and driven at 1800 r.p.m. by a synchronous motor. The four brushes are regular medium hard carbon motor brushes, ¼″ thick x ½″ wide, set in holders and capable of revolution to adjust to synchronism. Two brushes feed

the high-voltage A.C. to the disc and the other two convey the rectified current to the filter system. In other words, it's a rotary reversing switch, operated synchronously.

Mr. Gooding says it runs without a hitch but the primary requirement is that it be a first-class machine job, run perfectly true., etc.

Amateur Storm Relief Work

By R. H. G. Mathews, Central Division Manager

ON the morning of February 21st the entire Fox River Valley in the northeastern part of Wisconsin was visited by a heavy rain storm continuing during the entire day and the greater part of the following night. During the night the temperature suddenly dropped to freezing, giving the entire district affected a complete coat of ice. The rain continued and froze as it fell, until trees poles, wires and everything in general was covered with from four to six inches of heavy ice. About 4:00 A.M. on the morning of the 22nd the temperature dropped still farther, which was followed by heavy snow flurries.

About this time electric wires went down, train service was brought to a standstill, and the entire telephone, telegraph, and power and lighting service of all the cities in the Fox River Valley was cut off. As Quinn of 9ZL put it "The only means of communication and transportation was by foot, with very poor footing at that". The next act of the storm was to bring still colder weather and high winds, which carried away telephone poles, wires and trees, eliminating the possibility of repairs.

At about eight o'clock on the morning of the 22nd one of the large paper manufacturers at Neenah, Wisconsin, went to Quinn Brothers, who have just taken over 9ZL's old special license, and asked them if there was any possible way to get a message through to Manitowoc in order to obtain coal to keep the mills running. Upon the explanation being given that they were without power due to the failure of the city lighting service, he informed them that the mills could supply their own alternating current from their power plant, and suggested the installation of a radio set at the mill.

After some discussion and the ransacking of all the stations in Neenah the Quinn brothers, together with Mr. Bishop of 9DV, scraped together a ½ k.w. spark transmitter and a regenerative receiver with detector and two-step amplifier. Although 9ZL's regular equipment consists of CW apparatus, in emergency the old reliable spark came into its own. As Mr. C. J. Quinn poetically puts it,

"Ashes to ashes or dust to dust,
The CW will work 'em
But in sparks we trust
We'll raise that ham with a spark or bust."

Within six hours the three of them had the set in operation which is shown on the enclosed photo, the three operators shown

being the two Quinns and Mr. Bishop. The set was tuned to 600 meters and communication immediately effected with the station of the Pere Marquette Railroad, WMW, located at Manitowoc, Wisconsin. In this connection it is interesting to note that the call of the Neenah emergency station, which was signing 9ZL, was not heard by WMW until one of the operators of the Manitowoc station who is an amateur and was listening on a 20 foot indoor aerial phoned the commercial station and informed them that they were being called.

9ZL had hardly cleared their emergency

traffic with WMW when 9DHG at Oshkosh called with a lot of traffic from his city which he reported to be in the same condition as Neenah. 9DHG had of course lost his aerial when the rest of the wires went down and his power was also disconnected. In order to overcome this difficulty he had put together a spark coil outfit and was working with a temporary aerial strung up in his attic. As the day went on other stations came in using temporary apparatus, for the most part spark coils. Among these were Lawrence College at Appleton, Wis., and Emmet Platten of Green Bay, Wisc. Many extremely important messages were handled and invaluable service rendered, particularly to the Northwestern Railroad Company, which had had several wrecks and was in great need of wrecking equipment. By radio this was secured and rushed to the scenes of the various accidents.

The condition outlined above obtained for a week in which time 9ZL handled 250 messages. A steady watch was kept at all times by the two Quinn Brothers and Mr. H. Bishop, all three of whom are ex-commercial operators. The messages handled related only of matters of extreme importance such as railroad messages, death messages and supply orders for the stricken districts.

By their work the amateurs of Wisconsin have engraved for themselves a place in the Radio Hall of Fame and have rendered to amateur radio in general a service which will not soon be forgotten.

A Symposium on Aluminum Electrolytic Rectifier Operation

Edited by S. Kruse

In these days of the onrushing C.W. the question of a cheap source of plate energy for vacuum tube transmission is a vital one. Electrolytic rectifiers have offered great promise but no reliable information suitable for amateur purposes has heretofore been available. The few cases where they worked satisfactorily seem to have happened accidently. Literature of the art confined itself to commercial applications of the rectifier—wholly valueless to us amateurs. So we have gone out and got the information. The A. R. R. L. Operating Department and our Affiliated Clubs, under the guidance of our Traffic Manager, unearthed the data among their successfully operating stations and Mr. Kruse compiled and analyzed it. Here, then, is reliable, practical, tested dope upon which reliance can be placed.

QST feels that it is putting forth a distinct contribution to amateur literature in presenting this symposium, and our cordial thanks are extended Mr. Kruse and the Operating Department members and Clubs whose co-operation made it possible.—Editor.

Contributors

This paper is compiled from information supplied us by the following A.R.R.L. members:

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The Good Electrolytic Rectifier

This paper was inspired by the discovery that many of our members are using very inferior electrolytic rectifiers for plate power supply without being aware what very poor performance they are securing. It is well therefore, to start by defining the performance of a good rectifier.

A good electrolytic rectifier of the aluminum type operates entirely without fireworks on the plates, without any noticeable heating, and it is possible to apply the full transformer voltage to it without any appreciable input until the filaments of the tubes are lighted. In other words the rectifier alone, put across the transformer, takes no power.

A rectifier that does not pass these tests is badly at fault and needs rebuilding at once.

The Number of Jars Needed

Someone was at one time guilty of passing out the misinformation that a rectifier jar will take care of something like 125 volts. This is absolutely wrong if ordinary aluminum is used and as yet we have no experimental proof that it is correct with any grade of aluminum. All the men who have rectifiers that have been shown by measurement to be performing finely, rectifiers that will pass the tests given above, are using one jar for every 40 or 50 volts.

The use of enough jars is the most important single item in rectifier construction. Jars must be added until scintillating, sparkling fire no longer appears on the plates but only a faint blue glow—a sort

phosphorescence—is left. All other precautions can then be observed but the main point has been taken care of. If you are lucky enough to have pure aluminum available, you may be able to use fewer jars, but the general rule remains—add jars until only the faintest blue or greenish phosphorescence is seen.

The Current Density

The current density governs the amount of heating which will occur in the cell. Small aluminum electrodes will heat rapidly and require water cooling of the jars or else the use of very large jars. Large electrodes will not heat, even though the jar is very small. As electricity at ten cents per kilowatt hour is an expensive thing with which to heat water, the large plates are thoroughly worth while. 100 milamperes per square inch is too much, but will do for short period operation. For the continuous work of a relay station or a phone set, this is entirely too high and a square inch should be allowed for each 40 milamperes.

Solutions

No rectifier works properly and continuously if well or cistern water is used; distilled water is just as necessary as for storage batteries. There follow solutions which appear to give not widely different results.

(a) Boric acid solution plus slight amount ammonia.
(b) Sodium borate.
(c) Ammonium borate 6%.
(d) Sodium bi-carbonate.
(e) Boric acid plus ammonia until neutralized.
(f) Mono-sodium phosphate 10%.
(g) Sodium phosphate.
(h) Ammonium phosphate.
(i) Phosphoric acid 3 ounces to a pint of water. Add ammonia until neutral. Then cool and add more ammonia, using 26% ammonia throughout.

In all solutions, ammonia can be added with benefit. Whatever solution is used, make it up in large quantities and then fill the jars; otherwise they will not operate alike. A large bottle in which some spare solution can be kept is convenient.

The solution evaporates in use and water must be added, otherwise the current density will become too great and heating will begin. The diluted solutions are inconvenient because it is hard to tell how much water shall be added, as part of the electrolyte has crystallized on the glass. With saturated solutions, one only has to refill with water or stock solution and make sure of the strength of the solution by keeping some undissolved crystals at the bottom of each jar.

Voltage Per Cell

With very good aluminum and chemically pure solutions, it is possible to operate with a voltage as high as 200 per cell. This cannot be done with the kind of aluminum ordinarily available, nor can it be approached at all closely. We have yet to see the first rectifier employing a voltage as high as 80 per cell which was not showing either excessive heating, which means low efficiency, or else destructive sparking, which also represents bad efficiency. With ordinary materials the voltage per jar must not exceed 50. This means that if 400 volts are to be rectified with a center tap transformer, there will be required 20 jars, 10 on a side, giving 40 volts per jar. If we are rectifying 1000 volts, 50 jars will be required. The importance of this can be seen by measurements made on an actual rectifier at 3ZY. When a 20-jar rectifier (10 jars on a side) was operated at 400 volts, the input to the rectifier with no tubes connected was 10 watts and there was absolutely no heating after two hours operation. Nor was there anything to be seen at the aluminum plates except a faint greenish glow. When 1000 volts, which is 100 volts per jar, was applied, this same rectifier drew 485 watts, warmed up very nicely in ten minutes, and gave a very fair small-sized Independence Day celebration. The present rectifier at 3ZY is a 48-jar affair operated at 1000 volts and drawing 15 watts on no load. This is a performance that some of our correspondents will go a long ways to equal. This rectifier, by the way, operates two or three hours every evening with no perceptible heating, although supplying about 200 watts to the UV-203 tubes.

Efficiency

No real good information on efficiency is available but it is of no great importance, as a rectifier which operates continuously and without heating is undoubtedly operating at good efficiency.

Temperature of Operation

There is an insistent tendency to quote an operating temperature. Judging by the information gained in this symposium, the proper operating temperature is room temperature. In other words, there should not be any heating of the rectifier and consequently no rise in temperature.

Life of the Solution

The frequency with which the rectifier solution must be renewed depends on the amount of use it gets and the purity of the electrodes. The best aluminum is not good enough and commercial aluminum is far from being good enough. There is also considerable variation between pieces of aluminum from the same sheet. Hence jars in the same series will not act alike. It may accordingly be necessary to clean up some jars before others and no definite time of operation can be given.

Life of Plates

The life of the plates, if they are reason-

ably pure, depends entirely upon the amount of electrolysis which they undergo. This assumes that they are not required to act as electrodes for a pyrotechnic display, in which case they will go very fast. Impure plates also do not last long since the impurities consisting chiefly of carbon and aluminum compounds remain as projections while the aluminum wears down between them, which shortly ruins the plate, making a carbon or iron plate out of an aluminum one, and causes the rectifier to cease operating. Such plates may be detected by their appearance and uneven operation, as they never glow uniformly over the entire surface.

Forming

With the phosphoric acid solution it is possible to set up a new cell and put it into use at once, as forming is almost instantaneous. With all the other solutions, gradual forming is necessary and a satisfactory job cannot be done with the cells in series. The proper way to do the thing is to place all cells in parallel and connect them to a source of direct current having a voltage of 100 to 200 with a 32 candle power lamp in series. All aluminum plates that intend to form will begin within ten seconds and be done in sixty seconds. Those that do not intend to form may be dirty on the surface and can be cleaned by caustic soda or caustic potash and tried again after careful washing. If no direct current is available, forming on low voltage a.c. can be tried but is not especially satisfactory, and the only remaining thing is to connect the cells in the way that they are to work later on and raise the voltage gradually. The rectifier can very easily be ruined by careless forming. The full transformer voltage must not be applied at once but gradually, remaining at each voltage until the input to the rectifier has dropped to practically zero. If at any time during the process the rectifier starts to heat, operations must be suspended until it has become perfectly cool again. Forming is not permanent as the coating dissolves off when the rectifier is not used for a time, hence long periods of rest must be followed by renewed formation.

Sealing the Cells

It is not generally very satisfactory to seal rectifier cells as they have to be cleaned periodically and the job of cleaning up fifty jars which contain aluminum, lead, water and oil, is an exceedingly messy one. The aluminum electrodes, however, tend to heat and corrode at the surface of the liquid and it is desirable to insulate them through this surface. This can be done with a coating of asphaltum but never with complete satisfaction, as the stuff tends to go into solution and a better material should be discovered. Paraffin will do if the cell can be kept quite cool but in summer weather is likely to let go and come to the surface of the cell. If an oil seal is used a white petroleum oil or grease, such as Squibb's petrolatum or albolene, will be found useful.

Spacing and Shape of Electrodes

The electrodes should be parallel and should not be too close to the sides of the jar, especially at the surface, as boiling will occur at that point if the jar is too near. Quite a few rectifiers are operating with a lead electrode larger than the aluminum one but their performance does not seem to be spectacularly different in consequence.

A new world's speed record established at the Boston Show. Joseph Seron's record in code copying, made at the last Second District Amateur Show, was short-lived, for here is Theodore R. McElroy of Somerville, Mass., new champion, being presented a cup by the show manager, after having received 51½ words per minute.

Purity of Electrodes

There is no very good test of the purity of the aluminum. Experience seems to indicate that cast aluminum is somewhat more satisfactory in operation, especially if the slabs are from a cast block. Cast aluminum usually contains zinc but is less likely to contain carbon and aluminum oxides than is low-grade sheet rolled from aluminum junk.

The only real test is to try the particular piece of aluminum and see how it acts. If it fails to produce the proper even performance at the working voltage, it must be thrown out and with it the solution in which it has been used. If the solution is not changed a new plate will also operate badly. A bottom clearance of one or two inches underneath the electrodes will aid if poor aluminum is used as the resulting precipitates can accumulate for some time before doing much damage.

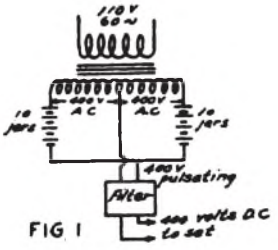


FIG. 1

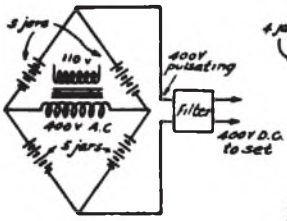


FIG. 2

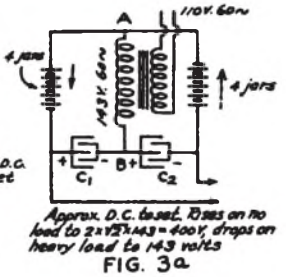


FIG. 3a

Sources of Aluminum

Sheet aluminum may be obtained from the Aluminum Company of America but no information has been forthcoming as to the grades, prices, or commercial forms. Eimer and Amand, 240 West 42nd St., New York City, supply electrolytic rectifier plates which have been formed in advance. Old aluminum arrester cones are good as the material has been chosen for a similar purpose. Aluminum rod may be obtained in the form used in electric and oxyacetelyne welding. These rods are 36" x ¼" and seem to be satisfactorily pure. Castings have been mentioned before and if they are made to order, care should be taken that the foundry does not add excessive zinc. Zinc is necessary to secure a clean casting but foundries have a pleasant habit of selling castings by the pound, which induces them to add zinc or something of that sort to weight up an aluminum casting.

The aluminum sold in the United States and Canada is that prepared by the Aluminum Company of America and its Canadian associate company or else is remelted and adulterated aluminum which was originally of the same origin. The process by which the aluminum is originally prepared is electrolytic and the metal is quite pure. It is obtainable in only this one degree of purity, according to the Boston agency of the firm, altho there are degrees of hardness due to the mechanical treatment the metal receives in rolling. Any aluminum that is purchased from the Aluminum Company of America should accordingly be satisfactory if it is in sheet form.

Cast aluminum is usually adulterated with zinc for the double reason that better castings are secured and that the foundry (which gets paid by the pound) gets more money for the same number of pieces. Impure sheet aluminum is also on the market. It is made from remelted material that was originally pure but now contains copper, iron, zinc and very commonly a good deal of carbon.

The general effect of the above is that any aluminum which was certainly purchased from the Aluminum Co. of America will be satisfactory.

Cleaning the Jars

When a cell has run for some time, a milky precipitate appears at the bottom. If the cell is deep, this will not reach the plates for some time. When the plates are reached, the cell should be cleaned up. The plates are laid aside while the jars are being emptied and scrubbed. If all the plates have been working perfectly, they should not be scratched or handled. If some are bad, they should be replaced and the rest used again, but if most of the cells are dead, it is necessary to clean up all the plates with lye and a coarse brush, then wash in water and reassemble with fresh solution.

Volume of Liquid

A large volume of liquid is not necessary if the voltage per cell and the size of plate are correctly chosen. A good rectifier operates at high efficiency, hence a large volume of electrolyte is not necessary for cooling purposes or to minimize the effect of evaporation. Ordinary jelly glasses may be used for a rectifier suppplying two 50-watt tubes at 1200 volts, and if the rectifier is operating properly will after several hours operation have heated so little that one cannot detect any difference by feeling the jars. The generally accepted idea that a pint or quart of solution is needed for such a rectifier or that a water jacket is necessary is based entirely on the performance of inefficient rectifiers.

Tests of Proper Functioning

Contrary to very general opinion, there must be no fireworks on the aluminum electrode. A very little thought will show that spectacular green sparks on the aluminum represent considerably electrical energy at ten cents per kilowatt hour, not to speak of the great wear on the aluminum electrodes which accompanies such a performance. Fireworks are a definite proof of excessive voltage per cell and the only remedy is to add more jars in series until the scintillating sparks have disappeared and been replaced by a uniform glow having

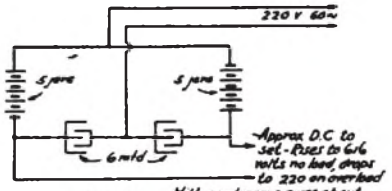


FIG. 3b

the appearance of phosphorescence. More jars may be added until this disappears also, but it is neither necessary nor desirable. The phosphorescent condition indicates a properly working cell. One that is dark *may* be working properly but there is no proof.

Rectifiers for Particular Jobs

A—*One 5-watt tube*, 350 volts, 40 mils ("E" tube or VT-2). Submerged part of aluminum plates, 1 square inch. Jars required, 20 for center tap or "bridge" connection, 10 for "voltage doubling" connection. (See "Rectifier Circuits".)

B—*One 5-watt tube*, 1000 volts, 75 mils (U.V.203). Submerged part of aluminum plates, 2 square inches. Jars required, 50 for center tap or bridge connection, 25 for voltage doubling connection.

C—*One 50-watt tube*, 1000 volts, 100 mils (U.V.203). Submerged part of aluminum plates, 2½ square inches. Jars required, 50 for center tap or bridge connection, 25 for voltage doubling connection.

D—*One 50-watt tube*, 1500 volts, 200 mils (U.V.203. Submerged part of aluminum plates, 5 square inches. Jars required, 72 for center tap or bridge connection, 36 for voltage doubling connection.

For two or three tubes use same number of jars but double or triple size of plates.

In all cases leave ¾" to 2" clear space under the plates.

For rectifier "A", 1" x 6" test tubes are possible. For rectifiers "B" and "C" jelly glasses are OK; for rectifier "D" jelly glasses or deep drinking glasses.

These rectifiers are very conservative and the size of the plates may be reduced thirty per-cent for intermittent work. The number of jars must not (with commercial aluminum) be much reduced.

Filters

A rectifier does not turn out direct current when it is operating on single phase supply. It merely turns the alternating current into a pulsating current. That pulsating current is 100 per cent. modulated at the supply frequency; it carries the very heaviest "growl" that can conceivably be put into any supply current and in consequence the tube set will also have a terrific 60-cycle growl on its emitted wave.

It is the job of the filter to receive this pulsating current and smooth it out so that the current which leaves the filter does so at an even rate; in other words, is true direct and continuous current.

There seems to be a general impression amongst the cheaper broadcast stations (which usually use rectified a.c. plate supply) that one only needs to bridge across the rectifier a large condenser and all will be well. This is not exactly true even when the condenser is very large and is very far from true if the condenser is kept to reasonable dimensions. It is, however, possible to construct a cheap and a compact filter without using vast capacities and still secure excellent results. We hope soon to publish a paper on this subject.

The Rectifier and the Radiophone

A rectifier used for a radiophone should be especially liberally designed and carefully operated. Noises that in themselves are not in the least objectionable are quite ample to ruin delicate shades of tone when music is rendered. These noises may be due to sparkling and boiling of the rectifier or to a defective filter which was not designed but simply put together by guess so that much "60-cycle" comes thru.

An excellent test is to listen to the carrier wave with an oscillating tube when the set is not being spoken or sung into. If the heterodyne note is not perfectly clear, that radiophone has no chance of ever turning out perfect music, regardless of the system or degree of modulation. Not one broadcast station in twenty will pass this test, which in itself is sufficient comment on the offhand way the present broadcast station is operated.

In the case of one Louisiana newspaper broadcasting station the "cooking" of the rectifier is so strong that it can be heard with a crystal at 5 miles and the 60-cycle hum causes all high pitched notes to "burr" strongly. Yet this paper is proud of its phone.

In the case of that station and many others much time, money and effort has been spent and nothing whatever produced that is worthy of respect, simply because there has been overlooked the very obvious precaution of listening to the output of the station in a highly critical mood and then making the needed changes in the rectifier, filter and possibly modulation system.

Rectifier Circuits

Of the three popular rectifier circuits the split-secondary seems to be in most general use, probably because it is simple and its action is rather obvious. This is shown in Figure 1.

The "bridge" circuit is somewhat less used but has the advantage that it can be operated with a transformer designed for some other purpose and not equipped with a center tap. This circuit is shown in Figure 2.

The "voltage-doubling" circuit has a theoretical advantage in that the output voltage is higher than the input voltage. Referring to Figure 3 the action is as follows: assuming for the moment that the end A of the transformer secondary is positive the current will flow as shown by the solid arrows and the condenser C_1 will be charged as marked. Now when the secondary voltage reverses the end B becomes positive and the condenser C_2 becomes charged as marked, while no current flows into the condenser C_1. Eventually both C_1 and C_2 will be charged to the peak voltage of the transformer, which is $\sqrt{2}$ times the secondary voltage. Now note that C_1 and C_2 are in series for the output, so this voltage is doubled. Thus if we started with a secondary having a voltage of 143 we would now have $2 \times \sqrt{2} \times 143 =$ 400 volts. This holds only as long as no load is applied. If we connect a load (some tubes) to the output leads, the condenser C_1 will be getting discharged while the condenser C_2 is getting charged, and unless the condensers are very large we will drag the voltage down to something like the transformer secondary voltage. In other words the voltage regulation of this sort of set is very poor. That is not necessarily a disadvantage as a sending station using oxide filament (Western Electric) tubes is thus made self protecting.

The voltage doubling circuit is to a certain extent self-filtering as the variations across the two condensers are in opposite phase and so cancel out. It will stand much more critical inspection than many center-tapped rectifiers with alleged filters.

The voltage-doubling circuit has one very pretty possibility. Where 220 volts A.C. is available the voltage-doubling circuit is all that is necessary to supply 400 volts plate for a small radiophone using 5-watt Western Electric "E" tubes (VT-2). This scheme Fig. 3b has been used quite successfully by Mr. J. E. Parker of 3XK. A condenser should be placed in the ground lead to avoid grounding the power line.

Number of Jars Used with Different Circuits

All three of the figures have been drawn as applying to an output voltage of 400 and the number of jars in each "string" marked alongside. The basis is an allowance of 40 volts per jar. Whether that particular voltage per jar is used or not, the relative number of jars required by the different systems is still the same.

The Lackawanna Phone Experiments

THE Delaware, Lackawanna & Western Railroad has resumed the experiments we heard quite a bit about before the war in telephoning from moving trains. With the later improvements and under the direction of D. W. Richardson, 3XM, of Princeton, some very interesting results have been secured.

Good signals were obtained with a single wire on one car but better results were had later with three cages 4½ inches in diameter, of six wires each, and suspended eighteen inches above the roof of the buffet car. A fifteen-watt phone set and a detector and two-step amplifier in conjunction with a regenerative set completed the equipment. Tests were made in late March on the Lackawanna Limited, the station signing "DL"

A very good idea was gained in the matter of what surroundings affect transmission and reception. The tests were made over all kinds of ground and at altitudes from a few feet above the high tide mark to two thousand feet above sea level. Under the steel superstructure of the terminal at Hoboken a few local amateur stations, two on phone, were picked up but there was a great increase on leaving the shed. Inside the Bergen tunnel, which is 4,283 feet long

Edgar Sisson, Jr., "ES" at 3DH, who with G. D. Murray and D. W. Richardson, all of Princeton University, had charge of the Lackawanna train experiments. Underwood & Underwood photo.

and 90 feet underground, two C.W. stations and several ships were heard dis-

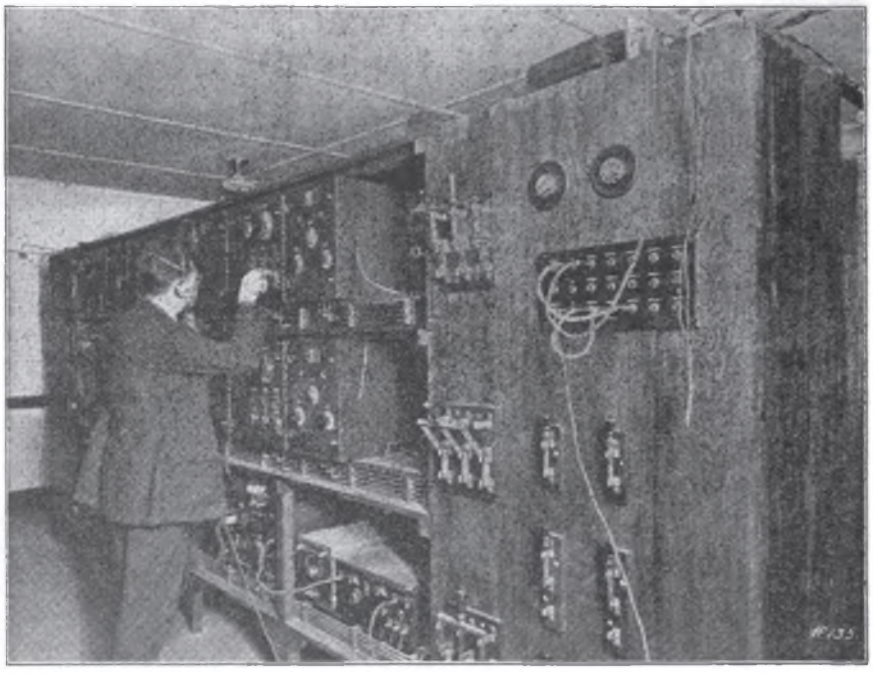
tinctly. On emerging from the tunnel the signals increased with a "bang." Going thru Newark and the Oranges tests were made in transmitting with the phone, which was picked up by several stations. When about ten miles from Scranton, 8ARI was worked while coming down the mountains

(*Continued on page 34*)

Radio Central

A Paper presented by Pierre Boucheron at meeting of Radio Club of America, Columbia University, January 27, 1922

OUR subject for this evening is to be pictorial rather than technical. I have therefore prepared a short paper based chiefly on the outstanding facts of the big station. I will first read this paper to you and then we shall proceed with the pictorial section. For this we have a number of slides featuring the most prominent sites and apparatus at Radio Central. We will follow this by a short reel of moving pictures depicting several interesting construction scenes and other incidents connected with the station, followed by some views taken on the official opening day, November 5, 1921.



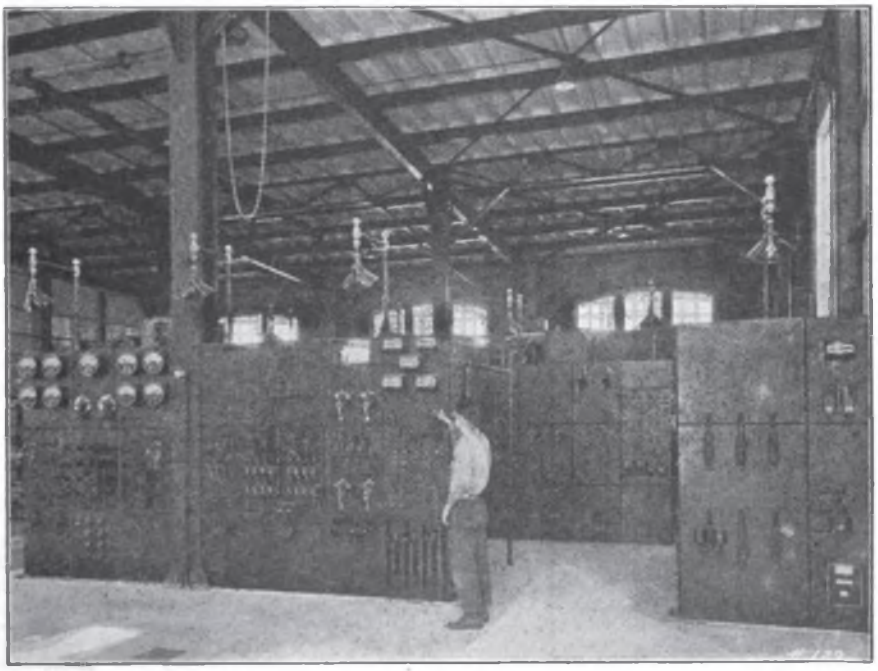
Receiving Shelf at Riverhead, L. I.

Before we proceed, we shall indulge in a few preliminary remarks. Some of you may wonder why the subject of the evening should be brought up before an amateur organization, for at first thought the activities of Radio Central are essentially commercial ones, and this paper deals with that end entirely. Here we have a huge station built by a commercial concern for a distinctly commercial purpose. My only excuse, therefore, is that the real radio enthusiast, whether an amateur or a professional (and by the way many of us here this evening are professionals) is vitally interested in everything concerning radio. Indeed, one has only to pick up the average radio magazine and glance through the pages to note the many and frequent descriptions of strictly commercial apparatus or plants originating not only in this country but throughout the world as well. This undoubtedly proves that the average radio amateur is interested in other subjects besides the strictly experimental one.

Then too we have in Radio Central perhaps the greatest radio project in the history of the art. In order that we may bring home the significance and the importance of this latest of American under-

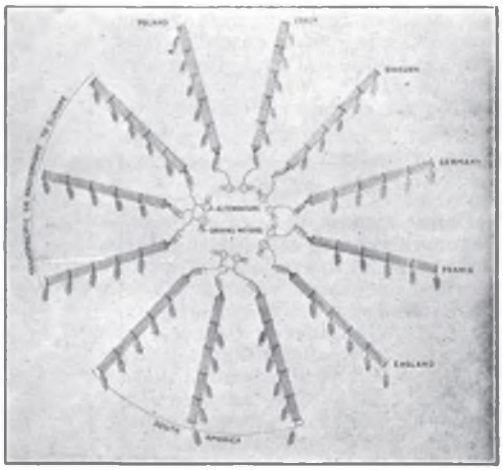
takings, a little history is possibly not out of place here. For many years, England has enjoyed the unique position of being the sole arbiter of the world's communication. She has been so to speak the center of communication—cable communication. You have but to look at any communication map to have this fact demonstrated to you in a most conclusive maner. Here you will see the great cables of the world stretching out far and wide to the most remote corners. Incidently, you will see this giant network of lines merge into one general direction or focal point—that of England. I am not here to tell you that England is to be censored for this. On the contrary, any other nation would have done likewise if placed in the same advantageous position, and it is only natural to expect this. These factors and the fact that the United States has not had adequate means of international communication have not particularly helped us to develop foreign trade. It was quite natural therefore that shortly after the great war, it was decided that if England was the center of cable communication, there was no reason why the United States should not be the center of radio communication. It was thus that Radio Central was conceived—a 100% American owned, controlled and operated wireless central point with facilities for world-wide wireless communication.

With the opening of Radio Central, therefore, New York becomes the focal point of world wide wireless communication. This means that existing radio and cable facilities to such leading commercial nations as Great Britain, France, Norway and Germany are now supplemented by a *direct* radio telegraph service.



Main Control Switchboard at Radio Central

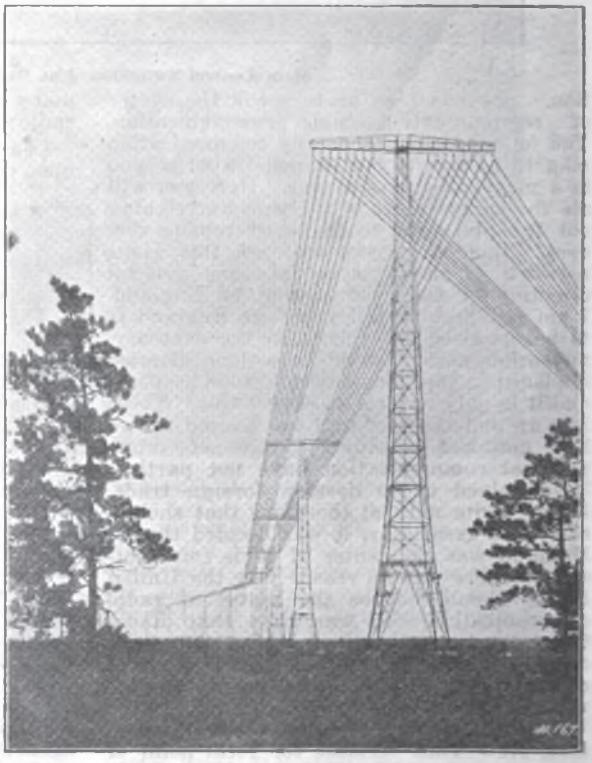
Commerce, as we know it today, depends upon complex and highly specialized factors for success. One of its most important agencies is communication, bringing, as it



The Antenna Combination

Above: Main Operating Room at New York.
Below: One leg of the antenna.

does, the marts of the world within easy reach of all. Indeed, without this vehicle world trade would fail utterly. Thus it has come to pass that the art of radio communication has slowly but surely taken its place as a necessary supplement to present cable circuits, and not only is Europe and the Orient covered by the radio system but the new station recently opened has been designed to eventually provide an additional and direct circuit to South America, thereby linking all commercial nations together.



Radio Central—Its Purpose and How It Functions

Unlike many industries, radio communication is essentially international in its operation and world wide in its scope. For this reason it has been the dream of communication engineers for several years to erect a huge transmitting station at a centrally located point in such wise as to command a world wide field of activity. Radio Central is the realization of this vision.

In the pioneer days of high power radio telegraphy, a station functioned alternately as a transmitter, a receiver and a telegraph

office. This involved much loss of time and greatly reduced traffic facilities, for a station had to stop sending while it received and vice versa. It, therefore, became apparent that the ideal radio station should comprise three separate but closely connected units operating by remote control and employing a transmitting unit, a receiving unit and a central traffic office, the latter preferably in the heart of the business district of large cities. The Radio Corporation has had this system in operation for some time and having found it most effective has incorporated it in the operation of Radio Central and other trans-Atlantic stations.

The new radio station, therefore, comprises these three units which are:

RADIO CENTRAL—A high power multiplex transmitting station located on Long Island some distance from New York City, planned to have several separate antenna systems each designed to communicate with a given country with remote telegraphic control from a point suitable to the handling of traffic.

RIVERHEAD, L. I.—A multiplex receiving station also located some distance from New York but separated by sixteen miles from the transmitter and so planned and arranged as to simultaneously receive all radiograms destined to the United States from as many foreign countries as take part in the world wide wireless system.

CENTRAL TRAFFIC OFFICE, NEW YORK CITY—The traffic center of the system where all actual radio telegraph operating takes place. Here radiograms are gathered from various sources and directly radioed to foreign points through Radio Central and other high power stations. This direct transmission is accomplished through the use of a special remote control system whereby operators at 64 Broad Street, New York City, do all necessary transmitting work.

In a like manner reception is accomplished with similar direct advantages where the incoming signals are made audible at Riverhead, L. I., and automatically transferred over land-lines to the central traffic office located in the heart of New York's financial district. These signals are interpreted and recorded on typewriters by skilled telegraph operators at high speed or are automatically received by ink-recorders. Final delivery is then effected through the regular messenger service.

Outstanding Facts About Radio Central

Radio Central Station is designed for world-wide wireless communication which includes Europe, South America and the Far East. This Super-Station is situated at Rocky Point (seven miles east of Port Jefferson) on the northern shore of Long Island, seventy miles from New York City. The station site covers 6,400 acres or 10 square miles. The construction began in July, 1920, and the first test signals were sent in October, 1921, a little more than a year later, a record in itself when one considers the great amount of work accomplished. 1,800 tons of structural steel were used to erect the first twelve towers, each employing approximately 150 tons. Each tower is 410 feet in overall height and the cross arm or bridge supporting the antenna wires at the top is 150 feet long. 8,200 tons of concrete were employed for the foundations of the twelve towers, the base of each tower leg being sunk nine feet below the ground with a total base area of 360 square feet. The distance between two adjacent towers is 1,250 feet or nearly three miles from the first to the twelfth tower.

Each antenna consists of sixteen silicon bronze cables ⅜ inches in diameter stretched horizontally from tower to tower. In all, fifty miles of this cable has been used for the first two antenna systems. The ground system for both antennae consists of 450 miles of copper wire buried in the ground in starfish and grid-iron fashion. The first power-house section covers a space of 130 feet by 60 feet and accomodates two 200 K.W. high frequency transmitting alternators with auxiliaries and equipment. A sending speed of 100 words per minute is possible with the use of each transmitting unit at Radio Central. This means a combined sending capacity of 200 words per minute for the two completed units. The present wave length in use is 16,500 meters. The erection of additional antenna units forming the spokes of the huge wheel and further improvements which are being made will correspondingly increase the transmitting capacity of the big station.

The transmitting range of Radio Central is practically world wide, as demonstrated at the official opening when the station was heard in all parts of Europe, as well as Australia, South America, Japan, and New Zealand.

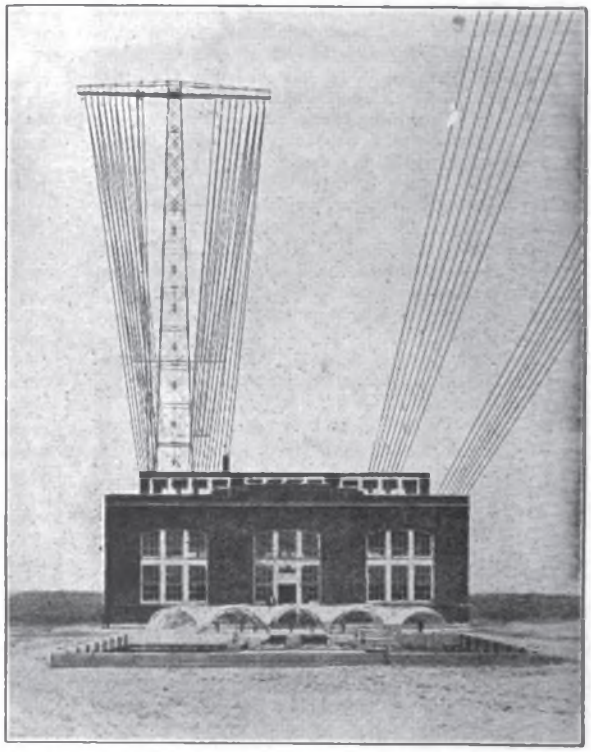
The cooling pond for cooling the water after it has circulated through the high speed alternators covers a ground space of 64 feet by 42 feet and is 7 feet deep. The pond is equipped with four spray heads which, when operating, present a beautiful and ornamental appearance.

The community house for the staff is a low one-story building closely resembling an exclusive country club. It contains sixteen single rooms, an official suite, a large living room and dining room as well as quarters for servants. The engineer in charge with a staff of fifteen assistants comprises the personnel necessary to maintain the huge station in operation at present. The 23,000 volt transmission line was built from Port Jefferson to the station, a distance of seven miles. There are no radio operators at Radio Central, the actual transmission taking place by remote control

from the Central Traffic Office at 64 Broad Street, New York City.

The receiving station working in conjunction with Radio Central is located at Riverhead, L. I., sixteen miles away. No operators are located here, for the distant signals are first received by radio, automatically transferred to wire lines and received at audible tones at the central traffic office, New York City. The action is automatic from the time the signals are transmitted abroad, picked up by the aerial, to the moment of actual transcribing by the receiving operators in New York.

The final installation at Radio Central will comprise twelve antenna units supported by 72 towers, forming so to speak the spokes of a giant wheel nearly three miles in diameter. Ten high-frequency alternators will be employed which in total will give a power output of 2,000 kilowatts or 2,700 horsepower. The electrical force thus brought into play at Radio Central permits the realization of the vision of communication engineers to transmit messages to all points of the world from a *single* centrally-located source.



The Power House at Radio Central.

The station was officially opened by President Harding on November 5, 1921 who took advantage of the occasion by sending a message addressed to the entire world. The sending of this message was accomplished as follows. It was first punched out on a tape by means of the Kleinschmidt perforator and then passed through a Wheatstone automatic transmitter. At a given moment, the President closed a switch near his desk at the White House and the message sped on its way from Washington to Rocky Point via the medium of a direct wire connected to the sending relay at Radio Central from where of course it was broadcasted. Something like thirty-three nations heard the President's message and these immediately acknowledged it by means of the quickest available method. Some of course, not being equipped with high power transmitters, cabled their reply but the majority came by radio. Incidently, a world record for long distance radio communication was established at this time when far-off Auckland. New Zealand, a distance of over 10,000 miles, easily copied the message and reported the signals quite strong and reliable.

An interesting contrast to this record transmission is furnished us by some remarks exchanged between Guglielmo Marconi and a reporter twenty-five years ago during an interview shortly thereafter published in McClure's Magazine for March, 1897:

> —"And how far do you think a despatch could thus be sent?"
> "Twenty miles!" (replied Mr. Marconi).
> "Why do you limit it to twenty miles?"
> "I am speaking within practical limits, and thinking of the transmitter and receiver as thus far calculated. The distance depends simply upon the amount of the exciting energy and the dimensions of the two conductors from which the wave proceeds."

Twenty miles in 1897—10,000 miles in 1922. In the comparatively short span of 25 years, radio communication has certainly made tremendous progress.

There is another little matter too which may have occurred to you and this has to do with the recent trans-Atlantic amateur test. Mr. Godley had no sooner assured us that amateur short wave communication across the Atlantic was an accomplished fact that some of the general public began to ask "how come" the fact that amateurs could with their "home made" sending sets send across the Atlantic with as low as a

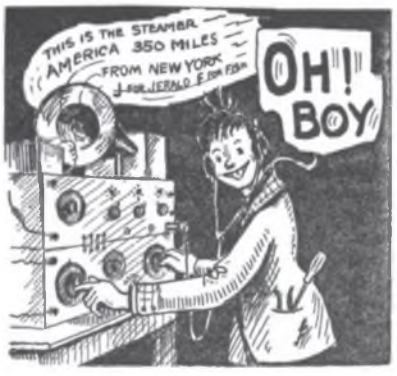
50-watt tube when it took the commercial stations 200 kilowatts more or less of electrical energy to do the same thing. It has been a hard job convincing these wise folks that telegraphing across the pond with comparatively small power at a special prearranged period at a most favorable time of the year under best possible conditions was one thing and to telegraph across the Atlantic with comparatively great power under all and any condition, winter and summer day and night and at high speed was quite another proposition. To you of course, familiar as you are with the wiles of radio, it is quite understandable but it is a different thing to prove it to the casual observer. I bring it to your attention only because to some it may seem rather incongruous to feature Radio Central at this time when we have not yet recovered from the glorious achievement of American amateur radio and its international communication possibilities.

Revision of Fire Underwriters' Rules

THE National Electrical (Fire) Code embodies the regulations formulated by the National Board of Fire Underwriters to insure the safety of buildings in which electrical installations of any kind have been made.

If these requirements are not met, insurance may be refused entirely or only granted at a much higher rate. Rule 86 of this Code covers the installation of radio equipment and in connection with the general revision of the code now in progress, it has been decided to revise this rule.

Certain tentative requirements have already been drawn up and published in mimeographed form as Letter Circular 62 of the Bureau of Standards. Any one especially interested in this subject may obtain a copy by writing to the Bureau, and suggestions concerning the changes in the code will be gladly received by William S. Boyd, Chairman of the National Fire Protection Association, 175 W. Jackson Boulevard, Chicago, Ill., until September 1, 1922.



Meanwhile the proposed changes are being followed by local inspectors to obtain "field experience", which will be the final test of merit in determining whether or not the changes will be formally adopted this coming fall. Representatives of various interests concerned have met in conference many times in the past year to discuss these matters. Our A.R.R.L. has been duly represented, by a technical committee headed by Mr. R. H. G. Mathews of 9ZN as Chairman, and at the later sessions by our former vice-president Mr. C. A. Service, Jr. For once in its life our A.R.R.L. has been in the (for it) peculiar position of favoring more restrictive rules and opposing a field whose sentiment it was to ease up on the regulations, which is quite contrary to the attitude which perforce has been our representatives' in radio legislative matters from time to time. In this case the tendency to ease up on the fire protection regulations was so influenced at times by the desire to make it easy for Mr. Everyman to have a radio set that proper and desirable protection was being sacrificed, in the opinion of our representatives.

Regulations for Receiving Stations

The proposed rules for receiving sets provide that aerials shall not pass over or under circuits of more than 600 volts; that the lead-in shall enter thru a bushing and shall not be smaller than No. 14 copper or No. 17 copper-clad steel wire, B. & S. gauge. An antenna grounding switch will no longer be compulsory but is still desirable; in any event, however, protection is to be secured by the use of an "approved lightning arrester which will operate at a potential of 500 volts or less", which shall be connected and located as near as practicable to the point where the lead-in enters the building. When an antenna grounding switch is installed it shall in its closed position form a shunt around the arrester. The same gauges apply to the protective ground wire as to the lead-in. Water piping is endorsed as a good ground connection but gas piping is barred. It is to be noted that the protective ground may be indoors or out. The receiving set ground wire also must be not less than No. 14 copper or No. 17 copper-clad steel and if run in full compliance with the rules respecting the protective ground wire, it may be used for both purposes.

Transmitter Regulations

Transmitter lead-ins shall not be smaller than No. 14 B. & S. gauge and all h.f. conductors must be firmly mounted five inches clear of building, etc., and both aerial and counterpoise lead-ins shall enter thru a bushing or tube having a distance of at least five inches to extraneous bodies. A drilled window-pane is OK'd. Antenna lead (and counterpoise as well, if used) shall be capable of grounding thru a double-throw knife switch having a break distance of 4 inches and a blade not less than ⅛ inch by ½ inch, this switch being mounted to clear the building wall, etc., by at least 5 inches. Slate bases are not recommended. It is at present contemplated that the switch may be located either inside or outside the building. The protective ground wire shall be at least as large as the lead-in and not smaller than No. 14 B. & S. Preference is given water-piping as an earth connection, with gas piping prohibited. The operating ground shall be of copper strip not less than ⅜ inch by ¼ inch or of copper or copper-clad steel having a periphery of at least ¾ inch (for example a No. 2 B. & S. wire). Neither ground need be insulated.

When street mains supply the power the circuit shall be installed in approved metal conduit, armored cable or metal raceways, even if lead-covered wire is used. A surge-protector shall be installed close to and on the supply side of every transformer, gap motor, generator motor, etc., consisting of one of the following: (1) two condensers (not less than ½ mfd., 600-volt test) in series across line with mid-point grounded, and each condenser shunted by a fixed spark-gap not over 1/32 inch separation; (2) two vacuum type protectors in series across line, mid-point grounded; (3) non-inductive resistors across line, mid-point grounded; (4) electrolytic arresters such as the aluminum cell type. In no case (thank heavens!) shall the ground wire of the protective device run parallel with the operating ground wire when within a distance of 30 feet nor may the protective ground be connected to the operating ground or ground wire.

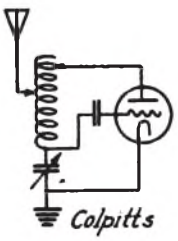
We live in hopes.

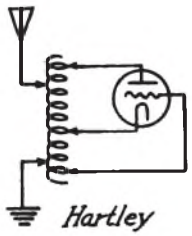
—K.B.W.

Circuits

THERE is much confusion among amateurs as to the proper name for the type of transmitting circuit they use. There are only a few basic types and just a few words will clear up the matter for keeps.

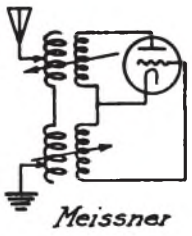
In the first place these are all Armstrong circuits, in that they make use of the feed-back principle discovered by E. H. Armstrong. Different investigators subsequently developed their own trick oscillators, each particularly suited to their own purpose, and their names are commonly associated with their circuits. There are a great number of such hook-ups but four chief ones which are encountered daily. A few words on each will enable the reader to identify the oscillators he sees in his later reading.

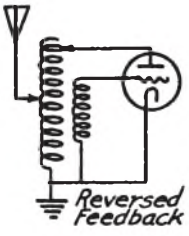




The Colpitts circuit has as its distinguishing feature a series condenser in the ground lead, across which the grid and filament are connected to secure a direct voltage feed-back. It may also be shown in this circuit that the r.f. power is introduced into the aerial circuit by means of charging the condenser formed by the antenna. In other words, it is a capacitively-coupled circuit.

The Hartley is the simplest of the electromagnetically-coupled circuits. It is sometimes known as the "split-inductance" hook-up, the filament tap to inductance being between the anode and grid connections. Ordinarily aerial and ground connections are taken off this same inductance, but the closed oscillator of Hartley's may be inductively coupled to the antenna circuit and the arrangement still be a Hartley.





The Meissner circuit differs radically from the Hartley, even from the coupled Hartley circuit, in that the grid and anode inductances are not electromagnetically coupled to each other. Instead, each is coupled independently to the antenna circuit inductance. If anode and grid circuits are coupled directly to each other, it is not a Meissner circuit. Over a considerable

band of frequencies the Meissner circuit will work without change in grid or anode inductances, the said circuits functioning aperiodically and the wave length being determined by the adjustments of the aerial circuit.

It's somewhat difficult to find a name for the last circuit shown, which differs considerably in its action from any of the others. Its nearest neighbor is the Hartley. If that portion of the Hartley inductance comprising the grid circuit be bent back and telescoped within the remainder of the inductance, we get this new arrangement, which has been called the "reversed feedback" circuit by Mr. R. A. Heising. In bending back this portion of the inductance to form a grid tickler it is necessary either to reverse the direction of its winding or to reverse its terminals—whence, presumably, its name.

The student of circuits will find much that will interest him in a most comprehensive and profusely illustrated article by R. A. Heising entitled "The Audion Oscillator", appearing in the Journal of the American Institute of Electrical Engineers for April and May, 1920.

— K.B.W.

QRM--Local and Domestic

By Gordon Peck, 2HC

WHO was the guy that said, "There's always something to take the joy out of life?" I'm sure I don't know but nevertheless there is much truth contained in those words.

Wireless is no exception. Ah, how well we amateurs are aware of it. We talk about it, read about it and worst of all we are compelled to listen to it. You all know what IT is. QRM is the answer. Every effort is being made to conquer it and through the help of the A.R.R.L. and the hearty co-operation of the amateurs, the local part of it I'm sure, will be eradicated to a certain extent in the near future.

Local QRM, although by far the worst enemy, is by no means the only one. Take for instance Domestic QRM. Oh boy, there is no real wild and wooly amateur that ever escapes this terrible mutilation of his tranquility, especially if his family has a full complement of brothers and sisters.

For example take George, an honest-to-goodness BUG who would like nothing better than to grab up about ten thousand dollars worth of nifty instruments, VT's and the usual junk, build himself a shack on top of the highest mountain he could find, safe from all intruders, where he could jab away at the old key to his heart's content and not even have to stop for meals.

But alas! George is no exception nor is he any privileged character, having to go to school just the same as the other fellows and (in his mind) waste a perfectly good six hours a day for six days in the week.

Of course all he ever thinks of in his English or History period is that new hook-up or something-or-other and to his bitter misfortune he generally gets called upon to answer some fool question on Ancient History. Naturally it always comes just as he is carefully scribbling out the swellest little diagram of how to make a crystal oscillate or somethin' that you ever saw. As usual, dire calamity follows, the result being something like this:—

"George Smith, what did Caesar say to Brutus in his last breath?"

Poor George stiffens a bit and scrambling to his feet, sputters out something like this, "Did you call on me, Teacher, er-er-why-er-Caesar didn't strike h-his wife t-tall he-er—?"

"STOP"—cries the teacher, "That will be enough, George Smith, take your seat. You are very inattentive."

Whereupon poor George takes his seat amid much gloom and humiliation yet secretly glad *that's* over with.

At last the bell and, hootin' cooties, what a rush! George's one and only idea is to get home to his shack as soon as possible if not sooner. Immediately on entering the room he quickly dashes to the table, slams in a switch, clamps the cans over his noble dome and from thence on is lost to the world.

Now right here is where the Domestic QRM comes in. It usually begins like this:

"Oh Georgie, Georgieee, Georgieeeee do you hear me"?

Georgie relucantly hashes out some QR's and an "AS OM" and slowly proceeds to the head of the stairs:

"Yes, Ma."

"George, I want you to go to the store for me right away. It will only take you a few minutes."

"Oooo Gee, Ma could you wait just five minutes more and I'll promise to come right down."

"Alright only five minutes now."

A few minutes later, "Oh Georgiee!"

"Yes, Ma."

"You come right down here this minute. Bridget must get the washing done today and she is all out of soap so you must go immediately."

No use, he's been up against this before and past experience says go to it. So, with a, "Sorry Ma, I forgot" and a minute more in the shack to send, "QRX PSE OM CUL" he makes his exit.

Back again from the store he imediately begins his pounding of brass, thinking that at last he is free, when to his horror along trots little Sis with:

"I'm going to Jimmie's for supper and Ma says its too far for me to go alone so you will have to take me over."

"Sufferin' catfish, can't you go alone, why the—Oh what's the use, I suppose I'll save time by going right away. Hurry up, Sis, and get on your duds," and he's off again.

A while later George returns with the idea that at last he will be unmolested, when to his dismal shack comes the sweet notes of the dinner gong and now no hope until after grub. He is at least thankful that in some mysterious way his homework is all done and he won't have *that* to bother him.

But this Domestic QRM is not so easily gotten rid of, for no sooner does he get settled down for a nice long chat with 8PDQ, 6BVD or some other distant station, than in rushes Kid Brother with some undone Algebra and as father has gotten just a bit rusty in math in his old age it is naturally up to poor George and again he is compelled to make the great sacrifice.

And so it goes day in and night out, at least so it seems to go to George but as a matter of fact—Shhh! don't say a word, Georgie makes good use of it very often as an excuse for a QTA to some bug who is sending just a little to fast, George in turn replying with a "Sorri OM bt QRM radio room."

THE LACKAWANNA PHONE EXPERIMENTS.

(Continued from page 26)

about 65 miles per hour, the voice being very clear both ways and heard all over the car. 8RH and 8BUW were worked in Scranton. 8BUW was repeating back a message when the train went thru a tunnel with hardly noticeable effects on the signals. Two way communication was carried on for twelve miles until going around a mountain when 8BUW was lost and not picked up again until the train had ascended to a large lake. Here 8ADQ and 8AOE were also listed.

A summary of the log between 5:15 and 7:10 p.m. on March 26th following statoins were heard in the order named: 2BRB QRZ, 1RX QRK, 2BK QSA, 1RX QSA, (about 40 miles from Scranton going 60 miles per hour) 1ARY loudest so far, 2BM QRK, 1RX very QSA, (now passing over plain and signals much stronger) 1CNI QRK, 1BQL QRK, 1GM very QSA, 2AHU QSA, 1ADL very QSA, 2ACY QSA (near Blainstown, N. J.)

Mr. Richardson explains that when he lists a call followed by "QRK" he means it was readable about 70 feet from the loudspeaker with the train windows open and "QSA" means readable about two blocks away when the train happens to be at a station. During the evening of April 5th the following were picked up: 2BFX, 1CK, 3ZO, 8CGZ, 1WQ and 9YB all very QSA; 8AWU, 8AHE, 8TT and 8AVT all QSA; 1AZK and 1CO both QRK; (11 P.M.) 8AVT, 8DK, 8WD, 8LQ, 8RQ, 8AJU and 9ME all very QSA; 8XE, 9AZA, 1AW, 9DCX, 1BVB, 1XAB, 1BRQ and 8CGZ all QSA; 2ACD, 8ANO, 8AYV, 2AHN, 3AGT, 8AJV and 8ANK (?) all QRK; (12 midnight) 9AZE, 9UU, 1SN, 9AGR, 8XZ, 9DKY, 3ARN and 8OZ all very QSA; 8LQ, 8GC and 8AGO all QSA; 8AWP, 8ZQ, 9AUL, 9OX and 8AAG all QRK.

"The loudest station of all, I think, for long distance, was 9DCX, which was little less than brutal," says Mr. Richardson.

(Concluded on page 40)

EDITORIALS
de AMERICAN RADIO RELAY LEAGUE

Our QST

WITH all the other magazines turning eagerly to popular radio because of the greater financial reward to be obtained in the big field of broadcast fans, we are more than ever determined that QST shall remain a magazine "of, by and for the amateur".

Our Board of Direction recently had to consider the question whether or not our QST should be changed into a popular magazine devoted to "the man in the street", in order to survive financially. Some cool and collected mind on the Board asked "Why? Why should we? QST is the mouthpiece of our association of amateurs, and if we can't support it as such it's time we quit". That judgment prevailed, of course, and it justifies itself more every day. There *shall* be one magazine devoted to the practical amateur! It isn't worth a cent to us amateurs to own a magazine telling how to copy broadcasts on a needle stuck in a potato for an aerial and a ground in mother's flower-pot, or in tedious answers to "how far away is 200 meters?".

There's another angle to this thing, too. All the broadcast listeners aren't "dumbbells", as T.O.M. has it—not by a jugful. A great many of them are going to become real amateurs and they'll need a real amateur magazine. They'll be wanting to transmit and they'll outgrow single-circuit tuners and they'll be curious as to what's happening in their sets. There is where QST will come in—*we purpose to continue to be a magazine devoted to the practical improvement of short-wave two-way communication!*

While we're talking about new-comers and listeners and things we want to protest the occasional characterization of the new radio folks as amateurs. They're not amateurs. An amateur is one who pursues a line of endeavor for love thereof and not for commercial gain. Broadcast listeners of course have no financial incentive but neither are they interested in radio as such, but rather are concerned only about hearing something and hang how they get it. They're not amateurs—they are *radio fans*, novices. We hope that some day they'll become amateurs but they are not today.

QST then is for us amateurs. Let us suport it and boost it in order that we may have a constantly-improving forum in which to club our ideas. The life of any magazine is dependent upon its advertising and advertisers don't advertise except where they get results. It is therefore the duty of us amateurs always to mention QST in writing advertisers, letting them know that the business comes because they advertise in our magazine. This support from our members, always an important thing, is more than ever vital in this day of oversold factories and many magazines. "Always mention QST when writing to advertisers", please—it helps all of us. And tell the new folks about QST; they drift into wireless rather accidentally and it may be weeks before they hear of the A.R.R.L. and its magazine. Put them next, so that they may learn of an amateur magazine and, as they awake to the knowledge of what it means to be an amateur and a member of the League, they will be one with us in the support and improvement of our QST.

Opportunity

SOMETHING is about to happen in radio reception methods. We don't know what is coming but something seems about to arrive and the air is charged with expectation. It seems fairly certain that present day systems of radio receiving are about to be vastly improved, so greatly increased in efficiency that what we will call modern equipment will ere long be regarded as crystal detectors are today.

A rumor of a new method of reception is worth exactly nothing. But when carefully guarded reports start drifting about from several places one begins to wonder if where there is so much smoke there might not be a little fire after all. For example, it seems well established that Armstrong has a method of "super-regeneration" little short of revolutionary, which he is almost ready to announce the world. Dame Rumor has it that, using two valves, the new system produces telegraph signals around a million times as good as a single regenerative audion of today. Somewhere we picked up the report that the idea is to prevent "spilling over" as the oscillating point is approached in regeneration—in other words, to be able to carry regeneration on and on without breaking into oscillation—and that this is done by feeding alternate negative

and positive resistance into the detector circuit, the resistance effects being created by the second valve. From France comes a report of a remarkable improvement in C.W. telegraph reception wherein, instead of heterodyning the incoming signals by means of an oscillating detector, the signal trains are caused to modulate the oscillating output of a feeble oscillator almost exactly as in a present-day constant-current radio telephone transmitter, with results said to be much improved over the more usual arrangements. Dr. Chaffee of Cruft Laboratory has something up his sleeve, too—something involving "antenna circuit regeneration" in addition to closed circuit regeneration, some more of the business of coupling a generator so as to feed negative resistance into a circuit to reduce its decrement and increase the current effects produced in it by the signal.

Much thought is being expended upon radio frequency amplification itself and altho there is still considerable to be desired in its performance on 200 meters and below, undoubtedly it will be "whipped" soon.

We should say that a remarkable opportunity to produce wonderfully-improved reception awaits the amateur who can devote some time to intelligent experiment in these directions. Perhaps a new line of thought will be opened up which will lead on to another epoch-making invention; in all probability that amateur will enormously improve his station's receiving performance, which in itself is sufficient reward; and at the very least he will have had a most interesting and instructive course of experiments in electron tube action. Why don't *you* try it?

Men Wanted

ARE you an amateur? If so, do you belong to the American Radio Relay League? If you don't, please read on:

There's an association of amateurs—the real amateurs who do things—known as the A.R.R.L. The only requirement for membership in it is the possession of a bona-fide interest in amateur radio. Accordingly almost anybody who wishes to can become a member but the radio fans who are only casually interested in wireless are not likely to find much in the A.R.R.L. which appeals to them. If you, Mr. Reader, are concerned only in the reception of signals and have never a stray thought as to what is happening in your set or why, or about how to improve results, then turn to something else in *QST* to read because this page won't interest you. However, if radio appeals to you for radio's sake, if you're actually interested in finding out what is going on, if you like to experiment with radio and can get a thrill out of making your own apparatus perform for you, then either you're an amateur or you're rapidly becoming one. And in either case you ought to belong to the A.R.R.L.

The League is a national organization of men like that. It is "of, by and for the amateur". Its directors and officers elected by its membership, are prominent amateurs. It governs its own affairs. It is not organized for profit and has no capital stock and no owners except its members. It is the standard-bearer in amateur affairs, recognized by the government as the spokesman of the American amateur.

The A.R.R.L. is primarily interested in radio telegraphy. Anybody can understand a phone and so it soon palls, but telegraphy goes on forever. The obvious activity of the League is the relaying of friendly messages by telegraphy between its member-stations, without charge and for the fun of the thing. Radio of course is a hobby, and capable of being followed in many ways. The method pursued by the League we feel is an entrancing one, and one which has stood the test of time. Relaying provides every possible working test for apparatus, teaches real operating, establishes a splendid fellowship amongst amateurs, makes co-operation absolutely imperative.

But the A.R.R.L. is much more than an organization of relayers. Its members stand united for legislative representation and protection, as a power for the enforcement of orderly operating and the courteous use of the ether. Above all it is a gang of *doers*—active lovers of the wireless game who, thru the co-operation afforded by their bonding into a national society, are able to stage special amateur radio affairs which provide an enjoyment of radio not to be found in desultory listening to radio telephones. *We relayed a message from the Atlantic to the Pacific and the answer back to the Atlantic in six and a half minutes! .Our west-coast stations talk to amateurs in Hawaii! Scores of our member-stations have been heard in Europe and soon we'll be able to talk with amateurs there regularly.* Every night our thousands of members get on the air together and talk to each other, relay messages, make friends, *enjoy radio.*

You can do these things too, if you want to. Radio amateurs are ordinary human beings. It doesn't require a super-brain or a millionaire's income to build and operate a real station. You can learn to do these things and have just as much fun as the rest of us—if you have the inclination to become an amateur.

The A.R.R.L. would like to have you as a member, if you are interested. Bona-fide interest is the requirement. The only charge is the annual dues of $2.00, which also includes a year's subscription to this magazine, *QST*. COME ON IN WITH THE GANG!

A NEW DEPARTMENT

In recognition of the rapid approach of the day when American amateurs will work across both oceans with comparative ease, and for the assistance of the amateur movement in other countries where similar aspirations are possessed by radio experimenters, QST establishes this department, which will be devoted to the presentation of information particularly looking towards the establishment of international amateur relay work.

Communications and news items of interest, particularly reports of amateur activity in foreign countries, are solicited.

It surely seems that regular international amateur communication will be an accomplished fact before long. As a direct result of our A.R.R.L. Transatlantic Tests great interest is being shown in the subject in many corners of the world, and we have the feeling that next fall will see its realization.

Amateur work with Canada, of course, we have had so many months that it is now a commonplace; yet do not all of us remember the real *thrill* that came with the knowledge that here were amateurs of two different countries actually breaking thru national barriers with private radio and knitting themselves into a common brotherhood? In just that same way we believe the amateurs of one country after another will come onto the air with us, and in not many months we will have an international affiliation. And Oh Boy! the thrill then! They're not all gone out of amateur radio yet—not by several micros.

As reported in the last QST, 6ZAC in Hawaii has established two-way communication with the U.S., and details of this remarkable work are found in this department. In our April issue we told of the tests of 3ZO with Venezuelan stations, and in our next issue we will have an interesting account of conditions in Porto Rico, surely justifying the expectation that the amateurs there will be QSO the U.S.A. by next fall and linking us with Latin-America as soon as the latter is ready. They're coming there too, fellows—there are amateurs in nearly every important city in South America, under restrictions it is true but getting sufficient authorization in many special cases to make possible amateur intercommunication with the southern hemisphere. Around Buenos Aires in particular there are several good private stations, one at least having a phone with a range of several hundred miles.

In Holland there are many enthusiastic amateurs, most of whom speak English. No transmission is permitted there yet, but with Britain and France recognizing her amateurs we do not believe it will be long before the Dutch amateurs are accorded similar privileges.

Now for good news! In France the lid is off and amateur transmitting licenses are being issued! We have heard that the general limits are put at 100 watts of C.W. on 200 meters. While that is not overly generous, we immediately have hopes of connecting up with them. Just a short while ago the French amateur magazines were publishing lists of British amateur calls and wondering if ever they could publish any of their own. We join with hams the world over in offering hearty congratulations to the French amateurs. FB, OM!

The French calls so far issued are similar to those in our own country, running 8AA, 8AB, 8AC, etc., and already quite a few licenses have been issued. The power and wave length vary, it seems. For example, 8AB is Mr. Leon Deloy, Nice, who has something over 5 amperes of C.W. in the antenna on 525 meters. Mr. Deloy was attached to the U.S.N. Communications Office at Washington during the war, and is well known to a number of American amateurs. 8AD at Juvisy-sur-Orge at present has a 900-cycle spark on 200 meters, 0.7 amp. in the aerial, but with a C.W. set coming up. 8AE in Paris has C.W. on 200 meters, and 8AH has C.W. and phone on 200 meters; etc. Soon we'll have to send our fifteen cents to Paris for a French call-book.

Mr. Deloy seems an easy leader in the new French amateur field. Dr. Corret, editor of "La T.S.F. Moderne", speaks of him as their "A.R.R.L. man". He has had much the same experiences with C.W. as we fellows have—for a long time 2 amps. was his maximum, then he "got the com-

bination" and now he has 5 amps. This is obtained from two 50-watt tubes with 2000 volts A.C. on the anodes. Mr. Deloy works nicely with Friend Burnham in London, roughly 600 miles; Blackpool, Aberdeen, and other points in the British Isles at distances up to about 1000 miles.

In Great Britain things are humming. Numerous amateurs are now keen on hearing U.S. signals and it looks like there should be several hundred of them outfitted sufficiently for this purpose by next fall. There are between two hundred and three hundred transmitting licenses issued in England now, under restrictions of course, but the prospects for high-powered amateur transmission in special cases seem equally favorable. For example, the Manchester society, in conjunction with Mr. Burne, British 2KW, the most successful of the British contestants in the Transatlantics, have received permission to use a special aerial and a power of 1 k.w., C.W., which was granted them especially for the purpose of endeavoring to connect up with American amateurs. Fellow U.S. amateurs, these English amateurs are out to transmit to America and they'll be on the air very shortly with a big kilowatt of C.W. We've a job ahead of us, to get busy on reception methods and be ready to copy them when fall weather comes. We're better now on transmission than we are on reception, and we will have to overcome that if we have international aspirations.

The British amateurs want to improve their receivers and want us to send every night at an earlier hour than our DX work usually begins, as it is a killing job to sit up every night until 6 a.m. in quest of sigs. What they need is signals around 6 to 7:30 p.m. Eastern Standard Time, and we are advised that there are qualified amateurs in London, Manchester, Birmingham, Liverpool, Blackpool, Aberdeen, etc., ready and anxious to listen. Our Operating Department probably will conclude arrangements for special tests at an early date.

The English amateurs are getting on quite well. It seems probable that the 1000 meter wave length will be abandoned there, and 400 used instead, which is gratifying. Most of their work at present is phone, C.W. telegraphy being rarely used and spark never, the average wave being 350 meters. They are specializing on low-power transmission and ultra efficient reception. Their 50-watt phones cover the country; for example W. W. Burnham in London is regularly phoning as far as 2JZ in Aberdeen, 500 miles, on ten watts, day or nigh using two valves for reception, one radio frequency amplifier and one detector while with 2 amps. on 360 meters he works voice to French 8AB in Nice.

The next winter is going to be a memorable one, fellows. Our cue is to do our utmost during the coming summer to bring our equipments to perfection in point of both reception and transmission. If we don't we will fall down in a wonderful opportunity, while if we do—the world is ours!

—K.B.W.

We ought to be able to hear French 8AB's five amps. of C.W., strays permitting. Mebbe Godley will dust off the ol' Super and give it a whirl from—Otter Cliffs would be a good place.

3ALN in Washington, D.C., and 8YD in East Cleveland, Ohio, report the signals of 6ZAC of Hawaii. 6ZAC has retaliated by reporting 1XM at 7:10 p.m. H.S.T. on April 14, on 200 meters. Some DX!

We wonder what next. And where oh where are the Sparks these days?

Messrs. Burnham & Co. of London announce that, owing to the growth of business it has been necessary to transfer their wireless department to a new company, "Burndept Ltd.," with offices and factory at Blackheath, S.E.3, and showrooms at 228 Shaftesbury Ave., New Oxford St., W.C.2. Demonstrations are given on most Sunday afternoons and a cordial invitation is extended to all American amateurs who happen to be visiting in London to call on them.

The A.R.R.L. Board of Direction has a committee known as the International Advisory Committee of the A.R.R.L., whose function it is to aid in the development of amateur relay work in foreign countries. The League does not believe it wise to undertake the formation of foreign branches of the A.R.R.L. even upon request but will gladly be of every possible assistance in the formation of societies "of by and for the amateur" in such countries. Correspondents desiring data are invited to address the League secretary.

And now a little relay, record: On April 21, 6ZF ex-6ALE worked NOF in Washington, D. C., direct and took a message for Hawaii, landed it immediately to 6ZAC in Maui, and in a few minutes passed the answer back to NOF. Washington to Hawaii with but one relay. Hot dawg!

Foreign Periodicals

It is interesting to read the foreign radio magazines. There is much in them that is new to us and we find them particularly holding our interest when they deal with amateur problems in their countries. For the information of our members we present a list of those known to us, with their U.S. subscription prices.

The two leading British periodicals are now combined in a weekly, known as "The Wireless World & Radio Review". Address 12-13 Henrietta St., Strand, London, W.C.2. Subscription 28 shillings per annum.

In Holland there is "Radio-Nieuws", the monthly organ of the Nederlandsche Ver. voor Radio-Telegrafie, printed in Dutch. Rate 10 florin per annum. Address the secretary, B. Slikkerveer, Columbusstraat 187, The Hague.

France has several radio magazines. "L'Onde Electrique" is a new monthly, organ of the Societe des Amis de la T.S.F., subscription 35 francs. Address J. Cornu, 102 bis, rue Didot, Paris XIV^e. "La T.S.F. Moderne", which frequently has been quoted in QST, is published at 11, Avenue de Saxe, Paris VII^e, rate 36 francs per annum. There is also an engineering periodical, "Radioelectricite", published by the Societe de Publications Radiotechnique, 12, place de Laborde, Paris (8^e), subscription 36 fr. per year.

In Italy there is "L'Audion", published twice a month by Audion, Via dell'Alloro 19, Firenze, as the organ of the Radio Club d'Italia. subscription rate 50 gold francs per annum.

We would be pleased to learn from our readers of any other foreign publications of possible amateur interest.

The Hawaiian Achievement

A.R.R.L. members are hereby advised that relay traffic for Hawaii may be accepted. It should be routed via 6ZAF, 6ZQ, 6ZR, 6ZB, 6EX, 6ZI, 6ZF or 7YA, all of whom are regularly QSO 6ZAC in Maui.

Thereby hangs a tale. In December last West Coast amateurs were given a thrilling kick by receiving word from Hawaii that they were being copied there extensively by C. J. Dow, then located on the island of Kauai. Mr. Dow had call letters of 6ZAC but no transmitter, and of course wanted one, in the hope of connecting up with the mainland. In a number of personal letters to 6ZAF he expressed a desire to have a set similar to 6ZAF because of its good clear signals, and accordingly a set was designed for him on these connections by Mr. G. M. Best, built in San Francisco by Mr. Heintz, and presented to 6ZAC by the magazine "Radio" in consideration for certain work he is doing for that journal. The new set was tested at Berkeley and heard OK by Dow, whereupon it was knocked down and shipped to him. Of course those in on the game counted the days until the time the packages should reach him and the probable time it would take him to get into operation. On April 11th and 12th 6ZAF sent him long broadcasts in response to a letter, giving directions for tuning the set and approximate location of helix clips, etc., and arranged to test with him at 11 p.m. the 13th. The following evening, unfortunately, 6ZAF was ill and confined to his bed, but 6ZAC's call was heard by 6ZQ, Berkeley, who immediately went back at him using 750 watts in a 500-cycle Telefunken spark transmitter with 10 amps. in a T aerial 40' long and 55' high. 6ZAC replied at once. They exchanged greetings and then passed messages, making a date for 1 o'clock the next night. The next several nights they worked with ease, sending single at a good clip with practically no repeats.

We asked Mr. Babcock of 6ZAF to tell us of his experience in linking up with 6ZAC, and we quote part of his letter:

"Of course the glad news was handed around the following day by local telephone and other means of communication, so that on Friday evening, the 14th, practically the entire Coast was standing by for Dow's signals. At about five minutes to eleven, while I was waiting for the scheduled hour to come around, I was sudenly pulled up with a jerk, hearing my call and the signature 6ZAC; and it's here the fun began. I went back at him promptly, and from eleven o'clock until nearly one, we worked continuously and without interruption, because everybody in the neighborhood was listening either to him or for him. It was fun to hear the chirpings of the various regenerating receiving sets in the neighborhood trying to get on his wave. Just before one o'clock—after more than an hour and a half of continuous communication—I told him that while I was getting a real thrill out of one of the rare experiences of life, I did think it was only fair to the others that I should let go and give someone else a chance. The instant I signed off, our neighborhood passed from absolute silence to bedlam. I picked out stations all the way from Vancouver to Arizona, all trying at once to be the next in line.

"On Saturday evening, the 15th, at about 10:20, I was calling 6ZX, and while listening for his comeback, heard just this "6ZAF de 6ZAC," to which I replied without thought, in the old land Morse fashion, "II GA"; and we were at it again.

"The traffic is being handled regularly every night back and forth. A few nights ago both 6ZQ and I heard Dow working some Honolulu station, but without hearing the latter. Also, Dow must have been on reduced power because his signals were very faint.

"The greatest interruption to our communication comes from CL8, who uses spark with high power directly on our wave; in fact with enough power to break Dow's reception completely. Inasmuch as this is an Army station it seems to be out of our reach to control."

On April 16th 6ZAC blew a tube and was temporarily kept off the air until new ones reached him by steamer. He uses two 50-

watters in a full-wave self-rectifying circuit.

For some unknown reason signals reach 6ZAC with extraordinary clearness. He hears the concerts of the Seattle "Post-Intelligencer", has reported 1XM, and mentions that a number of other stations "including 2FP keep pounding in pretty regularly". He is on the ocean side of a range of mountains some three or four thousand feet high, with nothing but open sea in front of him for more than two thousand miles.

QRX soon, everybody, for an A.R.R.L. relay from Honolulu to Central Europe.

6ZAC says he's ready for traffic for the Orient as soon as the Jap amateurs come to life. Then there's ex-5YH at Peking. Watchasa OM—what's a mere 5000 miles of Pacific Ocean between you and Hawaii? We're waiting for you!

British Amateur Recommendations

At a recent conference of the wireless societies of Great Britain the Wireless Society of London was requested to open negotiations with the Post Office Dept. looking to an improvement in amateur recommendations. The society committee made recomendations in substance as follows:

That whereas at present amateurs are permitted to communicate with but five other stations, who are specified in their license, no restriction be imposed upon their communication except that under no circumstances may an amateur make a "CQ" call.

That instead of being confined to a specified two-hour period of operation daily, transmission be authorized for an aggregate total time of two hours per day without specifying hours, except that no uninterrupted transmission shall last longer than 10 minutes.

That amateurs have two wave lengths, one short and one medium; that the 1000 meter wave be abandoned and 400 meters or thereabouts used for C.W. and telephony, with the present 180-meter wave expanded into a band from 180 to 200 or 220, for C.W., telephony or spark.

The committee reminds the Post Office that they have been requested to assist in "maintaining reasonable discipline" and state they are prepared to do so wholeheartedly but "that their task will be lightened considerably if amateurs appreciate that the authorities desire to impose only such restrictions as may be really necessary, and show a willingness to withdraw others that may perhaps seem merely irksome."

The situation, we should say, is encouraging.

THE LACKAWANNA EXPERIMENTS

(Concluded from page 34)

Nearly all previous theories on the effect of location on signals were confirmed except that the immediate proximity of rock, steel bridges, and bodies of earth made very little difference. In passing thru thickly wooded sections all long distance signals faded out entirely, while the nearness to a body of water or stream, even tho small, greatly increased the signal strength. In rounding a curve on a perfectly level plain one set of signals would completely fade out and others come in. Aside from the general interest in these experiments, the data obtained may throw a little light as to why some locations are poor or why no signals are received from certain directions.

—B.P.

Receivers

By L. Q.

"I CAN work anyone I can hear."

The next time anyone springs that remark just take him for a walk to a few small stations that concentrate on receiving and let him conclude for himself, that he has not *claimed* a good sending set but *admitted* a rotten receiver.

Moral—An ostrich also thinks things have quit happening when he puts his head in the sand.

The Operating Department

F. H. SCHNELL, Traffic Manager
1045 Main St., Hartford, Conn.

YOUR attention is invited to the outline of the reorganization of the East Gulf, Rocky Mountain, Central, and New England Divisions, particularly as regards your own location if you are situated in any of these divisions.

One of our oldest Division Managers, Mr. G. R. Entwistle, resigned because of business pressure and in his place we have Mr. P. F. Robinson, otherwise known as 1CK.

When Boyd Phelps, former manager of the Dakota Division, came to help grind out QST, he left a vacancy which is now filled by N. H. Jensen, new manager of the Dakota Division.

J. A. Gjelhaug has been appointed manager of the Winnipeg Division, and Wm. D. Wood, Jr., has been appointed manager of the Vancouver Division.

A new division has been provided for in Hawaii, known as the "Hawaiian Division" of which Mr. C. J. Dow (of 6ZAC fame) has been appointed manager.

The East Gulf Division carries first honors in individual message traffic, which speaks well for good operating through heavy static.

The April message report shows that C.W. traffic is gaining monthly, and of course with the summer static we believe that C.W. will show a greater percentage than spark before Old Man Static "switches off".

C. W. McCLUNG, 4BF
515 msgs.
St. Petersburg, Fla.
East Gulf Division

Message Traffic Report By Divisions

APRIL

Division	C.W. Stns.	C.W. Msgs.	C.W. M.P.S.	SPARK Stns.	SPARK Msgs.	SPARK M.P.S.	TOTAL Stns.	TOTAL Msgs.	TOTAL M.P.S.
Central	11	609	55	16	1693	106	27	2302	85
Dakota	14	580	42	15	1044	70	29	1624	69
East Gulf	10	1233	123	7	296	42	17	1529	90
New England	9	456		11	1007		20	1463	
Northwestern	3	60	20	18	504	28	21	564	27
Ontario	3	79	27				3	79	27
Pacific	14	540	39	17	1278	81	31	1818	55
Roanoke	16	420	26	8	180	22	24	600	25
Rocky Mountain	7	348	50	9	281	31	16	629	39
Vancouver	3	22	7	5	62	12	8	84	10
West Gulf	1	23	23	10	483	48	11	506	46
Winnipeg	1	47	47				1	47	47
Total	92	4417	48	116	6828	59	208	11245	54

Total Spark—6828—61%
Total C.W.—4417—39%

PACIFIC DIVISION
J. V. Wise, Mgr.

C.W. Msgs.: 6ZZ-192, 6CU-86, 6AS-81, 6KA-54, 6ASV-44, 6ZB-48, 6EN-42, 6JD-25, 6ALU-17, 6ZX-12, 6AK-4, 6ALA-4, 6KY-3, 6ABX-1. Total, 540.

Spark Msgs.: 6VK-317, 6GF-118, 6ZZ-111, 6LC-100, 6AJH-91, 6HP-84, 6AS-80, 6ZD-47, 6AHF-40, 6FH-30, 6OL-19, 6AFP-20, 6GS-16, 6HY-12, 6ALA-8, 6ALU-3, 6ZC-2. Total, 1278.

DISTRICT A: QRM and "flu' have been with us steadily, and now the heat is cutting down distance every day. 6AAH and 6ZD are still doing regular work east and west of Phoenix, Arizona. 6AFP was doing excellent work, but has had to move

his station. Thus the small amount of traffic from him this month.

Mr. D. G. Chilson has been appointed Assistant District Supt. for Pima, Pinal, Gila, and Navajo counties. He is located at the University of Arizona, which has just been issued the new call 6YB. Mr. Chilson is doing good at his own station 6ASV, tube equipment being used.

DISTRICT B: No reports from any Assistant Superintendents this month, so district "B" still holds its proud position at the head of the wrong end.

DISTRICT C: QRN has hindered a lot of good DX work in this district this month. A few good nights have enabled us to keep the hook clear. The route east is still open via Denver. 6ZZ, or 5ZA. Those able to clear Denver are: 6JD, 6KY, 6EN, all C.W. With the aid of an automobile and force, traffic reports were gathered from nine stations.

Mr. C. F. Filkstead, 6CU, has been appointed Assistant Supt. for Hollywood. He is doing splendid DX on fifteen watts C.W. and is on the job every night.

DISTRICT D: No report from this district. 6ZE, old 6ALE, is being heard quite steadily lately on 200 and 375 meters.

DISTRICT E: 6PJ and 6PR, of Santa Cruz, are under repairs, leaving 6AAU to handle the work, which he has been doing in fine shape. From this district to San Francisco, traffic is handled by 6TU, 6HC, and 6VX, all spark equipment.

DISTRICT F & G: We may note here that the Dist. Supt. Mr. T. B. Brown has moved to 318 Valley St., San Francisco, Cal. 6ALA, of Santa Rosa, has his set working. 6AWT, of San Francisco, is certainly making his lone fifty watter talk for itself. We find the same old gang on the job and doing credit to our A.R.R.L. They are: 6EX, 6HP, 6VK, 6ASJ, 6AWT, 6IM, and 6AS. The manager would like to say that station 6AS deserves a little more credit than he claims for himself. Brown belongs to the order of "Night Owls" and he handles more than his share of the bay traffic. We think 6IM is used to married life now, as we hear him on every evening again.

DISTRICT H: The major part of traffic thru this district has been handled by 6FH, 6GF, 6ABX, and 6IC, with some by 6KM. 6AK has his fone fixed as a C.W. transmitter. 6ZX has canned his old spark for the latest equipment, "the little bottle". It is due to this reason that his traffic report is so short of the average. He is willing to wager that his 20-watt C.W. will put rings on his old rock crusher, if the boys will oscillate their tubes. In this, as in all central districts, the boys work direct north or south every and any evening on both spark and C.W.

DISTRICT I: Mr. Garrett, 6CC, of Colusa, Calif. has just been appointed District Supt. of this district. Tho no report yet we hear 6TC, 6CC, and 6AIX on the job up there.

DISTRICT J: 6AJR made the report for this district this month. Reno, Nev., still holds her place as working north and south best. Thus a fast route north or south is maintained from the two extreme limits of the coast. The route east to Salt Lake is working well, but still handles less than the others.

ROANOKE DIVISION
W. T. Gravely, Mgr.

C.W. Msgs.: 3IW-110, 3BLF-87, 3BDB-60, 3BZ-54, 3CA-42, 3BHL-36, 3BIJ-31, 8SP-21, 8BPU-20, 4DS-18, 4DC-11, 3RF-10, 4EN-10, 4GH-10, 3MO-6, 3AEV-4. Total, 420.

Spark Msgs.: 8AXY-74, 8WD-29, 4CX-25, 4EA-15, 3AOV-13, 8BAZ-10, 8SP-7, 4DS-7. Total, 180.

Traffic has lagged during the past month due to several causes. Relay operations were checked by broadcasts and listeners, static, and apathy on the part of many operators.

The division is undergoing complete reorganization under the new plan of the Operating Department. The complete personell including City Managers, District Superintendents, and official relay stations, will be given in next issue. The Assistant Division Managers have been appointed, but as they have not yet perfected the organization in their respective states, no detail will be given out until it is done. However, it is well for all stations located in the division to understand that, in future, the Manager's report wil only deal with the live, active, operating stations, so you who are in this category are requested to furnish traffic reports promptly each month. Due credit and mention will be given the individual station doing the active relaying.

Men! Line up in the new permanent organization and give your District Superintendent or City Manager your hearty cooperation when called on.

NORTHWESTERN DIVISION
H. F. Mason, Mgr.

C.W. Msgs.: 7DP-35, 7QB-23, 7BS-2. Total, 60.

Spark Msgs.: 7BK-115, 7HI-64, 7OT-62, 7MP-42, 7LY-38, 7EX-37, 7MU-32, 7BG-27, 7BF-15, 7XB-10, 7IY-20, 7VZ-7, 7ON-7, 7ZU-8, 7NC-6, 7VM-6, 7RM-5, 7DJ-3. Total, 504.

MONTANA: H. E. Cutting, A.D.M., at Libby, reports 7VZ has been making improvements ,and is now a permanent link in our Northern route east. 7DJ reports Helena coming to the front with four good stations, 7KZ, 7IE, and 7DJ on spark, and 7HW on A.C.C.W. From Glasgow 7EX reports that sickness and QRN have crippled

the report from that end of the state this month. 7HS is on the job with C.W., and a permanent summer route through the northeastern part of the state is being organized. 7ZU at Billings reports increased activities and is taking traffic on C.W. now. In Bozeman, 7LY is looking around for a second op so that better watches may be stood. 7MP does not know whether to change over to C.W. or not, but reports 9BD of Vancouver, B. C., the most consistent from the north coast, with all California stations QSA. He has worked 9APK of Chicago.

IDAHO: In Boise, 7YA on 375 meters and 7OT on 200 are both clearing traffic. 7OT is working on schedule with 6QR and 6ASJ. As Moscow, 7JF is reaching out, and 7ZM is still handling traffic in his accustomed style.

WASHINGTON: Ass't Mgr. Reichert has resigned on account of lack of time to carry on the work, consequently we can only give a scanty report until we get someone on the job. Walter Lemrich, 7SC, has been appointed D.S. for Grays Harbor County, and is handling traffic on C.W. He states that he is in a remarkable location for carrying on DX work. 7KJ and 7NN are on with spark and handling quite a bit of traffic. 7HI at Auburn has been doing very consistent relay work. In Seattle, 7BF, 7IY and 7BK cleared most of the traffic for the month. North bound traffic is passed to Canadian 5AK, 5CN, or 9BD every night. Eastern traffic goes through 7VZ at Libby, Mont., or 7GE at Pasco, or 7YA at Boise. Messages for the south are cleared regularly with 6TU, 6VX or a number of other sixes, all of whom are consistently received. Traffic for Portland usually goes through better if routed via Salem, as bad QSS is experienced with Portland direct. 7GE at Pasco is a reliable station that is doing good work.

OREGON: Royal Mumford, 7ZJ, A.D.M., reports the following changes in the personnel within the last month: George Cameron, 7DP, has been appointed D.S. for Portland and vicinity; Walter Russ, 7ED, is now City Mgr. for Portland; and P. F. Peyton, 7MU, has been appointed D.S. of Salem and vicinity succeeding 7TJ who is now at sea. All DX stations are encouraged to keep a log of all messages handled, so that we may have complete reports in this respect in the future. 7MU and 7BH are effectively clearing traffic from all directions. From Myrtle Point, D.S. Baker, 7KE, reports a scarcity of stations in his part of the state, but that he has been handling quite a bit of traffic. 7QT is rebuilding at Corvallis 7HF had his transmitter stolen, so is quitting the relay game. This leaves 7IW and 7MF on the job doing good work. D.S. Thibodo, of Seaside, 7HD, states that the same QSS situation exists between there and Portland as exists between Seattle and Portland, viz.: that over a period of about three months in the winter time, Portland stations cannot be heard. Southbound traffic is being routed via 7MF while msgs. for the north should go via the stations 7HI, 7BK, or 7ND. There has been very little doing for the past few weeks in Portland and vicinity in regard to relay work, as many of our DX stations are either out of commission, or their operators have left for Alaska. 7DP on A.C.C.W. is the star station in Portland this month. 7GJ is on at times. 6ZI reports DP's C.W. as the best in the north. 7DP desires communications from all C.W. stations in Idaho and Montana with a view to making an all-C.W. route east.

WEST GULF DIVISION
F. M. Corlett, Mgr.

C.W. Msgs.: WRR-23.

Spark Msgs.: 5PE-240, 3QI-64, 5ZH-56, 5MK-46. TC-31, 5EW-15, 5QU-13, 5MJ-8, 5VN-5, 5NG-5. Total, 483.

NORTH TEXAS SECTION: For the benefit of those who have not noticed the assignments of territory which have appeared from time to time in QST please write Robert L. Clinkscales, 3913 Hamilton Ave., Dallas, Texas, who will be glad to give you the information as to whom you are to make your monthly report.

Traffic has been moving slowly thru the Northwest District on account of increase in QRN. Old 6ZZ deserves considerable credit for his reliability and the consistency of his spark and C.W. Mr. Gooding has been right on the job and even when he was prevented working spark during the Pacific Coast broadcasts, he worked 5IF

on C.W. for the traffic.

5ABO, is doing some first class receiving at the same time working on his spark transmitter. Traffic has been going through 5IF from 9WI, 5QA, 9DSD, 5IQ, and 5IG very reliably. 9DSD comes through the interference with a boom and is strong and steady. 5TU, has just finished installing a very efficient set, and is being reported all over the country as very QSA. His signals go thru static as if it wasn't there. 5IS, has been doing very little lately except sitting up with OW and watching the stars.

General activities around Waco and vicinity are as good as could be expected, now that QRN is so fierce. Every one seems to fall for receiving sets to listen on 360 meters. 5IQ and 5ZAF continue to hold down the traffic thru Waco, though the traffic fell off during the past month. 5IQ has installed 10 watts of C.W. Conditions this side of Waco proper are improving, with 5LM and 5PP struggling at Temple and 5MK at Ennis.

5QS is going strong. 5EW has installed C.W. 5NC is back strong as ever after having a little trouble with his sink gap. 5JG just completed his 30 watt C.W. 5PE has been doing some fine work on ½ K.W., and has worked stations in every district except the 7th.

SOUTHERN TEXAS SECTION: Spark sets are getting more and more scarce with each report from this section, 5YG, 5BA, and 5JI being the only DX spark stations now operating in these parts. Splendid results are being obtained with C.W. and fones at 5NK, 5NN, 5PO, 5ZX, 5JM, 5CA, 5PB, 5ZV, and 5YG.

All traffic from San Antonio district is suffering from strong harmonics from the high-powered army station there. 5ZAK has moved his set to Kelly Field and united with GP4, which assures us of a wonderfully efficient relay station. The Radio Inspector has been in San Antonio conducting exams. and visiting installations under the guidance of Mr. Wall, 5ZAE, A.R.R.L. representative for that city. Traffic for San Antonio district totalled 66 messages, and for the Laredo district, 27 messages.

5MT continues to be the busiest station, and is daily assisting the State Dept. of Markets by supplying the 5XU broadcast station with information regarding shipments from the valley. 5UF is the only spark station in operation. 5ZAN continues to operate with a splendid C.W. and fone set. 5ZN is to be congratulated upon his continued effort to discharge his duties as Dist. Supt. with the many handicaps he has met with this season.

OKLAHOMA: Sparks are all getting scared out by the static. 5BR, 5LO, 5BM, 5FO, and 5HK are installing C.W. and making preparations in general to battle QRN. Dist. Supt. Whartenby of Enid is planning a large fone set. Messages reported from his district total only 14 on account of the QRN.

In the eastern part of the state 5BM is going to keep traffic moving with his new 50 watt C.W. BM worked 4GL and "gobs" of 5's and 9's the first nite the set was completed. F. B.!

5AQ, is a very consistent station. W. H. England is opening up with a 100 watt C.W. which surely sounds like business to us. This makes several good relay stations in northern Oklahoma.

WINNIPEG DIVISION
J. A. Gjelhaug, Mgr.

C.W. Msgs.: 4CB-47.

More good relay stations are needed, especially between Winnipeg and Regina, about in Brandon, Man., that would help greatly to span the long jump west from Winnipeg.

4CB has been doing fine work with his 15-watt C.W. this month, having handled considerable U.S. east and west bound traffic when spark stations could not connect up very well. 4EI of Moose Jaw, Sask., is a new 5-watt C.W. station. 4BG reports very little doing in traffic work this month.

To all A.R.R.L. stations in the Winnipeg Division: Please get in touch with your Dist. Supt. if you have not done so already, and give him a brief report about the 15th of each month of what you are doing in relay work, what stations you work with, how many messages handled during the month ending the 15th, etc. This will help greatly in laying out routes and getting a line-up of things in general. By doing this you are not only helping the whole A.R.R.L., but also helping yourselves. "Blow your own horn"—there is nobody that can come and blow it for you. A brief report of this nature will go nicely on a post card and would only take you a few minutes to write. If you could arrange morning schedules with each other you will find that this is the best time in summer. Try it and you will be surprised.

ALASKAN DIVISION
Roy Anderson, Mgr.

A. A. McCue's much talked of 20-watt C.W. set was never installed and we are sorry to inform those who follow our activity that Mr. McCue has left for a more southern climate.

While experimenting with a Westinghouse tuner at 7IT, the following amateur calls were heard, using 2-steps and small aerial, April 5th or 6th: 7BK, 7GE, 7NN, CI8 (who is he?), 9BD and 7OH. All were QSA in spite of local interference and the fact that the "J's" insisted on seeking our 200 wave.

Fellows, we want to get something lined up. Let's hear from a bunch of you. What kind of sets have you? How many miles is it good for? What hours could you keep? What people in your district have radio sets? What kind? Address?

You know that there are hundreds of fellows in the states who follow our progress (?) so let's go!

ROCKY MOUNTAIN DIVISION
M. S. Andelin, Mgr.

C.W. Msgs.: 9XAQ-98, 6ZA-65, 9ZAF-61, 9AMB-40, 9DVA-39, 6ZAM-30, 7ZO-15. Total, 348.

Spark Msgs.: 6AFD-64, 6ZAM-57, 7OS-30, 6ZAJ-26, 7ZO-25, 6ATH-23, 7ZV-21, 6BKE-18, 6AWH-17. Total, 281.

We have in this division at present several good relay stations that are in operation and handling traffic continuously. Several also have closed down for the summer on account of QRN. We have an all-summer route in operation and intend to keep it going all summer. The relays are accomplished in short jumps and most of the stations are capable of daylight communication with each other. Most of the traffic has gone across the division by two routes, 7ZO at the north and 6ZA and 6ZAM alternating at the south.

The division has undergone complete reorganization according to the plan set forth by the Traffic Manager and all members of the division are requested to give their best support and co-operation to their respective superintendents.

The appointments made so far in the reorganization are as follows: *Wyoming*, Norman R. Hood, 1022 So. Ash St., Casper, Wyoming, Executive Assistant and Assistant Division Manager; *Utah*, Glen Garner, 533 26th St., Ogden, Utah. Assistant Division Manager; Ralph Baker, Supt. for District #1, which includes the northern part of Utah; Evan Seegmillar, Supt. for District #2, which includes southern Utah.

VANCOUVER DIVISION
W. D. Wood, Mgr.

C.W. Msgs.: 9BD-13, 5CT-6, 5BI-3. Total, 22.

Spark Msgs.: 9BD-32, 5CN-12, 5AK-9, 5FE-5, 5DO-4. Total, 62.

In the reorganization of this division the following appointments have been made: Assistant Division Manager, R. M. Ellis, 5BI, North Vancouver, B. C.; District Superintendents: Prince Rupert District, J. Barnsley, 5AX; Cloverdale District, R. M. Balfe, 5AD; Chase District, H. V. Weaver, 5ET.

Appointments have yet to be made in the following districts: Vancouver Island—Victoria man wanted for this job: QSL pse. Kootenay District—Need a live wire up that way. Edmonton District—The Manager is sadly in need of news from there. Calgary District—Same applies as to Edmonton.

J. T. North, Jr., 5AK, has been appointed City Mgr. for Vancouver, and N. Goode, 5FE, is our City Mgr. for New Westminster. 5CN and 9BD, have less trouble handling traffic with 6's in California than with nearby stations such as 7BK and others in Puget Sound.

Notices have been sent out by the Dept. of the Naval Service Radiotelegraph Branch, Ottawa, that all amateurs in the Dominion of Canada are now allowed 180 meters for spark work and 200 meters for C.W. Experimental stations will continue to have "9" calls and are now allowed 200 for spark and up to 275 for C.W. Amateurs in this Division should write to Mr. E. J. Haughton, Div. Supt., Victoria Branch Office, for any particulars.

C.W. signals are traveling upwards to the northwest in great style this time of year, but there are none to be compared with 6ZI of Oakland, Cal.

6ZAC of Hawaii is QRK here and 9BD is ditto in Maui. 5CN, 5CD, 5CZ and 5AD will soon be on the air with small C.W. sets. 4CB is alaways QRK in Vancouver and we work him pretty regularly. We Canucks are all pulling strong for a Trans-Canada relay route. It looks like a goner until next fall, but we shouldn't give up the ship too soon for everyone knows "CW DUZIT."

EAST GULF DIVISION
B. W. Benning, Mgr.

C.W. Msgs.: 4BF-515, 4GL-300, 4BY-183, 4II-96, 4IZ-47, 4YA-30, 4IW-25, 4EH-20, 4KU-14, 480-3. Total, 1233.

Spark Msgs.: 4BI-130, 4EZ-62, 4HS-55, 4KO-17, 4JZ-12, 4BC-12, 4DZ-5. Total, 296.

Under the new Operating Department scheme the following appointments have been made: W. B. Pope, Assistant Division Manager, Georgia; V. C. McIlvaine, Assistant Division Manager, Alabama; M. F. Harrod, Assistant Division Manager, Florida; W. C. Etheredge, Assistant Division Manager, South Carolina.

This month marks the appearance of the "East Gulf Radiogram", a magazine with the express purpose of promoting the radio interests in the south. The growing popularity of all forms of radio has made it imperative that such a magazine be published in this part of the country or we will have the alternative of being overwhelmed by the more numerous "listeners." This Division needed a publication to assist in developing its organization into an efficient, trouble-proof, and co-operative unit more capable of handling relay traffic.

FLORIDA: In accordance with the new Operating Department changes we now

have the state divided into four districts as follows:

Northern Florida, District #1,
M. D. Clarke, Dist. Supt.
Central Florida, District #2,
E. R. Hall, Dist. Supt.
Southwestern Florida, District #3,
W. E. Wood, Dist. Supt.
Southeastern Florida, District #4,
F. M. Gookwalter, Dist. Supt.

Although our mighty friend Static has started with the preliminary bout we are doing our best to stay on the job. In District #1, 4ZE has succeeded in connecting with 4FD and 4GN regularly and this has proven to be a reliable short-jump relay. In District #2 we have some of the larger cities of Florida including Orlando, St. Petersburg, Ocalo and Tampa. There are good prospects for relay material in this district. Both 4II and 4BF are "knocking em loose" on C.W. 4BF is the star DX station of Florida haveing worked 6KA on several occasions and handled traffic with him. This station has been appointed City Manager of St. Petersburg and the operators there are doing their best to establish a real relay center. 4KD and 4JZ on spark, and 4IZ on C.W., are handling traffic. 4BH (C.W.) has just started active work. This is District #3. In District #4, both 4BC and 4DZ are doing good work on spark, 4BC and 4EZ from a dependable route to the east coast.

SOUTH CAROLINA: Not a DX station in operation. Everyone seems to be interested in listening only.

GEORGIA: 4BY and 4GL are still "knocking about". Both sets were reported heard by ship 300 miles off the English coast. This is exceptional summer work, even for C.W. In Atlanta, most of the messages were handled by spark, due to the fact that 4FT is now the broadcasting station of the Atlanta Constitution. 4EH, 4CO, 4KU, and 4YA, have handled a few messages with their low powered C.W. sets. On spark, 4BI and 4HS take the highest honors. 4GM has combined sets with 4BI. 4AU has dismantled and will not be on again until next fall.

DAKOTA DIVISION
N. H. Jensen, Mgr.

C.W. Msgs: 9WU-185, 9BBF-78, 9AEJ-60, Twin Cities-55, 9AWM-49, 9AAO-40, 9AFQ-28, 9AUU-20, 9YAJ-20, 9AOR-12, 9PI-12, 9BMO-9, 9EA-7, 9BKP-5. Total 580.

Spark Msgs: 9AIG-265, 9YAJ-129, 9LW-125, Twin Cities-87, 9AGN-80, 9DOC-75, 9FX-60, 9AVZ-55, 9BRI-40, 9BAF-30, 9ZC-28, 9TI-20, 9AYW-19, 9BOF-16, 9EE-15. Total 1044.

NORTHERN MINNESOTA: Stations handling traffic in this District are 9ZC, 9EA, 9BAF and 9AOR. Plans are being made for summer routes.

SOUTHERN MINNESOTA: 9XI has succeeded in getting an appropriation thru for a big phone set. Mr. Carpenter is active in getting summer routes organized for short jumps leading into Minneapolis. The amateurs of Southern Minnesota met in Convention at Sleepy Eye a short time ago, and formed the Radio Association of Southern Minnesota. Officers were elected and plans made for organization. Mr. E. T. Sperling, 9BBF, New Ulm, was elected Traffic Manager, and an operating schedule was drawn up. Most of the amateurs attending were from the southwestern part of the State. There appears to be very little doing in the southeastern part. The stations most active in the District are: 9YAJ, 9BBF, 9AWM. Daylight routes are being started. 9YAJ operates from 4 to 6 P.M., daily.

NORTH DAKOTA: 9WU has consistently worked all three coasts and every District, both Canadian and U. S., on 50 watts. There are a number of good relay stations in the district, the leaders of which are: 9WU, 9LW, 9AGN, 9DOC, 9AEJ and 9FX.

SOUTH DAKOTA: A new station in this district that has been doing good work is 9BRI at Winner. Since 9YAK has been out of commission, 9AIG has taken the lead in traffic work. 9AVZ is another good relay station, having no trouble in working west. In the northern part of the district 9PI, 9AKX and 9TI are leaders.

ONTARIO DIVISION
A. H. K. Russell, Mgr.

C.W. Msgs: 9AL-49, 3JI-26, 3JK-4. Total 79.

April is the start of a new year in radio for Canadian amateurs, as on April 1st all licenses have to be renewed. And with the renewal of licenses this year the axe has fallen. The new regulations have apparently come into force which are substantially as follows: spark, 180 meters; general amateur, C.W., 200 meters; and special amateurs, 275 meters on C.W. and 200 meters on spark. This results in a very substantial improvement in amateur conditions in Canada, and the Naval Dept. is to be congratulated on its decisions. The department also has adopted a scheme which could well be followed in the United States of licensing broadcasting stations for waves ten meters apart, to avoid the conflicting waves which at present are heard at all times from American broadcasting stations.

From District No. 1, we hear that Byerlay and Mackay are going great. The former is also getting C.W. going. Gowan in Kitchener was heard one night only on C.W. but not since.

Toronto district is still going C.W. Sta-

tion after station is changing over, and several of the new C.W. stations have done fine work, especially 3JI.

Donnelly in Kingston reports that the broadcasting has cut into relay work badly. 3IL in Kingston recently copied the 20 watt C.W. station 6ZB. Brockville seems to be dead to radio, but Staebler and Sinclair in Gananoque are livening up their town.

CENTRAL DIVISION
R. H. G. Mathews, Mgr.

C.W. Msgs: 8VY-245, 8BFH-91, 9AZE-63, 8BXX-60, 9UW-46, 8BEX-40, 9GU-21, 9ACE-20, 9AVO-15, 9AQG-6, 8BFI-2. Total 609.

Spark Msgs: 9ZI-356, 8FT-332, 8ZO-250, Mich.-188, 8UC-136, 9ME-157, 9AJH-60, 8AHY-48, 9YB-47, 8AIZ-36, 8AFS-26, 8BFI-19, 8AFH-17, 8BSI-13, 8BEX-4, 9AWU-4. Total 1693.

With April has come the start of the reorganization of the Operating Department in this Division. All outstanding appointments have been cancelled in accordance with the orders of the Traffic Manager, and appointment certificates recalled. New certificates both for appointments in the department and for appointment as official relay stations will be issued as fast as appointments can be made.

The following have been appointed under the new reorganization plan:

OHIO: Mrs. C. Candler, 8ZL, 105 S. Ash St., St. Mary's, Ohio, Assistant Division Manager.

District No. 1 consists of the following counties: Williams, Defiance, Paulding, Van Wert, Mercer, Fulton, Henry, Putnam, Allen, Auglaize, Lucas, Wood, Hancock, Hardin and Logan. Superintendent, K. A. Duerk, 8ZY, 1000 Wilhelm St., Defiance, Ohio.

District No. 2 consists of the following counties: Ottawa, Sandusky, Seneca, Wyandot, Marion, Morrow, Crawford, Erie, Huron, Richland, Knox, Lorain, Ashland, Medina and Wayne. Superintendent, J. P. Turner, 681 George St., Clyde, Ohio.

District No. 3 consists of the following counties: Cuyahoga, Summit, Lake, Geauga, Portage, Ashtabula, Trumbull and Mahoning. Superintendent, Paul A. Marsal, 1527 Lakeland Ave., Lakewood, Ohio.

District No. 4 consists of the following counties: Darke, Preble, Butler, Hamilton, Shelby, Miami, Montgomery, Warren, Claremont, Champaign, Clarke Greene, Clinton, Brown, Madison and Fayette. Superintendent, L. E. Furrow, 8FT, Troy, Ohio.

District No. 5 consists of the following counties: Delaware, Franklin, Pickaway, Union, Ross, Highland, Adams, Scioto, Pike, Ross, Licking, Fairfield, Perry, Hocking, Athems, Vinton, Jackson, Meigs, Gallia and Lawrence. Superintendent, M. F. McDowell, 8EC, 612 Mithoff St., Columbus, Ohio.

District No. 6 consists of the following counties: Holmes, Coshocton, Muskingum, Morgan, Washington, Noble, Guernesey, Tuscarawas, Stark, Columbiana, Carroll, Harrison, Jefferson, Belmont and Monroe. Superintendent R. D. McCommon, East Palestine, Ohio.

WISCONSIN: Ben A. Ott, 9ZY, La Crosse, Wisc., Assistant Division Mgr.

District No. 1 consists of that part of Wisconsin bounded on the east by Lake Michigan, on the north by a straight line drawn from Portage to Port Washington and on the west and south by a straight line drawn from Portage to the junction of Wisconsin and Illinois on the shore of the lake. Superintendent, C. N. Crapo, 1175 2nd St., 9VD, Milwaukee, Wisc.

District No. 2 consists of that part of Wisconsin bounded on the east by a line drawn from Portage to the junction of Wisconsin and Illinois on the lake, on the north by the Wisconsin River on the west by the Mississippi river and on the south by the state line. Superintendent, K. C. Maas, 9AZA, Whitewater, Wisc.

District No. 3 consists of that part of Wisconsin bounded on the east by the eastern state line, on the south by a line drawn from Portage to Port Washington, on the north by the state line and on the west by a straight line drawn from Portage through Wausau to the north state line. Superintendent, J. Kraus, 9ACM, Sheboygan, Wisc.

District No. 4 consists of that part of the state bounded on the north by a straight line drawn from Wausau to Hudson, Wisc., on the east by the Wisconsin River and a straight line drawn from Portage to Wausau, on the south by the Wisconsin River, and on the west by the Mississippi or state line. Superintendent, Robert White, 9AEH, La Crosse, Wisc.

District No. 5 consists of that part of the state bounded on the east by a straight line drawn from Wausau to the northern boundary of the state, or in other words the western boundary of District No. 3, on the south by a straight line drawn from Wausau to Hudson, Wisconsin: on the west by the state line and on the north by the state line. Superintendent, E. J. Krusel, 9YAC, Superior, Wisconsin.

MICHIGAN: C. E. Darr, 137 Hill Ave., Highland Park, Detroit, Mich., Assistant Division Manager.

District No. 1—Superintendent, F. D. Fallain, 8AND, 104 Wash Bldg., Flint, Mich. District No. 2—Superintendent, M. H. Pancost, 8ZF, 1101 Climax Ave., Lansing, Mich. District No. 3—Superintendent, A. T. Shirrine, 8JZ, Holland, Michigan. ...City Manager of Detroit, E. G. Boyes, 611 W. Willis St., Detroit, Mich.

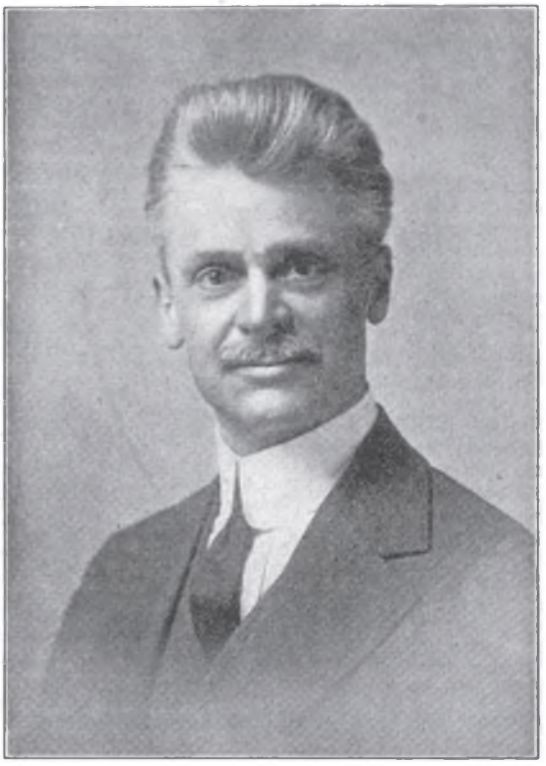
NORTHERN INDIANA: M. W. Hutch-

(Continued on page 05)

Who's Who in AMATEUR WIRELESS

THERE may be some member of the A.R.R.L. who has not yet met Hiram Percy Maxim, the "Old Chief", president of the American Radio Relay League.

For once in our young life we wish that we could write—write fluently and have that knack of picking up adjectives and adverbs that would make it possible for us to do a good job in speaking of H. P. Maxim. Because we have so cordially detested flowerly writing as applied to the preparation of a magazine such as our QST, however, we haven't a trace of beauty left in our style and are afraid we're out of luck. We can only say that here is a *man*—a real man's man—if God ever made one!



HIRAM PERCY MAXIM

Mr. Maxim, son of Sir Hiram Maxim, noted inventor of automatic firearms, was born in Brooklyn, Sept. 2, 1869, educated at Massachusetts Institute of Technology, and has been identified with electrical manufacturing since its early days. His business connections have been successively with the Thomson Electric Welding Co., Lynn, Mass., American Projectile Co., one of their subsidiaries; Pope Mfg. Co., Hartford, Electric Vehicle Co.; Westinghouse Electric & Mfg. Co., East Pittsburgh, and finally the Maxim Silencer Co., of Hartford. Mr. Maxim was one of the earliest automotive engineers in this country—a pioneer in the automobile game.

He was pushed into radio by his son Hamilton in 1910 and mastered the code at the age of forty. Thus he has watched the development of radio thru the eyes of a man of mature judgment. In those early days, of course, initials were used for call letters and one's wave length was anything that passing fancy dictated. He was among the early ones to take out a license when the law of 1912 was enacted, and for some years before the big war was 1ZM in Hartford. After the war he became 1AW and has stuck to it ever since.

Mr. Maxim is prominently identified in many lines of activity. He is president of the Aero Club of Hartford, former chairman of the Hartford branch of the American Society of Mechanical Engineers, president of the Technology Club of Hartford, a member of the Executive Committee of the M.I.T. Alumni, a consulting mechanical engineer — active in many lines. His chosen field is *sound*, on which he is a national authority, his studies into this field having resulted in the invention of the Maxim silencer, not only familiar on rifles but finding multitudinous applications in industry, or motor-driven vessels, etc.

Of all of Mr. Maxim's many affiliations, however, we believe he is proudest of his connection with our A.R.R.L. It was he who first conceived a national society of amateurs devoted to relaying and who started the ball rolling. From the very first he has fathered the A.R.R.L., guided its des-

(Concluded on page 50)

CLUBS wishing information on how to become affiliated with the American Radio Relay League can secure same by addressing a letter to the Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. There is no charge for affiliation. Every good radio club, society, or association is eligible for affiliation.

Wisconsin's First Annual Radio Show and A. R. R. L. Convention

The Milwaukee Amateurs' Radio Club is holding Wisconsin's first annual A.R.R.L. Convention in conjunction with the Radio Show to be held at the Milwaukee Auditorium June 21st to 25th inclusive.

The Radio Show is under the direction of Mr. Spearman Lewis of the Chicago Opera Company. The convention call has been issued on authority of Mr. Ben A. Ott, District Superintendent of A.R.R.L. for Wisconsin. The convention is under the direction of C. N. Crapo, Milwaukee, City Manager for the League.

The convention is to be held in Plankinton Hall at the Milwaukee Auditorium and will be open to the general public. Distinguished speakers from radio centers have been assured. Pre-convention headquarters will be open at the Hotel Plankinton, where an information bureau will be maintained. Up-state members who anticipate attending are requested to communicate forthwith with Herbert F. Wareing, Chairman of Reservations.

The following Committees have been appointed:

Convention Director	C. N. Crapo
Program	L. S. Baird
Reservations	H. F. Wareing
Banquet	E. W. Ruppenthal
Entertainment	D. W. Gellerup
Publicity	A. J. Simandl

Wednesday—Show Day, reception, and registration of men. Visits to prominent stations.

Thursday—Opening day of Convention. Reception. Tours of city. 7 P.M. Formal opening of Convention by League representatives and city officials followed by non-technical lectures.

Friday—1 P.M. Traffic meeting, District of Wisconsin. All A.R.R.L. men requested to be present. 4 P.M. Technical and popular lectures. 7 P.M. Technical lectures.

Saturday—Afternoon, special features to be announced later. 8 P.M. Banquet.

The Women's Radio League of America

The women's Radio League of America, Inc., held its first Annual Meeting on Tuesday evening, May second, in Room 907 Y.W.C.A. Building, 53rd Street and Lexington Ave., New York.

The following officers were elected:

President	Miss Abbie Morrison
Vice-President	Mrs. Eleanor G. Regan
Secretary	Mrs. J. Koch
Treasurer	Miss Elizabeth Rhodes

The regular meetings of the League are held on the first and third Tuesday evenings of every month at the above address. Code practice for those who wish it is at 8 P.M., business meetings at 8:30 and the speaker of the evening at 9:00.

At the meeting on May 16th, Mr. A. A. Hebert, Treasurer and a director of the American Radio Relay League and Vice-Pres. of the Second District Executive Council, spoke on "Co-operation and Organization."

All women interested in radio are invited to attend these meetings, and if desired courses in radio telegraphy or telephony can be arranged for.

Dallas Radio Club

U.S. Radio Inspector Theodore G. Deiler, from New Orleans, visited several North Texas cities on a recent tour of inspection. Amateur examinations were conducted in Dallas on Tuesday April 18th, and commercial examinations Wednesday April 19th. An informal dinner in honor of Mr. Deiler was given by members of the Dallas Radio Club, officers and directors. Mr. Deiler visited Ft. Worth, Austin, Houston and San Antonio.

Scenic Highway Radio Club

A mass meeting of most of the radio men of the city was held here Tuesday, March 21st. Meeting was called to order by the President of the Scenic Highway Radio Club and then discussions took place by the leading radio amateurs of the city as to the proper method to be adopted con-

cerning broadcasting. No agreement could be reached on the subject of regulating the wave of radiophone broadcasting stations. Many were of the opinion that the waves from 600 to 1000 meters should be set aside for this specific purpose but no agreement could be reached. So we took up the discussion of sending during the broadcasting of concerts.

Many arguments were advanced as to why spark transmission should be allowed during the evening but all of these were promptly refuted by the members. Finally hours were decided upon for the listening in on broadcasting stations. These were from 6 to 10 p.m. In the evening no amateur in the city of Clinton shall send out any form of message by either spark or CW transmission, nor shall any testing whatever take place during these hours. This was put to a vote and every one was unanimously agreed on this form of regulation.

As yet we have had little interference, practically none, and we feel assured that if the Radio Clubs in other cities would get together on this proposition we would be assured of hearing radiophone concerts without any interference at all.

Philadelphia Amateur Radio Association

The Philadelphia Amateur Radio Association held its last regular meeting in the Widener Memorial Library at 1200 North Broad St. on Monday April 8, 1922. Mr. W. C. McFadden who is from the Laboratory of the Phila. Navy Yard gave a talk on Radio Frequency Amplification and discussed the subject fully. The subject was very interesting to all the amateurs as they have been experimenting on it.

Mr. Chas. VanDerVera gave a short talk on "Practical Experiments with Audio Frequency" which was very interesting. Information and prices were given by the President on "Condensite Celeron." Mr. John Delp, Jr., talked on "New Circuits for using Audio Frequency" and a discussion followed.

The President decided that on account of the hot weather the next meeting would be the last, until the third Monday in September.

Cleveland Radio Association

The Cleveland Radio Association has come out with a very neatly printed card giving their recently adopted traffic regulation which we can recommend to other clubs judging from the results that has been secured in Cleveland. Any clubs interested in obtaining a copy of these regulations may secure them from P. A. Marsal, Cleveland City Manager, 1527 Lakeland Ave., Lakewood, Ohio.

The Delaware (Ohio) Radio Association

has two traffic stations, 8AJX and 8AJE, which aided in sending out the football and basketball scores for the high school and Ohio Wesleyan University. The scores of football games were sent out by 8YK using a relay on the football field.

At a meeting of the **Philadelphia Amateur Radio Association**, held on January 16th, E. B. Meyers of Jersey City read a paper on "Vacuum Development from 1884 to 1922." C. A. Service, vice president of the A. R. R. L., spoke in the interest of the 3rd and 4th districts convention. Because of the large attendance, many members had to stand during the lectures. This club is growing splendidly and doing good work in its territory.

H. P. MAXIM

(Concluded from page 48)

tiny, presided at the deliberations of its Board, represented it at Washington—given freely of his time and energy. His kindly counsel and mature advice have been the biggest factors in the building of our League.

Hiram Percy Maxim is a prince!

—K.B.W.

OPERATING DEPARTMENT

(Continued from page 47)

inson, 9HR, Middlebury, Ind. Assistant Division Manager.

District No. 1 consists of all territory in District of Northern Indiana east of a north and south line drawn through South Bend, including South Bend. Superintendent, E. E. Pippinger, 9FS, 806 S. 7th St., Goshen, Ind.

District No. 2 consists of all territory in the District of Northern Indiana west of north and south line drawn through South Bend. Superintendent, J. Ralston Miller, 9CP, 854 Calumet Ave., Hammond, Ind. South Bend City Manger, F. S. Libbe, 9DAK, South Bend, Ind. Fort Wayne City Manager, L. S. Slagle, 9ME, 530 Masterson Ave., Ft. Wayne, Ind.

This is probably the last report of the Miami Valley District under the old organization. Activities in this district seem to have diminished considerably during the past month, due, on doubt, to the heavy static that has appeared. Some of the stations also have had operating troubles in the way of burned out tubes, condenser and gap troubles. It is interesting to note that only two stations had any C.W. traffic to report. This is not necessarily an indication that the C.W. stations were not able

(Concluded on page 57)

LIGHTNING PROTECTION

This summer we have about twenty times as many aerials in this country as last and with the first clap of thunder christening the launching of the static season, we hear the cry from thousands of householders, "How much danger is there from lightning striking my house?"

These same houses have stood many summers full of light wires, door bells, gas and water pipes, tin roofs, gutters, down spouts, and other metal objects. The average antenna differs little from these so it is not any more probable that lightning will strike this summer than last. Some while ago QST asked for information on cases of direct hits on aerials and only two cases it seems are on record.

Damage by lightning is either caused by a direct hit or by heavy currents induced by a flash of lightning between two clouds or between cloud and earth. Direct hits are always too violent to be protected against as the heaviest cables and switches invariably melt. The lightning flash seems to abide by no set rules, often following unreasonable paths. The National Fire Protection Association is realizing these facts in changing the requirements for ground wires from No. 4 to No. 6 B. & S. copper, and now has a tentative revision that only requires No. 14 copper wire or No. 17 copper-clad steel.

Heavy induced currents are not nearly so rare and are the only ones that protection can be secured against. The electric discharges known as lightning are the result of a gradual collection of a charge on a cloud as it forms and moves across the country. The charges can be gradually and silently removed by grounded lightning rods, aerials, steel buildings, etc. Receiving aerials should be grounded at all times when not in use by a lightning arrester having a short air gap. The arrester type is preferable for a receiving station as it does not rely on the memory of the operator. The air gap should be short enough to break down at a potential of 500 volts or less. The vacuum type has the additional advantages of being free from moisture and a less possibility of the electrodes fusing together because of the greater separation in a vacuum for the same break-down voltage.

The new regulations will not go into effect before fall. However certain points in installation should be closely adhered to. The lead-in wires should not be smaller than No. 14 B. & S. gauge copper or No. 17 copper-clad steel. The protective device should be located as near as possible to the point where the wire enters the building and not near any easily ignitable stuff or inflammable gases or combustible dust. The ground wire can be bare or insulated, not smaller than that required for the lead-in, and should be run in as straight a line as possible to a good permanent ground such as water piping. Gas piping is not permissible but other grounds such as steel frames of buildings, driven pipes, buried plates, cones, etc., are OK. The ground wire should be protected against mechanical injury and approved ground clamps used.

With the above precautions it is doubtful if your house is in any way more liable to be bothered by lightning this summer than in any past summers. —B.P.

In February 1921 the Dallas Radio Club

Since we published the list in our last issue of licenses granted to broadcast stations, several new QRA's have come to our attention which may be added. They are:

City of Dallas,	Dallas, Texas	WRR
McCarthy Bros. & Ford,	Buffalo, N. Y.	WWH
K & L Electric Co.,	McKeesport, Pa.	WIK
Doubleday-Hill Electric Co.,	Washington, D. C.	WMU
Atlantic Journal,	Altanta, Ga.	WSB
Findley Electric Co.,	Minneapolis, Minn.	WCE
Minneapolis Journal,	Minneapolis, Minn.	WBAD
Minneapolis Tribune,	Minneapolis, Minn.	WAAL
Commonwealth Electric Co.,	St. Paul, Minn.	WAAH

appointed the station of their president, Mr. F. M. Corlett, 5ZC, as broadcasting station for the Weather Bureau and Police Department. An efficient organization was worked up for delivering the reports thru the stations of the A.R.R.L. members. The following July the city purchased a phone set from a local club member and now under the call WRR the weather forecasts and police reports are sent out on telegraph and phone on 485 meters at noon and 7 p.m. (C.S.T.) followed by entertainment of various kinds for retaliation. WRR has been heard over a good portion of the country with a set of low power which seems to have a steady daylight summer range of 200 miles on phone and of course much further on C.W.

Long-Distance Therapeutics

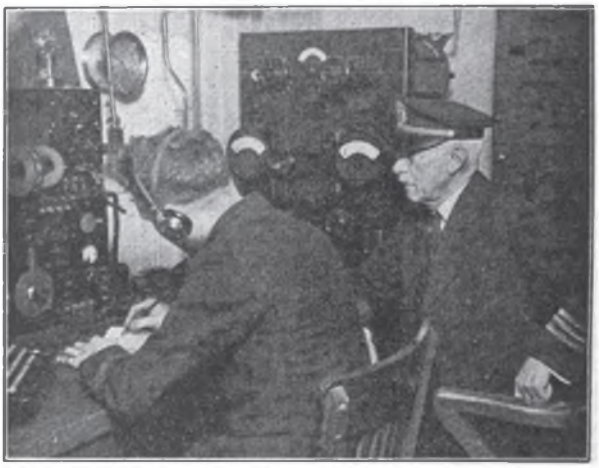
Nowadays the surgeon on duty on the high seas not only cares for the ills of the passengers and crew of his own ship but often is called upon to give aid to other vessels within the wireless call.

Dr. Michael Rebert, who appears in the photograph, recently was aroused late one night by the wireless operator on his vessel and informed that twelve members of the crew of a Norwegian freighter were in terrible agony and desired medical attention. Dr. Rebert inquired as to the history of the ailment and found the crew had partaken rather forcibly of canned lobster. He diagnosed the case as ptomaine poisoning. When the twelve suffers had finished the doctor's directions they had exhausted their entire supply of Rochelle Salts and reported progress at dawn.

Recently Dr. W. S. Ford, of the Steamship "Potomac", aided and abetted the stork by wireless. Late one night he received this message: "Captain's wife on board. Expect arrival of stork before we can reach port. Please assist." This was a stumper but the doughty doctor could not fail in this emergency, so he gave the directions in language that could be understood by the layman, while the stork hovered over the distant freighter. Two days later the doctor received this message: "Now have a new son. Don't know your name, doctor, but will call him Napoleon Ford. A thousand thanks. God bless you."

Dr. William S. Irwin when surgeon on the Steamship "Centenial State" was summoned to the wireless room one day and informed that the lighthouse keeper on a lonely island in the Caribbean was suffering as a result of an injury to his leg. Further details showed that gangrene had set in and that amputation was necessary immediately. Across the 800 miles of sea it was asked if any of the four other inhabitants of the island would attempt the operation if provided with specific directions. The surgical operation was performed by the cook using a butcher knife and a kitchen saw. Inasmuch as no anaesthetics were available, the injured man had to grin and bear it, but fainted before the operation was concluded. During the following days the doctor was kept informed that the patient was doing well, as he had a robust constitution. Several months later in passing the island he learned that his patient was well on the road to recovery.

Only a few weeks ago the doctor and patient met for the first time when the one-legged man grasped his hand at the pier in New York and said, "Doctor, you don't know me but you ought to inasmuch as you are responsible for taking off my leg." Then followed a rehashing of the historic case.



Directions for a Very Simple Set

Letter Circular 43 of the Bureau of Standards described a simple home-made radio receiving set using a crystal detector. This set was of the simplest possible construction and could be made by any amateur for a very moderate price, probably under $10. The demand for this circular was so great that it was decided to print it as a regular publication of the Bureau of Standards, and it is now available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c per copy. Persons writing for this material should refer to Circular 120 of the Bureau of Standards.

May 10th marked the close of a contest conducted by the Standard Furniture Co. of Seattle, for the best home made re-

ceiving set tuning from 100 to 500 meters. The entries were made in various classes according to whether amplifier units were included, left out, or just crystal detectors used. There was also a separate class for boys and girls under 14 years of age, and a fifth class for the smallest crystal set. Two cash prizes of $25 and $15 were given in each class but the first in which the prizes were $50 and $25. The sets were actually tested on the broadcast of KFC using the same tubes and aerial in each test.

Getting Started Listening
(*Continued from March*)

Having settled the question of the aerial and ground, we are ready for a discussion of the apparatus. It is difficult to recommend specific apparatus as there are so many combinations ranging from simple sets made at home for a few dollars to elaborate ones found on the market at good stiff figures. Simple crystal outfits bring in the broadcasts over limited distances, but in general they are toys and not to be recommended unless one lives within a few miles of a powerful broadcasting station. So we are discussing here the sets using vacuum tubes—the only really practical sets at present.

We will need:

(1) A tuning set or "receiver" of some sort

(2) Vacuum tube equipment consisting of a detector and if possible one or two stages of audio-frequency amplification

(3) A storage battery to heat the filaments of the tubes

(4) A high-voltage dry battery for the "anode circuits" of the tubes

(5) A pair of telephones, commonly called a "head-set", and

(6) A "loud-speaker" or horn, so that the signals may be heard thruout a room without head-sets.

The best way to discuss these necessary items in the set is to take them up briefly in turn.

The tuner is the apparatus that is used to adjust to the various wave lengths and makes it possible to pick up any desired station within range. It consists of various electrical circuits of coils and condensers capable of adjustment in their electrical dimensions, which determine the wave length to which the set will respond. Some tuners are simple to the last degree and some have several adjustments that must be handled. These features determine the type of set to be bought. Remembering that the purpose of the tuner is to differentiate between the signals from the various stations, how important it is to have a tuner that will really weed them out and pick up the desired one—a feature known as "*selectivity*"! Selectivity is to be had in an easily managed form in so-called "regenerative" tuners of the coupled or "*three-circuit*" type, and we strongly urge the acquisition of this type of set. There are now on the market dozens of makes of "simplified" tuners, the operation of which is whittled down to a solitary knob or two, but in them the selectivity has been sacrificed either to save expense or in the mistaken belief that the public cannot learn to operate a modern tuner. Most of these single-circuit or simplified tuners are vicious things, and in truth a back-sliding to the early days of radio when we didn't know any better. Of course they bring in the signals good and loud, but they bring in an unwanted signal as well, and ships and commercial stations and perfectly law-abiding amateurs are heard in distressing fashion "all over the tuner".

The modern "three-circuit" tuner is capable of a high degree of selectivity so the above interference rarely occurs on it. Its alleged complication is gross exaggeration and anyone can master it in an hour and get not only good selectivity but actually louder signals over greater distances. From this it will be seen that the three-circuit tuner is emphatically recommended if the best results are wanted.

Some sets have the vacuum tube outfit built in their cabinet and some are separate. In either case one can get sets using one, two or three tubes. The first tube is necessary in every set. It takes the place of the crystal of simpler sets but does the job many times better. It is called a "detector" or "rectifier". This isn't a textbook so we'll let it go by saying that a detector is necessary, comes all hitched up for business, and generally works without trouble.

Now signals may be heard from long distances in the head-set with just the detector tube but it is often desirable to have louder signals, particularly to put out thru a loud-talking horn. This is accomplished by vacuum tube amplifiers but this time the tubes function to boost the strength of the signals passed thru the detector. Whether the amateur has one or two stages is almost standard now. It is not generally desirable to exceed two stages unless special precautions are taken to cut down stray noises.

Tube sets may be had for from $10.00 to $100.00. As in most things, the price one pays about determines the performance of the set, and it pays to get a well designed and well built one of reliable make.

Two batteries are needed for the receiving set. One is to light the filaments of the tubes and is known in radio engineering as the "A" battery. Generally this is a lead plate storage battery of much the same type as used in automobiles. All vacuum tubes on the market in this country

are designed for use on a 6-volt battery. Such batteries are rated in "ampere-hours" capacity at one charging. The larger this rating the longer your set can be operated without recharging the battery tho the largest sizes are very heavy and bulky. An 80 A.H. battery is a good average. Dry cells are wholly unsuited to this work.

Then there is the "B" battery for the plate circuits of the tubes. These come in blocks of 22½ volts, made up of small flashlight cells sealed into units, and generally tapped for various voltages. They are a staple on the radio market. The voltage needed depends upon the set—generally between 18 and 22 volts on the detector and 45 or more on the amplifiers. The same "B" battery may be used for both—which means two blocks.

Why shouldn't he enjoy radio? It's in the family and both his Pa and Ma are old-time amateurs. This is Walter G. Estey, three-year-old son of Mr. and Mrs. F. Clifford Estey of Salem, Mass. Mr. Estey is sales manager of the Clapp-Eastham Co. and chairman of the Boston Executive Radio Council.

A good pair of telephone receivers of 2000 to 4000 ohms resistance completes the set. Several pairs can be used at the same time so that more than one can listen to faint signals. After all a head-set is the best way to get the most out of radio.

It is often very desirable, however, to put out the signals thru a loud-speaker so that they may be enjoyed by everyone in the room, much like a phonograph. There are several loud-speakers on the market, some embodying their own special tube amplifiers, which are well suited for this work. They connect in place of the head-set—in fact, they are merely an enlarged telephone having a horn attached to set a large volume of air in motion. Then there are countless devices consisting of a single telephone with a horn, or sometimes just a horn to which one or both of the regular telephones may be clamped. These make a simple and fairly satisfactory loud-speaker, generally enough for the average home. They have no amplifiers in themselves except the megaphone effect they use, and are to be used only when an amplifier is available—a detector alone in general will not give loud enough signals to actuate it.

A simple loud-speaker may be made at home by procuring a Baldwin telephone and an old phonograph horn, or by clamping the Baldwin receiver to the tone arm of a phonograph (horn or cabinet type) in place of the reproducer.

Thus outfitted the radio world awaits you. Broadcasts of entertainment, lectures and news can be heard in any part of the United States, and ships at sea and amateurs for hundreds of miles can be heard on their dot-and-dash telegraphy. Naturally it's not all roses — there's summer "static" that fries and crackles and almost drowns out signals, and sometimes leaky power lines and defective arc lights cause a terrible rumpus, but everybody has to put up with a little of this and there's still enough of sweetness to make it most fascinating.

There are amateurs in almost every town in the country—not newcomers in the game but "bugs" who have been at it for years, although more often than not they are just lads. They are the ones who know amateur radio and the novice can do no better than by making the acquaintance of a practical amateur. Amateurs are a splendid lot, willing and even anxious to help in the advancement of their chosen hobby. They'll help you put up that aerial, answer your questions, tell you how to hook up your gear, show you how bright to burn your bulbs and how to tune in signals. The quickest and surest way of finding out how many things that this article can't tell you is just this:—get in touch with a local amateur—*he knows.*

It is rumored that the British Post Office Department is experiencing a change of heart and in change of its policy is going to allow every facility for the extension of wireless telephony in that country. England for some time has been watching the spread of popular interest in broadcasting in this country and does not intend to be outdone. An important announcement is expected in Parliament soon, according to press reports.

Probably government control of radio in England will turn out in the end to have been a very good thing as it will prevent the frenzied radio conditions that characterize our country at present. Britain has a more serious and sober way of going about things which will stand her in good stead in the expansion of popular home radio. Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Co., is quoted in the *New York Tribune* as saying "I don't want to see 'radio flu' here. In America the boom is rather premature. The equipment in use is rather primitive and not such as we should like to see employed here. I think that America is going ahead too fast in this direction, and I can forsee chaotic conditions if indiscriminate and vast use of wireless telephony comes."

We amateurs are having lots of new names applied to us these days. G. H. Dacy, in the "Scientific American", keeps up with the habit of the day by calling us "the American urchin".

Our guess is that there will be a whole lot of broadcasting stations closed up as soon as Secretary Hoover gets the authority needed to look after radio, as the Telephony Conference proposes he shall have. In other words, some broadcast stations exist today simply because an inadequate law gives no one the authority to prevent them from operating. It's a cinch there will be no more of this business of having every department store in a city trying to broadcast. The fellows with the poor modulation, the stations with the uninteresting programs, the unintelligent operators—out they'll go! Where there are a group of private broadcasting stations in the same community essentially duplicate each other's service, it probably will be considered that they are unduly interfering and the Secretary of Commerce will exercise his power to revoke licenses.

Gee but it will be good to see some of the rottenest ones weeded out.

QRA "6BO"?

In recent months some malefactor has been having great sport all by his lonesome in fooling various eastern stations into thinking they were hearing a "6". 6BO, he said he was, and he gave his name and town, and said he was using 500 watts of C.W., which of course might account for the very-QSA signals he made in the 8th and 3d districts. 3ZY, 3ALN, some nines, and many eights including 8BIL, 8AWP, 8AD, succeeded in connecting up with this "Californian".

The point is that it wasn't 6BO at all. Mr. Preston of that station suggests that the offender is around Pennsylvania some place, as most of the cards he has received are from that vicinity. Why not swing a loop on him and let us know your readings?

We would like to know who this bird is, and promise that upon receipt of sufficient information we shall do our level best to get the axe for him—for keeps.

"C.W. and the old A.R.R.L. Spirit did the job", says Keith Russell, 9AL, of Toronto, Canada, in explaining the newspaper publicity he got in placing his equipment and services at the disposal of the Power Company. Between 9AL and 8ANJ at Niagara Falls great assistance was given in relaying messages relating to repairs on the power cables. Canadain amateurs are on the job too.

We have received several dozen requests to print change of addresses and calls. If we start this hundreds more will undoubtably come in, which it will be impossible to publish. We will, however, when specially requested, print the address at the head of each list of "Calls Heard" selected by us.

The Old Man says that C.W. sets ought to be called CQ sets.

We get mail addressed any old way but the prize one came in the other day addressed to the "Q Street Magazine". Hi!

"Your decrement must not exceed .Z"—*Radio Digest.*

We are sorry to state that many of the popular magazines predict increasing static this summer. We hoped with a million aerials in the air that the distribution of static per aerial would decrease in proportion.

S. Kruse, who is engaged in experimental work for the John Hays Hammond laboratory, is at present one of a crew who are doing some experiementing between two radio-equipped ships in the Gulf of Mexico.

1GOF says that QST is improving every month judging from the pictures in the April issue.

Examinations will be given for the position of Junior Engineer for the Bureau of Standards on July 5th and August 23rd. Details may be obtained from the nearest Civil Service office.

It was evident to the Bureau of Standards from inquiries received from builders of the simple crystal receiver described in their Letter Circular 43 that there was need for description of a set possessing greater possibilities than the first one. A second publication is therefore being prepared—a 2-circuit receiving set with variable coupler. This set of course has greater selectivity than the single-circuit set and has the great advantage that most of the apparatus used in the first-mentioned outfit may likewise be employed in the new installation. This publication is Letter Circular LC-44, which will be issued as Bureau of Standards Circular No. 121 by the Superintendent of Documents for 5c a copy. The date of issue cannot yet be given.

Suggestion to American manufacturers contemplating the production of radio frequency transformers: mount them so as to go in a standard tube socket, whereby transformers may be easily changed for different wave length ranges.

We are informed that Mr. Linsey Winser of Bakersfield, Cal., has received the call 6ZS "and will vibrate on 375 meters". Page Bee Palmer!

The unkindest cut of all is to have a newspaper call us the "American Radio Delay League". Maybe the Editor sent a msg by the A.R.R.L.

We note with interest that the "Radio Review" and the "Wireless World", both of London, have consolidated under the name of "Wireless World and Radio Review", which will be published weekly. The combination should result in a wonderful magazine to which we extend our most hearty wishes.

We have heard indirectly that the Vesta Battery has a range of 6,000 wave lengths. It must be highly damped, which eliminates the possibility of C.W. as an electrolyte.

KDKA has an acknowledgment card with a blank space for filling in the height of their aerial at the time they were reported. Maybe they get different wave lengths by hoisting or lowering the antenna.

According to 4BW California has nothing on Georgia. Grover Jones of Macon sells radio bugs at reduced rates a storage battery which when freed of its charge will be charged free once a month without charge.

In radio we are finding out that "all is not sweet that twitters".

Mr. H. H. Wish, who has been cartooning for QST lately, has been assigned the call 1PK although he is confined to his bed. He suggests that had it been 1QT (one quart) instead of 1PK (one peck) greater interest might have been aroused.

Changes at the QST Factory

Chas. A. Service, Jr., past vice-president of the A.R.R.L. terminated a pleasant connection with our headquarters office to become manager of the radio department of the Electric Supply & Equipment Co., with his office in Hartford. He was succeeded by Robert L. Northrop of Lynn, Mass., ex-1COA, who now enjoys the resounding title of office manager and executive assistant to the secretary. The lure of the commercial game was too strong for Bob Higgy of old 8IB, and he resigned his assistant editorship of QST to return to Columbus and embark in business on his own, being succeeded at our diggings by Boyd Phelps of 9ZT, Minneapolis. Phelps' acquisition by this office is our gain but the loss of the territory from whence he came, as in coming with us he has had to resign from the management of the Dakota Division and the temporary guidance of the Winnipeg Division, so ably led by him.

Phelps, poor unfortunate, came to us without a nickname of any sort. Accordingly one was manufactured for him by trying to pronounce his initials—"Beep". Beep is now the happy operator of station 1HX, Hartford, where he is proving to the world that his recent QST dope on "Radio below 200 meters" actually works by radiating good energy on waves as low as 70 meters—harmonics of course. Reliable communication is had with Boston on 130 meters. The boy's all right.

Thru an error in April QST the Thordarson amplifying transformer was listed at $4.00 whereas it should have been $4.50.

Read 'Em and Weep!

4CB of Morse, Sask., has worked many U.S. stations including 6AWT of Frisco, and has been heard in Hawaij on 15 watts.

6KA has been heard by 1BDI at Orono, Maine.

8ACF has been heard on detector only by several stations in Long Beach, Calif. He uses the same 10 watt set that got over to Scotland.

8HJ of Elmira, N.Y., has heard 6CU, 6KA and 6XAD on one tube and has been heard by 6XAD using 10 watts.

6ZF, 6ZG, 6ZI, 6ZS, 6ZZ, and 6XAD have all been heard at Oil City, Pa.

6ZZ, 6EH, 6WV, 6XAD, and 7AH have been heard at 1BDU, Winthrop, Mass.

6ZZ and 7MI were heard on one tube by 1CFJ at Portland, Maine.

8VY has been heard QSA or very QSA by 6XAD, 6ARF, 6AOW, 6ARE, 6RR, 6ZZ, 7LU, 7JS, 7TQ, 7ZS, (5ZA), and Can. 5CN on one 50 watter.

9APW worked 9BBF and 9AYS on a VT1. copied by 3JJ while working 9FZ on 5 watts; worked 8OZ, 8BDO and heard by 6XAD on 10 watts; added 5 more watts and worked 2FP, 8AWM, 8AIO and 3ADK.

6ZB, San Diego, Cal., on 20 watts was copied by Can. 3IL of Kingston, Ont.

8BRL works 5ZA, 6XAD, and 6BO(!).

6ZZ was copied thru heavy QRN at Can. 3DS, Kitchener, Ont.

8BDB has been reported QSA in Palo Alto, Calif. on 15 watts.

6AWP worked 9WU on 10 watts.

4EZ on one tube copied 6EN nearly an hour after the sun was up.

6AWP has been heard on 10 watts in Cleveland, Ohio, by 8AGZ; off Key West, Fla. on the S.S. McKelvey; at Yakutat, Alaska, on the S.S. Admiral Watson; and at Wailuku, Hawaii, by 6ZAC.

Soon we will reduce the above column by saying, "The following 6's have not yet been heard on the Atlantic Coast."

Wanta no ur range? Call 3TS as fast as you can.

9AL in Chicago asks for relief. He is not transmitting but gets tons of cards reporting Canadian 9AL, Keith Russell, 11 Pinewood Ave., in Toronto, Can., on C.W.

What are your ideas on a good cover design for QST? We know many of you are close critics but we want some ideas now. We do not mean drawings, for we will tend to that, but ideas that will make good covers.

OPERATING DEPARTMENT

(Concluded from page 50)

to work through the static, but no reports were received from the C.W. stations except that of 8BEX.

Southern Indiana shows a good total of messages, but the phone broadcasting situation is the cause of the drop in the number of messages handled in this territory. Everyone is supposed to stand by in southern Indiana for phone broadcasting until after 10 o'clock and a lot of the younger relayers turn in by that time.

The Committee of Radio Amateurs of Lafayette has adopted traffic regulations applying to every county, which provide:

6:00 A.M. to 5:30 P.M. Free Air.
5:30 P.M. to 6:30 P.M. Local Traffic.
6:30 P.M. to 9:05 P.M. Listening Period.
9:05 P.M. to 6:00 A.M. Long Distance Period.

This schedule has been faithfully followed and as a result the radio situation in and about Lafayette has improved greatly.

J. E. Hall, of Seymour, Ind., has been putting this city on the map. 9DYU, 9AMO and Mr. Hall's own stations, 9ASJ, have been handling about three hundred messages a month among them.

All routes in Northern Indiana are in working order and much traffic has been passed over them.

9DAX, 9PC, 9UC, 9ASB and 9BGF are now using fone and C.W. 9DAX is heard at 9HR at any time of day and will prove a reliable station.

NEW ENGLAND DIVISION

P. F. Robinson, Mgr.

C.W. Messages: 1SD-105, 1ASF-89, 1PR-78, 1BDV-55, 1BRQ-32, 1FB-22, 1BKQ-54, 1PT-25, 1CMK-18, 1BYG-10. Total, 456.

Spark Messages: 1RX-275, 1CNI-240, 1SN-195, 1LZ-84, 1WQ-80, 1BYG-48, 1BJE-36, 1BRQ-36, 1AOK-33, 1DY-8, 1FB-8. Total, 1007.

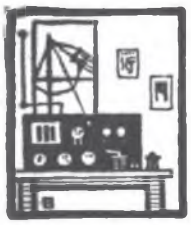
In keeping with the reorganization of the Operating Department, the following have been appointed Assistant Division Managers in this division:

Maine: F. H. Pierce, 1BRQ; Connecticut: J. L. Reinartz, 1QP; Eastern Mass.: L. G. Cumming, 1FB; Western Mass.: A. S. McClean, 1JQ; New Hampshire: H. W. Bean, 1OE; Vermont: L. F. Packer, 1ARY; Rhode Island: J. F. Sullivan.

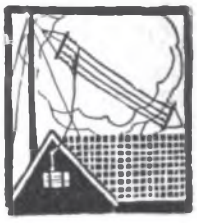
Further appointments covering the offices of District Superintendent will be announced as soon as these vacancies are filled by capable men.

Much of the joy in amateur radio in this division has been taken out by a great number of broadcasting stations, some of which "hog" the ether without regard to amateur affairs. It is not fair that the broadcast listener be given the entire evening and the amateur be crowded out until the wee small hours of the morning.

Daylight Sunday Tests have been arranged in order that a number of the stations operated by the younger fellows will have a chance to handle relay traffic without causing interference to the listening stations.



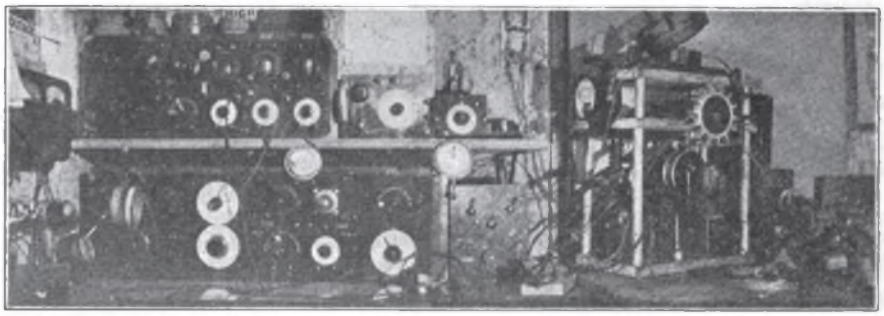
Amateur Radio Stations



4EG, Woodruff, S. C.

The photo shows the station of W. C. Etheredge, A.R.R.L. District Superintendent of South Carolina. There are many novel features in design and arrangement worthy of note in this station. In building the set flexibility in wave range, unity in control, accessibility, and electrical efficiency were kept in mind.

The cabinet at the left contains four Formica panels 8 by 9 by ¼ inches. Binding posts are provided on each panel so that by short strips the units are connected. Any of the panels may be removed without disturbing the others. Busbar wiring is used thruout. From left to right the panels



are as follows: coupling panel, wave control, detector, and plate circuit control. On the coupling panel is a three-coil mounting with a 43-plate variable condenser below, which is used across the tickler coil on long waves. The wave-control has a 43-plate variable condenser at the top connected in the antenna circuit and a Clapp-Eastham variometer at the bottom which is in the grid circuit for short waves. A variable condenser may be added across the secondary binding posts for long waves. The detector control uses a small variable grid condenser and an end-cell switch for the B battery. The plate control panel contains a variometer at the bottom and a plate loading coil at the top. The variometer has only twenty-four turns on the rotor and twenty-two on the stator which makes tuning easier. The short range of the variometer is made up by the plate loading coil of 88 turns of No. 28 wire wound on a three inch tube and tapped every eight turns.

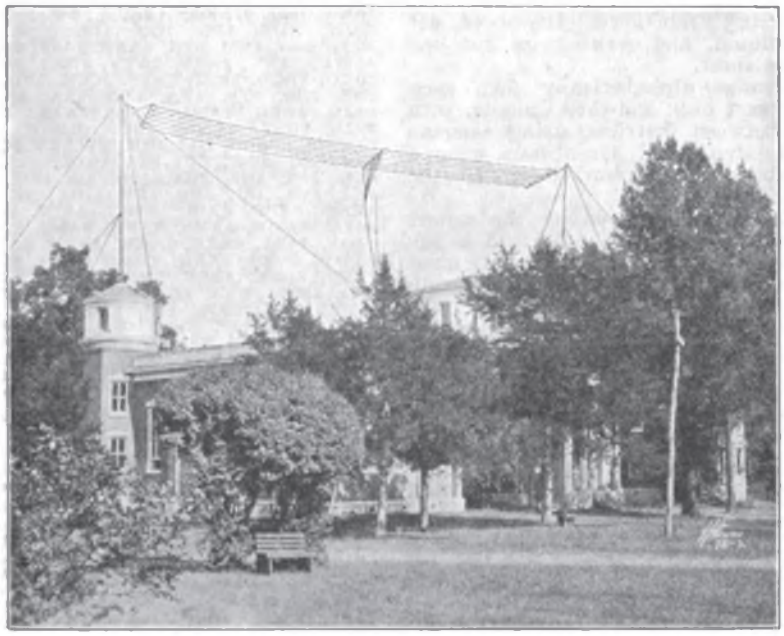
The upper cabinet contains three panels. The one to the left contains a Clapp-Eastham loose-coupler, tho not as much used as the three coil mounting below. The next is a spare detector with potentiometer control and the panel to the right is a two-step amplifier. Also setting on the shelf is a home-made wavementer with a range of 150 to 3,000 meters, and an Amrad wavemeter. The meters to the extreme left measure the voltage of the A and B batteries and a sensitive ammeter is in each filament circuit.

For 200 meter work a primary coil four inches in diameter with 8 turns of No. 22 wire is found best, used with a secondary of 28 turns of No. 28. For phone reception 4½ inch coils are used with 18 turns on the primary and 48 on the secondary. Honeycomb coils are used on the long waves but amateur radio is by far the most interesting.

The antenna is of five cables spaced 2½ ft. apart, 20 ft. long and 35 ft. high. Ground is obtained to water pipes and a counterpoise under the antenna.

The spark set shown to the right on the table in the frame consists of a ½ K.V.A. Thordarson transformer, Jewell thermocouple ammeter, Murdock antenna switch and O.T., Benwood disk on ¼ horse motor, and an oil immersed condenser built in sections in storage battery jars. The glass plates are ¼ inch thick and cut from broken pieces of windshield glass.

Since the photo was taken a CW and phone set has been added using short range but effective loop modulation with the "sure fire circuit." Filament voltage is obtained from a transformer whose core is made from an old 50 ampere watt-meter and now has a 440 turn primary winding of No. 28 enamel wire and a secondary of 32 turns of No. 18 tapped in the middle. The plate supply transformer is made on a core 6 by 7 inches outside and 1¼ inches thick. The primary has 330 turns of No. 18. The secondary is wound on a fibre tube that slips over the other leg of the transformer and contains 1244 turns of No. 28 enameled wire with oiled paper between layers. Filter chokes are made of secondaries from an ignition coil on a ½ inch square closed iron core. The rectifier is made of 10 tumblers with ¼ inch wide electrodes of aluminum and lead. Common cooking soda in distilled water is used, covering the plates a half inch. This makes the ideal inter-city set and shows what can be done in making most of it in the workshop.



5YE, University P. O., Miss.

5YE is the station of the University of Mississippi and has no doubt been heard by many of us.

The antenna is T type, six wires, 95 ft. long, spacing 38 inches, and well insulated. It is supported on two 55 ft. cypress poles on top of a building 45 ft. high. The flat metal roof directly below forms the ground and has about five thousand square feet soldered together and in addition is earthed in many places around the edge.

The transmitter is located in a special room directly below the center of capacity of the antenna. The transmitting set is mounted in a separate cabinet with glass doors. The aerial and ground leads are brought directly to the cabinet and the change-over switch is operated by distant control, making it unnecessary to bring the antenna circuit to the operating table. The transmitter is arranged for either synchronous or non-sink operation with Acme or Thordarson transformers. The condenser is of 59 glass plates one-fourth inch thick, one foot square, and with heavy tinfoil circles eight inches in diameter. This follows closely Mr. Mathews article. "The Ideal Spark Transmitter", in April 1921 QST. The closed circuit is of three inch ribbon and heavy copper braid. The transformer is located in the compartment below with all care being taken in insulation and the prevention of induction in the power circuits. With eight inches of coupling the Jewell meter reads six amperes with exactly one k.w. input, power factor 85%.

The receiving equipment includes a Grebe CR-6 short wave regenerative set with two steps of audio frequency amplification, Baldwin and Brandes phones, etc. A DeForest fifteen panel set is used for long

(Concluded on page 66)

Calls Heard

HEARD DURING APRIL

Unless Otherwise Specified

Instructions to reporters:

(1) Typewrite or neatly print the calls "double-spaced", on a separate sheet of paper, running them across the sheet, not down a column, and writing on but one side of the sheet.

(2) Arrange alphabetically thru each district, from 1 to 9, and then Canada, with no break between districts, using commas to separate items and parentheses around calls of stations also worked—as in the examples below.

(3) The period covered by the report shall be from the first of one month to the first of the following month. All lists must be received by us the 10th of the following month for publication in the next QST.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner and then make a second paragraph in identical form listing the C.W. stations. Commercial calls will not be published.

Pearl Harbor, T. H.

April 22-23rd; 6ZX 7:32 P.M., 6KY calling 6ZAC at 7:40, 6KI calling 6ZZ at 9:02, 6ZI from 9:57 to 10:30 telling 6ZAC QRL, and again at 11:17 QSA; 6ZG calling 6ZAC at 10:20 and 10:28, 6ZAC QSA at all times, 6ASJ calling 6ASM at 12:26 and 1:22 several msgs copied from 6ZG, 6NY heard QRZ.

"Stations 6ZI and 6ZG are particularly to be complimented on their transmitters and workmanlike operating. Receiving was done with one detector tube and one step audio amplification. Will arrange schedules with any amateurs that wish to try their 'transpacific' luck." Address Mr. A. L. Newton, Chief Radioman, U.S.N., U.S.S. Chicago, Flagship, Submarine Base, Pearl Harbor, T. H.

Ex-3AHA, Germany

Feb. 2 (2260 miles east of Cape Henry.) 7:05 7:23 A.M. G.M.T.: 2FP and 2BNZ on C.W., 2OM on spark. April 6th (In harbor, Kiel, Germany) 9 P.M.—"8 MT de 2LZ" (C.W.), 9:05—"2 OM de 2LZ", 9:22—"2 MZ de 2LZ tks om QRM QRN what wave does 8MT work on? K" All of above heard with Paragon circuit and only one tube.

Canadian 3BP, Newmarket, Ont.

Spark: 1AMQ, 1ARY, 1AW, 1AZK, 1AZW, 1BEP, 1BKQ, 1BOQ, 1BRQ, 1CNI, 1COK, 1CZ, 1GM, 1HO, 1LZ, 1RV, 1SN, 1XZ, 1YB, 2AER, 2AHJ, 2AJE, 2ARB, 2ARY, 2AXK, 2BEM, 2BEO, 2BLP, 2CCX, 2DK, 2DN, 2DX, 2EL, 2FP, 2JZ, 2PV, 2SZ, 2TJ, 2WB, 2WT, 2XQ, 3AAG, 3ABB, 8AJD, 3AQR, 3ASO, 3AUW, 3HX, 3FB, 3FP, 3GX, 3HJ, 3IL, 3LR, 3PU, 3TJ, 4BF, 4BI, 4FD, 4GU, 5FJ, 5HK, 5JB, 5RZ, 5SM, 5ZU, 8AFB, 8AFG, 8AHQ, 8AMB, 8AMZ, 8ARD, 8ARS, 8AUV, 8AXN, 8AXY, 8AYC, 8AZF, 8BAZ, 8BBI, 8BBK, 8BCO, 8BFX, 8BFY, 8BJT, 8BNY, 8BRL, 8CR, 8CS, 8EW, 8KY, 8LO, 8OI, 8OS, 8PT, 8QY, 8TB, 8TT, 8UC 8WD, 8XB, 8XAE, 8YAE, 8YN, 8YU, 8YV, 8ZA, 8ZAE, 9AAW, 9ACB, 9AEQ, 9AGR, 9AHX, 9AIU, 9AIV, 9AJH, 9AKM, 9ALM, 9AOU, 9APK, 9AQZ, 9ASK, 9AUA, 9AUL, 9AVP, 9AWZ, 9AXU, 9AZA, 9AZF, 9BAK, 9BED, 9BFG, 9CA, 9CBA, 9CS, 9DHZ, 9DMJ, 9DMP, 9DOI, 9DPB, 9DQM, 9DSO, 9DWP, 9DZY, 9GC, 9KD, 9KI, 9LF, 9MC, 9OF, 9OX, 9PS, 9RC, 9SL, 9SN, 9TV, 9UG, 9VL, 9WC, 9WO, 9WX, 9XT, 9YAC, 9YAK, 9YAJ, 9YB, 9YQ, 9ZH, 9ZJ.

C.W.: 1ADL, 1AJP, 1AMQ, 1ARY, 1ASF, 1BDI, 1BKA fone, 1BKQ, 1BSD, 1BWJ, 1CIK, 1CIV, 1CJH, 1CJZ, 1EE, 1ON, 1PR fone, 1PT, 1UJ, 1XAD fone, 1XM, 1YK, 2AAB, 2AJF, 2AME, 2ANZ, 2AWF, 2AXK, 2AXV, 2AYV, 2BEA, 2BEH, 2BNZ, 2BQU, 2BQD, 2BTJ, 2BYS, 2CCK, 2EH, 2FP, 2KP, 2NZ, 2SQ, 2TP, 2VA, 2XQ, 2ZK, 3AAG, 3AAY, 3AJD, 3ALN, 3ANJ, 3AQR, 3AXK, 3BA, 3BHL, 3BIJ, 3BNJ, 3BNU, 3BOF, 3BUR, 3BZ, 3CM, 3FM, 3FR, 3GH, 3HJ, 3HR, 3IW,3KM,3OF,3QZ,3RF, 3SM, 3SQ, 3VW, 3ZO, 3ZZ, 4ADL, 4AS, 4BF, 4BY, 4EH, 4FT, 4GL, 4GX, 4OO, 4II, 4KC, 4LP, 4ME, 4XA, 4YA, 4ZC, 5DO, 5FV, 5HO, 5JB, 5XA, 6BO, 6XAD, 8ADG, 8AGO, 8AGZ, 8AIM, 8AIO, 8AJX, 8ALT, 8AMK, 8AMS, 8ANB, 8ANC, 8AOB, 8AQO, 8AQF, 8AQZ, 8ARK, 8ARW, 8ASM, 8AVL, 8AWM, 8AWP, 8AXB, 8AXK, 8BAJ, 3BBD, 8BDU, 8BEF, 8BEO, 8BEX, 8BFX, 8BFY, 8BNY, 8BOX, 8BQL fone, 8BSS, 8BXA, 8BZH, 8CAZ fone, 8CBJ, 8CFS, 8CKO, 8DV, 8DW, 8JS, 8LB, 8LW, 8NJ, 8OM, 8OW, 8QZ, 8SP, 8UC, 8UK, 8US, 8WY, 8XAK, 8XV, 8ZY, 8ZM, 8ZZ, 9AAP, 9AAS, 9AAV, 9AAY, 9AEQ, 9AFO, 9AJA, 9ANE, 9AOR, 9ARK, 9AVA, 9AWM, 9AXF, 9AZE, 9AZH, 9BFO fone, 9BJB, 9BJN, 9BLO, 9BRL, 9BSG, 9CT, 9DAX, 9DOF, 9DOS, 9DZQ, 9EI, 9GC, 9GL, 9IL, 9IO, 9KP, 9PS, 9QE, 9UC, 9WA, 9WI, 9WQ, 9WU, 9ZAF, 9ZG 9ZL, AN-5.

Canadian 3EY, Toronto, Ont.—One tube

Spark: 2DM, 2FP, 2SZ, 2AJE, 3HJ, 4CX, 8AFB, 8AHQ, 8AJW, 8AMQ, 8BRL, 8XE.

C.W.: 1PR, 1PT, 1RD, 1YK, 1AJP, 1AMQ, 1ARY, 1BGF, 1BKQ, 1BWJ, 1XM, 2NZ, 2AAB, 2BEA, 2BTJ, 2ZK, 3BA, 3HG, 3VW, 3ALN, 3ANY, 3BEC, 3BHL, 3BUV, 3ZO, 4IV, 5FV, 8BO, 8BV, 8OZ, 8PT, 8QB, 8SP, 8ACF, 8ADG, 8AGO, 8AIO, 8ANJ, 8AOO, 8ARK, 8BCL, 8BDB, 8BDU, 8BLZ, 8BPI, 8BQU, 8UK, 8VY, 8XB, 8XE, Can. 3BP.

Canadian 3JI, Toronto, Ont.

C.W.: 1II, 1ON, 1PR, 1QP, 1TS, 1VQ, 1XA, 1XZ, 1YB, 1ADL, 1AJP, 1AMQ, 1ARY, 1AVB, 1AZW, 1BAS, 1BDC fone, 1BDI, 1BEP, 1BGF, 1BKA fone, 1BKQ, 1BLE, 1CAH, 1CGS, 1CHJ, 1CMK, 1CNF, 1CNR, 1CVJ, 2DN, 2FP, 2HI, 2KP, 2OF, 2SQ, 2WI, 2WT, 2XB fone, 2XJ fone, 2ZK, 2AJA, 2AJW, 2APA, 2ATS, 2AWF, 2AWS, 2AYV, 2BEB, 2BEJ, 2BEM, 2BFT, 2BFX, 2BGI, 2BJL, 2BLP, 2BNQ, 2BNZ, 2BQA fone, 2BQU, 2BQV 2BTW, 2BXP, 2BYS, 2BZV, 2CBW, 2CCD, 2CFT, 2CGQ, 2CJV, 2DTU, 3BA, 3BG, 3BZ, 3CA, 3CC, 3FP, 3GP, 3IL, 3IW, 3NH, 3NO, 3PB, 3QV, 3QZ, 3VS, 3WF, 3ZN, 3ZO, 3ZZ, 3AAY, 3ADX, 3AJD, 3ALU, 3ANJ, 3ANY, 3APQ, 3BEC, 3BFS, 3BHL, 3BIJ, 3BNU, 3BOF, 3BUV, 3BRW, 4AS, 4BQ, 4BY, 4CO, 4DE, 4DS, 4EB, 4EH, 4EL, 4EN, 4EU, 4GL, 4GX, 4ID, 4II, 4IV, 4KC, 4LP, 4XB, 4XD, 5BF, 5DA, 5FV, 5HO, 5IF, 5XA, 6BES, 6EN, 6XAD, 8AM, 8BO, 8CG fone, 8DV, 8EA, (8HJ), 8HM, 8HT,8KH,8KI,8LB fone,8LT,(8NB),(8ND),8OS,8PN, 8PT, (8QB), 8QZ, 8RQ, 8SE, 8SP ,8TB, 8UC, (8UE), 8VV, 8WR, 8XE, 8ACF, 8ADG, 8AFL, 8AGG, 8AGK, 8AHK, 8AHL, 8AHR, 8AIG, (8AII), 8AIO, 8AJT, 8ALB, 8AMB, (8AMK), 8ANB, 8ANJ, 8ANR, 8AOA, 8AOO, 8AQF, (8AQZ), 8ARK, 8ASK, 8AUE, 8AUY, 8AVK, 8AVL, 8AVW, 8AWM, 8AWP, (8AWW), 8AWX, 8AWY, 8AXB, 8AXC, 8BAE, 8BAJ, 8BBD, 8BCQ, 8BDB, 8BDI, 8BDU, 8BEF, 8BEO, 8BEX, 8BFX, 8BGF, 8BIL, 8BJO, 8BJR,

8CFC, 8CJX, 8CKM, 8CKO, 8CLW, 8CMM, 8CMX, 8BJS, 8BJV, 8BKE, 8BLW, (8BLZ), 8BNJ, 8BNY, 8BQL, 8BRL, 8BSF, 8BUQ, 8BUX, (8CBJ), 8CCX, 8CNG, 8COI, (8COO), 8CQH, 8CQL, 8XAD fone, 9YAA, 8ZAF, 9BP, 9EI, 9GL, 9IL, 9IO, 9KM, 9KP, 9QE, 9SO, 9VK, 9WC, 9WQ, 9XI, 9AAY, 9AIY, 9AJH, 9AJM, 9AKD, 9AMO, 9ANE, 9AOG, 9AOU, 9ARK, 9BAA, 9BAF, 9BGH, 9BHE, 9BHQ, 9BLB, (9BLC), 9BLK, 9BRL, (9BTA), 9CBA, 9DAX, 9DKY, 9DTA, 9DZQ, 9YAE.

Spark: (8AHQ), (8ASL), (8AXN), (8CBJ).

Canadian C.W.: 2BG, 3DS, (3FK) fone, (3KP) fone, (3SJ) fone, (3TN) fone.

1BRQ, Lewiston, Maine

Spark: 1AA, 1CC, (1FM), 1GM, 1HO, 1JT, (1LZ), 1MA, (1QO), (1RV), 1SN, 1SZ, 1WG, 1YB, 1YD, (1ACO), 1AJE, (1AKG), 1AKQ, 1ANZ, 1AOK, 1APO, (1ARY), (1AUV), 1AWB, 1BCF, 1BFU, (1BHG), (1BHE), (1BJS), 1BOE, (1BQL), 1BSD, (1BVH), (1CCH), 1CGI, (1CGU), (1CIB), 1CJA, 1CNI, 1COK, 2AAF, 2AD, 2AER, 2AFD, 2AHU, 2AJD, 2AJE, 2APB, 2AQI, (2ARF), 2ARY, 2AWF, 2AXK, 2AY, (2BCC), 2BFU, (2BML), 2BQ, (2BQU), (2BSC), (2BY), 2CT, (2DN), 2EH, 2EL, (2FP), 2JS, 2JZ, (2MN), (2OX), 2PF, (2PV), 2RM, 2SP, 2TS, 3ABB, 3ABF, 3AC, 3AGT, 3AJD, 3AJP, 3APB, 3APD, 3ARD, 3ARN, 3AWE, 3AY, 3BFM, 3DN, 3FP, (3QN), 3RW, 3WB, 4EA, 8ADK, (8ADQ), 8AFA, 8AFB, 8AFO, 8AHE, 8ALO, 8APB, 8AQO, 8ARD, 8AW, 8BAZ, 8BDB, 8BKN, 8BRL, 8BSY, 8BXY, 8CHV, 8DY, 8EW, 8JJ, 8LB, (8MZ), 8RQ, 8VQ, (8WE), 9UV, 9DSO, 9VL.

C.W.: 1AGI, 1AJP, 1AKA, 1AKG, 1AMQ, 1ANQ, (1ARY), 1AVR, 1AZI, 1AZW, (1BAS), 1BBM, 1BCF, 1BDC, (1BDI), 1BEJ, 1BEP, 1BGF, 1BIH, (1BKK), 1BKQ, 1BLE, 1BLT, 1BQA, (1BQE), 1BQJ, 1BSD, (1BUA), 1BWJ, 1BW, 1CAK, 1CAY, 1CGI, 1CGS, 1CIK, 1CJH, 1CMK, (1CNR), 1CQS (1II), 1JZ, 1ON, (1PR), 1QP, 1RD, 1RH, 1UJ, 1VT, 1XB, 1XM, (1YK), 2AAB, 2ACQ, 2AEH, 2AFP, 2AGB, 2AJA, 2AJR, 2AK, 2AVU, 2AWF, 2AWL, 2AYV, 2BAG, 2BCL, 2BEA, 2BEH, 2BII, 2BLP, 2BML, 2BNZ, 2BP, (2BQV), 2BQT, 2BQU, 2BQY, 2BTJ, 2BTW, 2BTZ, 2BXP, 2CBT, 2CC, 2CCD, 2CEN, 2CFI, 2CFT, 2CGQ, 2CJN, 2CT, 2DX, 2EV, 2FP, 2GU, 2JW, 2KV, 2LO, 2OF, 2OX, 2QZ, 2RF, (2RY), 2TS, 2UD, 2VW, 3AAO, 3AAY, 3ABB, 3ACZ, 3AIN, 3APQ, 3BIJ, 3BKO, (3BNU), 3BOF, 3BTI, 3BUV, 3BZ, 3CA, 3CC, 3FR, 3HG, 3IL, 3IW, 3NH, 3NO, 3QZ, 3VS, 3VW, 3ZO, 4BF, 4BY, 4DC, 4DS, 4GL, 4GX, 8ADG, (8AGO), 8AHH, 8AIO, 8AKQ, 8ALT, 8AMN, 8AQF, 8AQO, 8AUH, 8AVL, 8AVO, 8AVW, 8AWM, 8AWP, 8BBD, (8BDU), 8BBO, 8BLX, 8BSS, 8BUQ, 8BX, 8BY, 8CFP, 8CLW, 8DV, 8LB, 8LS, (8NB), 8NX, 8OZ, 8PR, 8QB, 8RK, 8SC, 8SE, 8SP, (8VD), 8VY, 8XE, 8ZK, 9ARK, 9BP, 9EI, 9FM, 9WQ.

1XZ, Worcester, Mass.—All C. W.

1BV, 1EE, 1GP, 1HX, 1IX, 1JT, 1IW, 1PT, (1QP), 1RR, 1TS, (1UJ), 1XE, 1XM, (1XX), (1YB), 1YD, (1YK), 1ZE, 1ADL, 1AIR, 1AIS, 1ARY 1ASF, 1AWB, 1AWH, 1AZJ, 1BBC, 1BBW, 1BES, (1BET), 1BKA, (1BKE), (1BKQ), 1BLN, (1BRG), 1BRQ, 1BYG, (1BYK), 1CAC, 1CEB, 1CIK, (1CNE), 1CNF, (1CNR), (1CPN), 1CQW, 1XAD, 2CK, 2DN, (2EH), 2FC, 2OE, 2RU, 2SQ, 2VH, 2WB, 2WR, 2WT, 2WX, 2XA, 2XJ, 2AAB, (2AFP), 2AJD, 2AJE, 2AJR, 2ANJ, 2AVR, 2AXK, 2BCF, 2BDG, 2BEB, 2BEM, (2BFX), 2BIJ, 2BNC, 2BNZ, 2BQU, 2BUM, 2BZV, (2CAF), 2CCD, (2CHG), 2CIZ, 3BA, (3BG), 3CZ, 3FM, 3FP, (3FS), 3IW, 3IZ, 3JH, 3OF, 3QV, 3SH, 3VW, 3WF, 3XW fone, 3ZO, 3ZY, 3ZZ, 3ADT, 3ADX, 3AJD, (3ALU), 3ANJ, 3ANY, 3APT, 3ARH, 3ARY, 3ARU, 3ATJ, 3AVS, 3AWH, 3BAL, 3BHL, 3BIJ, 3BJY, 3BNU, 3BTK, (3BUV), 3BVF, 4AX, 4BY, 4EH, 4GL, 4II, 4IV, 5AA, 5JB, 8CG, (8BO), 8CK, 8CN, 8DV, 8EV, 8LB, 8LQ, 8PN, 8PT, (8QZ), 8VQ, 8VY, 8WY, (8XE), 8YD, (8YU), (8ZZ), 8ABM, 8AGO, (8AHK), 8AJX, 8AJV, 8ALB, 8ANB, 8ANR, 8APD, 8APR, 8APT, 8AQO, 8ARD, 8ARK, 8ARW, 8ASM, 8AVD, 8AVL, 8AWH, (8AWM), 8AWY, 8AXC,8BCL,8BDH,8BEF,(8BKE),8BLX,8BQU,8BQV 8BSY, 8BTO, 8CCD, 8CCM, 8CGB, 8CJX, 8CNG, 8COO, 8COW, 8XAK, 8ZAE, 9BP, 9BS, 9CT, 9EI, 9KM, 9KP, 9PS, 9PT, 9WQ, (9AAP), 9AFN, (9AIY), 9AJA, 9AOG, 9ARG, 9AWO, 9BED, 9BPC, 9BSG, 9CAE, 9CBA, 9CBR, 9DAX, 9DEA, (9DGQ), 9DOH, Can. 3CZ.

1PR, Newton, Mass.

C.W.: 1ACO, (1ADL), 1AGI, 1AIP, 1AJP, (1ARY), (1AWO), 1AZW, (1AZX), 1BDC, 1BDI, (1BET), (1BKQ), 1BPZ, 1BQE, 1BQL, (1BRQ), 1BSD, 1BYM, 1CAK, 1GCT, 1CIK, (1CPN), 1CSS, (1EE), 1II, (1LZ), 1ON, 1PB, (1QP), (1UJ), (1VT), 1XZ, (1YB), 1ZE, (2AAB), 2AIF, 2AJA, 2AWL, 2AQH, 2AQI, 2AWF, 2AWL,(2XE),(2AYV), 2AZZ,2BCF,2BEA,2BEB,(2BEH),2BGI,2BGF,2BJQ, (2BLP),(2BNZ),2BQD, 2BQU, 2BRB, 2BTJ, 2CBW, 2CFI, 2CIZ, 2DK,(2DX),(2FC),2FP, 2KP, 2LQ, 2LH, 2NZ, 2RY, 2SQ, (2WB), 2WXM, (2ZK), 2ZK ph., 3AJD, (3ALL), (3ALN), (3ALU), (3ANY), 3AQH, 3ATG, (3BEC), (3BIJ), (3BNU), (3BTK), 3BUV, (3BZ), 3CC, 3EM, (3FM), 3GH, 3IL, 3IR, (3IW), 3NH, 3QZ, (3VW), 4BY, 4GL, 4II, NX4, 4ZA, 4ZE, 5DA, 5FV, 5LA, 5NZ, 8AFJ, 8AGK, 8AGO, 8AHQ, 8AHK, 8ALT, (8AMK), 8ANB, 8AQF, 8AQZ, (8ARK), (8ASV), 8AUH, (8AVL), (8AWM), 8AWX, 8AXB, 8AXC, 8AXY, 8BCL, 8BDU, (8BEO), 8BEF, 8BGD, (8BIL), 8BJS, 8BOO, 8BKE, (8BLX), 8BLT, 8BNY, 8BQV, 8BSY, 8BSO, 8BU, 8BUQ, 8BUX, 8CBJ, 8CFP, 8CHX, (8CMM), 8CNN, 8CQL, (8COO), 8CPC, 8CPG, 8CTZ, 8DV, 8EV, (8HJ), 8JJ, 8KS, 8NB, 8OZ, 8PN, 8PT, 8UC, 8UK, 8VJ, (8VV), 8XE, 9AAP, 9ADX, 9AIY, 9AJA, 9AJH, 9ARK, 9AVG, 9AYH, (9AXF), (9BLC), 9CT, 9DAX, 9DKY, 9DRQ, 9DZQ, 9FZ, 9KM, 9KP, 9PF, 9WU, (9UH), 9ZL, Can. 2BG, 3BP, 3IZ, 9AL, 9AW.

Spark: 1ADC, (1ARY), 1AZK, 1BHR, 1BOP, 1BOQ, 1BPZ, (1BRQ), 1FM, (1YB), (1YD), 2AJE, 2AQI, 2AWF, 2CT, 2DN, 2FP, 2JZ, (2PV), (2SZ), 2TS, 2WB, 3ZO, 3HJ, 3BA, 3WT, 5FD, 8ACF, 8AHQ, 8AXO, 8AXY, 8BSY, 8MZ, 8UQ, 8XE, 9AAW, 9ARG, (9AXF), 9AZA, 9DZI, 9DXM, Can. (3BP), 3GI, 3FO.

1BGF, Hartford, Conn.

Spark: (1AW), 1GM, (1QO), 1RX, 1YB, 1ADL, 1AGI, 1AKG, (1BEF), 1BFI, (1BHW), (1BIY), 1BJR, 1BOP, (1BOQ), 1BRL, 1BRQ, 1BTP, (1BUC), 1CQS, 2DN, 2NZ, 2TF, 2AJE, 3BZ, 3FP, 3GX, 3PU, 3XW, 3YP, 3ABB, 3ARN, 3BHL, 4CX, 4DI, 4GX, 5DA, 5XA, 9KP, 9OX, 9UU, 9UG, 9AAW, 9AWZ, 9AZA.

C.W.: 1AL, 1DR, 1HX, (1II), 1QP, (1TS), 1UJ, 1VQ, 1VT, (1XM), 1XZ, 1ZE, (1AJP), (1ALY), 1AMQ, (1ARY), 1ATQ, 1AUN, 1AWB, (1AYL), 1AYZ, 1BBW, 1BCB, (1BDC), 1BES, 1BGC, 1BIK, 1BKA, 1BKQ, 1BNE, (1BNT), 1BOI, 1BQE, 1BQK, 1BSD, 1BWJ, 1CAK, 1CBJ, 1CGS, 1CJH, 1CJZ, 1CMK, 1CNE, 1CNR, 1CNI, 1CWR, 2BZ, 2CT, 2DK, 2DZ, 2FP, 2FZ, 2OE, 2SQ, 2TP, 2ZK, 2AEH, 2AIF, 2AJO, (2AWF), 2AYU, 2AYV, 2BEA, 2BEH, 2BEM, (2BFZ), 2BNZ, 2BRC, 2BTJ, (2BZV), (2CBW), 2CCD, 2GCK, 2CHG, 3BG, 3BU, 3FR, 3IW, 3KM, 3OM, (3QV), 3QZ, (3RF), 3VS, 3XL, (3ZO), 3ADX, 3AJO, 3ALL, 3ALN, 3ALU, 3ANY, 3BIJ, 3BNU, 3BTK, 3BUV, 3XAA, 4BU, (4GL), 4LP, (4ZC), 5FV, 5XU, (6ZZ), 8AW, 8BO, 8DY, 8LX, 8NM, 8NO, 8OU, 8OW, 8PT, 8SE, 8XE, 8ZE, 8ABV, 8ADG, 8AGO, 8AIO, 8AQF, (8AQO), 8ARK, 8ASM, 8AUX, 8AVD, 8AVL, 8AUK, 8AWM, 8AWP, 8AXC, 8BCC, 8BDB, 8BDH, 8BDU, 8BEF, 8BFX, 8BGV, 8BKE, 8BLX, 8BSY, 8BWK, 8CAY, (8CBJ), 8COO, 8CQL, 8ZAE, 9BP, 9EI, 9FZ, 9II, 9IL, (9IO), 9KM, 9UC, 9WA, 9WQ, 9WU, 9AAW, 9AAY, (9AJA), 9AJH, 9ARK, 9AWZ, 9BED, 9BLC, (9CBA), 9DGD, 9GDQ, 9DSO, 9ZAF, C3BP, C3ZC, C3EI.

1ASF, Medford, Mass.

Spark: 1ADL, 1AZK, 1BOQ, 1BRQ, 1BVB, 1CM, 1COK, 1HO, 1YB, 2AAF, (2AHU), 2AJE, 2ARY, 2AWF, 2CT, 2DN, 2EL, 2FP, 2JZ, 2RM, 2ZN, 3AJD, 3ARF, 3FP, 3HJ, (3TA), 3WU, 4BI, 8AHQ, 8AQO, 8EV, (8ZO), 9TU.

C.W.: 1ADL, 1AGI, 1AIP, (1AMQ), 1AMS, (1ARY), (1AZW, dalite), (1AZX), (1BAS), 1BBW, 1BDI, (1BES), 1BGF, (1BKQ), 1BSZ, 1BW, (1BYN), 1CAK, (1CGS), (1CHJ), 1CIH, 1CJA, (1CMK), 1CNE, 1CNF, 1CNR, 1EE, 1HX, 1II, 1JT, (1PT), 1UF, (1VT), 1XAD, (1YK), 1ZE, (2AAB), 2ABS, (2ACT), 2AEH, 2AF, 2AID, 2AIF, 2AJA, 2ALP, 2AME, (2AQU), 2AWL, (2AYV), 2BBN, 2BCF, 2BCW, 2BDG, 2BEA, 2BEB, (2BEH), 2BER, 2BFX, 2BG dalite, 2BGI, 2BJH, 2BLP, (2BNZ),

2BQH, 2BQE, (2BTJ), (2BTW), (2BWV), 2BXP, 2BYS, (2BZV), 2CAH, 2CBG, 2CBQ, (2CBW), 2CCD, 2CCE, 2CCL, (2CCU), 2CEC, 2CFI, 2CFT dalite, 2CIM, 2CIZ, 2CQG, 2DTU, 2DX, (2EH), 2FC, 2FG, 2FP, 2FZ, 2GF, 2IZ, 2KV, (2KP), 2NZ, 2OF, 2PB, (2RM), 2RU, (2RY), 2VC, 2WR, (2ZK), (3ADX) 3AIH, 3AJD, (3ALN), 3ALU, 3ANQ, (3AQF), 3ASO, 3ATZ, (3AVY), 3BDM, 8BG, 3BHL, 3BIJ, (3BJY), 3BLF, (3BNU), 3BRC, (3BTK), 3BWV, 3CC, (3FB), (3FM), (3FP), 3FR, (3GH), 3GZ, 3HG, 3IW, (3QZ), (3QV), 3RF, (3VS), 3VW, 3WF, 4BY, 4CK, 4CO, 4GL, 4GX, 4XB, 4YA, 5FV, 5UL, (8AGO), 8AIO, 8ALT, (8AMK), 8AMM, 8ANR 8APH, (8AQO), 8AQR, 8ARK, 8ARU, 8AVD, 8AVI, 8AWM, 8AWP, (8BDB), (8BDO), 8BDU, (8BEF), 8BIS, 8BJO, 8BJS, 8BK, 8BKE, 8BSO, 8BU, (8BUX), 8BXH, 8CBJ, 8CMM, (8COO), (8DV), 8DR, (8HJ), (8HM), 8NV, 8OZ, 8PT, (8QB), 8QZ, 8SE, (8UK), 8XE, 8XI, 8XZ, 8ZAE, 9AAV, 9AIY, 9BDB, 9BLC, 9DZQ, 9FZ, 9IL, 9IO, 9KP, 9QE, 9XI, Can. 3BP, (3CZ), 9AL.

2AWF, Albany, N. Y.

Spark: 1AA, 1ACO, 1AW, 1BOP, (1BOQ), (1BRQ), 1CNI, 1GM, 1HO, 1RV, 1RX, 1YD, 2AAF, 2ABM, 2AJE, 2AQI, 2AR, 2CGJ, 2CT, 2DN, 2EL, 2RM, 2TS, 2WB, 3ABB, 3AGT, 3AOV, 3AQZ, 3EH, 3FB, 3FP, 3GX, 3HJ, 3II,3NB,3PU,3QN,3RW,(4CX), 8ACF, 8AFB, 8AHH, (8AHQ), 8AHZ, 8AIC, 8AIJ, 8ARD, 8AUY, 8BEP, 8BSS, 8BSY, 8CDI, 8CH, 8CHV, 8CQL, 8EB, 8FT, (8JJ), 8KY, 8LB, 8RQ, 8TT, 8VQ, 8WO, 8WZ, 8ZO, 9AAW, 9AGR, 9AWP, 9DCX, 9DHZ, 9DSO, 9KI, 9MC, 9OX, 9UH, 9YB, Can. 3BP, 3FQ.

C.W.: 1AYZ, 1AZW, (1BRQ), 1BWQ, 1CAC, (1CNC), 1CNR, 1JT, (1QP), 1UJ, 1XZ, 2AJR, 2AYV, 2AZZ, 2BCE,2BEA,2BEB,2BEM,2BFZ,2BND, (2BRC), 2CCD, 2CFT, 2DX, 2FP, 2FZ, 2KP, 2NZ, 2OF, 2VH, 2WI, 2ZL, 3AAD, 3ADT, 3ALU, (3ANJ), 3ANY, 3AQH, (3AWH), 3BA, 3BG, (3BHL), 3BIJ, 3BJY, 3CC, 3FS, 3FV, 3HG, 3IW, 3KM, 3QV, 3SH, 3VW, 3XL, 3XZ, 3ZO, 3ZY, 4BQ, 4BY, 4EB, 4EH, 4GH, 4GL, 4IV, 4KC, 4LP, 5DO, 5FV, 5RL, 5WO, 8AGO, (8AJA), 8ANB, (8ANJ), 8AQO, 8AQZ, 8ARK, 8ARW, 8ASM, 8AUY, 8AVD, 8AWM, 8AWY, 8AXC, 8BKE, 8BLX, 8BO, 8BPU, 8COO, 8CZD, 8DV, 8FT, 8HM, 8LB, 8LX, (8PN), 8QZ, 8TB, 8UK, 8VY, 8XAK, 8XE, 8XV, 8XWA, 8YM, 8ZAE, 8ZZ, 9AAP, 9AJH, 9AOU, 9ARG, 9BP, 9DEA, 9DGQ, 9DZZ, 9EI, 9FZ, (9IL), 9KP, 9SO, 9XI, 9ZL.

2BNZ, 10 Hawthorne Pl., E. Orange, N. J.

C.W.: (1ADO), 1AW, 1CR, (1ES), 1HK, 1HX, 1II, (1PR), 1PT, 1QP, 1SN, 1UJ, (1XD), 1XE, 1XM, 1XZ, 1ZE, 1ADL, 1AIP, (1AJP), 1AKG, 1AKL, 1ALE, 1ALW, 1AMQ, 1AQJ, (1ARY), (1ASF), 1AVR, 1AWB, (1AXD), (1AXW), (1AZW), 1BDC, 1BDI, (1BEA), (1BES), 1BJH, 1BKO, (1BKQ), 1BLE, 1BNT, 1BOQ, 1BQE, (1BSD), (1BWJ), 1CES, 1CGS, 1CIK, (1CMK), 1CNR, 2FC, 2HI, (3BA), 3BH, (3CA), (3CC), 3CF, 3CZ, 3EM, 3FP, (3FS), 3GH, 3HG, (3HJ), (3IL), (3IW), (3JL), 3LC, 3QV, 3QZ, (3TJ), 3TT, (3UC), (3UQ), 3VQ, (3VW), (3ZO), 3XW fone, 3AAY, (3ACC), (3ADX), (3AFU), 3AGH, (3AJD), (3ALN), (3ALR), (3ANJ), 3ARN, (3ASO), 3AWH, 3BAK, 3BFP, 3BGM, (3BIJ), 3BJY, 3BLF, 3BNG, 3BNU, 3BPA, 3BRS, 3BRW, 3BUV, 4BF, (4BY), 4CD, 4CO, 4DC, 4DI, 4DM, 4DO, 4DS, 4EH, 4FS, 4FT, (4GL), 4GN, 4GO, 4GU, 4GX, 4HB, 4HG, 5DA, 5FV, 5LA, (5WO), 5ZA, 6ALE, 6XAD, 6ZZ, 7XB, 8AM, 8BK, 8BO, 8BQ, 8BU, 8DV, (8EA), 8EM, (8GE), (8HG), 8HJ, 8HM, (8IQ), 8KH, (8KS), 8LB, (8LX), 8OZ, 8PN, 8PT, (8QB), 8QC, 8QZ, 8SE, 8TB, (8UC), 8UK, 8VJ, 8VY, 8WR, (8ADG),(8AGO),8AHE, 8AIM,(8AOI), (8AJV), 8ALB, 8ALT, (8ANB), 8AQF, (8ARD), (8ARK), 8ARW, 8ARY, 8AUH, 8AVD, 8AWM, 8AWY, (8AXC), (8AXD), 8AXY, 8AZG, 8BAZ, 8BCI, 8BCO, (8BDB), 8BDG, 8BDO, 8BDU, 8BEF, (8BFM), (8BFX), (8BIL), 8BKE, 8BLT, 8BOX, (8BQV), (8BRL), 8BRQ, (8BUM), (8BUX), 8BXH, 8BXK, 8BXQ, 8CAY, 8CAZ, 8CBJ, (8CKM), (8CKO), 8CKW, 8CPC, 8COO, 8CON, 9EI, (9FZ), (9IL), (9IO), 9IQ, (9KP), 9OP, 9PR, 9AAS, 9AAY, 9AIL, 9AIP, 9AIY, 9AJA, 9AJH, 9AKD, (9ALS), 9ANE, 9AOG, 9ARK, 9AUA, 9AWS, (9BLC), 9BLO, 9BSG, (9DAX), 9DGQ, 9DKY, 9DTM, 9DWY, 9CBA, Spark: 1ARY, 3FP, 3HJ, (3JL), (3UC), (3AJD), 3BDT, 3BYC, 4EA, 4GA, 8RQ, 8VQ, 8AFB, 8AFQ, (8BUM), 8CQL, (8XE), 9OX, 9ZN.

2AFI, Bogota, N. J.

Spark: 1AW, 1BAQ, 1BVB, 1COK, 8DY.

C.W.: 1ADL, 1AJP, 1AMU, 1AR, 1ARY, 1ASF, 1AWB, 1AWM, 1AYZ, 1AZW, 1BBW, 1BGF, 1BKQ, 1BLE, 1BLI, 1BSD, 1BUA, 1CJA, 1CK, 1CLI, 1CNE 1CNR, 1JT, 1LP, 1PR, 1PT, 1QP, 1ZE, 2ALW, 2BQU, 2BT, 2KL, 3ALN, 3ANY, 3AXC, 3BG, 3BHL, 3BIJ, 3BLF, 3BZ, 3EM, 3FP, 3HG, 3IC, 3IW, 3KQ, 3QV, 3QZ, 3VW, 3WF, 3XL, 3ZO, 3ZY, 4BF, 4BY, 4GL, 4II, 4IV, 5DAU, 5WO, 8AGO, 8ALB, 8ANB, 8AQZ, 8ARD, 8ARV, 8ARW, 8AVL, 8AWP, 8AWX, 8AXC, 8BBD, 8BCL, 8BDL, 8BEF, 8BK 8BKE, 8BLX, 8BNY, 8BO, 8BQU, 8BSY, 8BXH, 8CAY, 8CFP, 8CJX, 8DV, 8KH, 8LW, 8NB, 8OZ, 8PT, 8QZ, 8SE, 8VE, 8VY, 8WR, 8XB, 8XE, 8XY, 8ZAE, 8ZZ, 9AAY, 9ABF, 9AIY, 9AJA, 9AJH, 9ARK, 9BED, 9CIZ, 9DAX, 9DZQ, 9EI, 9FZ, 9G- - -. (QRA?), 9II, 9IO, 9LE, 9WQ, 9ZL.

3ARN-3HS, Washington, D. C.—Every District

Spark: (1AKG), -AMQ, (1AOK), 1ARY, 1AW, 1AZK, 1BCF, 1BDC, 1BDT, 1BEP, 1BFZ, 1BGF, 1BOE, 1BOQ, (1BVB), 1BWY, (1CHJ), 1CJA, 1CK, (1CNI), 1HO, 1LZ, 1RX, (1SF), 1SI, (1SN), 1WQ, 2AAF, 2AER, (2AHU), 2AIJ, 2AJE, 2AQI, 2AR, (2ARY), (2AWZ), 2BFX, 2BK, (2BSC), 2BTW, 2CJS, (2CT), 2DD, 2DI, (2DN), 2EL, (2FP), 2JZ, (2PF), 2SQ, 2SZ, 2TS, 2WB, 2WV, 3ABB, 3AGT, 3AJD,3AOV,3AQZ,3AXK,3BFU,3BSH,3CC,3DM,3FP, 3NB, (3PU), 3QN, 3QV, (3TA), 4BI, 4CX, 4DH, 4DQ, (4FD), (4GN), 5ABY, 5JF, 5PY, 5SM, 5XA, 8ACF, 8AFA, 8AFB, 8AGO, 8AHE, 8AHH, 8AHQ, 8AIO 8AJE, 8AJT, (8AJV), 8AJW, (8AJX), 8ANO, 8ANW, 8APB, (8AQO), 8ARD, (8ASL), 8AUQ, 8AUX, (8AUY), 8AWP, 8AWU, 8AWV, 8AXB, 8AXC, (8AXN), 8AXY, 8BAZ, (8BBU), 8BOO, 8BCR, 8BDU, 8BDV, 8BEP, 8BFY, 8BRL, (8BSS), 8BSY, 8BXC, 8BXT, 8CGZ, 8CH, (8CHV), 8CLR, (8CPP), 8CQL, (8EA), (8EB), (8EO), 8EW, 8FT, 8HG, 8IN, 8JJ, 8KY, 8NO, 8RQ, 8SP, 8TK, (8TY), 8UC, 8VH, (8VQ), 8VW, 8WD, (8WE), 8ZO, (9AAW), 9AAY, 9ACB, 9AFK, 9AGR, 9AIR, 9AMT, 9ANP, 9AOU, (9APK), 9AQE, 9AQZ, (9ARG), 9ARR, 9AVH, (9AVX), 9AYH, 9AZE, 9AZF, 9AZH, 9BAK, 9BED, 9BFG, 9CA, 9DAX, 9DCX, 9DDG, 9DHZ, 9DIO, 9DKK, 9DMJ, 9DQQ, (9DSO), 9DZI, 9DZY, 9FF, 9FI, (9FK), 9KI, 9LF, 9MC, 9NQ, 9OX, 9PW, (9UH), 9UU, 9VL, 9WD, 9WX, 9XI, 9YB, 9ZJ, 9ZN, Canadian 8FO, 3GE, 3GX, 3KG, 8PV.

C.W.: 1ARY, 1ASF, 1AZW, 1BBW, 1BGF, 1BKA fone, 1BKQ, 1BRQ, 1BWJ, 1CGO, 1CJH, (1CNI), 1ON, 1QP, 1UJ, 1VT, 1YK, 2AAB, 2AEH, 2AQU, 2AWF 2AYV, 2BEA, 2BEH, 2BGI, 2BML, 2BNZ, 2BQH, 2BRB, 2BTW, 2CBG, 2CBW, 2CCD, 2CFT, 2CGQ, 2CJN, 2DK, 2DN, 2FP, 2OE, 2RY, 2SQ, 2UD, 2VA, 2XJ fone, 3AJD, 3ALU, 3AQH, 3AYV, 3BA, 3BAI, 3BHL, 3BLF, 3FP, 3FS, 3IH, 3NC, 3QV, 3QZ, 3RF, 3VW, 3ZO, 4BF, 4BY, 4GH, 4GL, 4GX, 4KU, 5CB, 5DA, 5HB, 5JB, 5XA, 5YG, 6KA, 6XAD, 7DW, 8ADG, 8AGO, 8AHK, 8AIO, 8AJV, 8ALB, 8ANB, 8AQF, 8AQZ, 8AUH fone, 8AUY, 8AVD, 8AWM, 8AXB, 8BBD, 8BCL, 8BDB, 8BDM, 8BDO, 8BDU, 8BDY, 8BIL, 8BKE, 8BPI, 8BZC, 8BZY, 8CCX, 8CFP, 8CKM, 8CKO, 8CMM, 8CN, 8CX, 8DH, 8HJ, 8KH, 8OZ, 8PT, 8QZ, 8RQ, 8SE, 8SP, 8UC, 8VL, 8VQ, 8WA, 8WR, 8XE, 8XV, 8YM, 8ZAE, 9AIY, 9AJA, 9AJH, 9AKP, 9AMO, 9ANR, 9AOG, 9APW, 9ARK, 9BED, 9BLC, 9BLY, 9BSG, 9BTA, 9DBV, 9DIO, 9DJG, 9DKY, 9DTA, 9DZQ, 9IL, 9IO, 9JG, 9LE, 9PE, 9PS, 9SO, 9WQ, 9WU.

3ALR, Washington, D. C.

Spark: 1AAE, 1AGA, 1ANY, 1AOK, 1ARY, 1AVI, 1AW, 1BCF, 1BPZ, 1BVB, 1CN, 1CWJ, 1HO, 1LZ, 1PF, 1RV, 1RX, 1SN, 1WR, 1ZN, 2AD, 2AER, 2AFO, 2AGA, 2AHU, 2AIF, 2AIG, 2AJE, 2AQD, 2AQI, 2ARB, 2ARK, 2ARM, 2ARY, 2AWD, 2BG, 2BGI, 2BSC, 2BXY, 2CLU, 2CY, 2EL, 2FP, 3AB, 3ABB, 3ABW, 3AC, 3AD, 3AGT, 3AHT, 3AIC, 3AJD, 3AK, 3AN, 3ANJ, 3AOV, 3AQH, 3ARM, 3AYC, 3BCF, 3BDP, 3BFU, 3BP, 3DM, 3EH, 3FP, 3GN, 3GX, 3PU, 3QN, 3UC, 3VA, 4AG, 4BI, 4CX,

4EA, 4LL, 4FD, 4FP, 4GN, 4IW, 5DA, 5IR, 5XA, 8AFA, 8AFB, 8AFD, 8AGA, 8AGE, 9AHE, 9AHQ, 8AHV 8AIO, 8AJT, 8AJX, 8ANO, 8ARB, 8ARD, 8ASL, 8AUO, 8AUX, 8AXN, 8AXO, 8AYC, 8AZF, 8BAZ, 8BDK, 8BDP, 8BEP, 8BRL, 8BUH, 8BUQ, 8BXC, 8CHV, 8DB, 8DL, 8DV, 8EA, 8EB, 8EO, 8EW, 8HS, 8HW, 8JJ, 8KN, 8KY, 8LB, 8NQ, 8RQ, 8TK, 8UC, 8VE, 8VQ, 8VY, 8VW, 8WD, 8WE, 8WR, 8WU, 8WV, 8WZ, 8ZW, 9AAW, 9AGB, 9AGF, 9AIF, 9AIR, 9ARR, 9AZE, 9AZF, 9DSO, 9DZY, 9MC, 9MY, 9OX, 9UH, 9UK, 9UL, 9US, 9XI, 9YC, 9ZJ, Can. 8BP, 8GN, 8GX, 8JI.

C.W.: 1ADL, 1AGI, 1AIP, 1AJP, 1ARY, 1AVI, 1AZW, 1BDC, 1BES, 1BET, 1BGC, 1BKE, 1BKQ, 1BTL, 1BWJ, 1BYK, 1CJH, 1CKQ, 1CMK, 1CNF, 1II, 1IV, 1PR, 1PT, 1RD, 1YB, 1YK, 1ZE, 2AAB, 2AEH, 2AFP, 2APB, 2AQH, 2AQU, 2AWF, 2AWJ, 2AYV, 2AZZ, 2BAK, 2BEA, 2BEH, 2BEK, 2BGN, 2BMA, 2BML, 2BNZ, 2BQV, 2BRC, 2BXR, 2BXY, 2BZA, 2BZV, 2CCD, 2CCL, 2CCX, 2CFT, 2CGQ, 2CIC, 2DK, 2DX, 2FP, 2KP, 2NZ, 2SQ, 2RY, 2VC, 2WI, 2XJ fone, 2ZH fone, 2ZK fone, 2ZL, 3AAE, 3AAY, (3AGD), 3AGI, (3AJD), 3ANY, 3APG, 3AQH, 3AQR, 3AXP, 3BG, 3BHL, 3BIJ, 3BNU, 3BTI, 3BUR, 3BUV, 3BVA, 3BZ, 3CA, 3DM, 3EM, 3HG, 3IY, 3JH, 3LC, 3NH, 3OZ, 3QV, 3RM, 3YE, 3ZN, 3ZO fone & C.W., 3ZZ, 4BL, 4BY, 4DC, 4EH, 4GL, 4GX, 4IL, 4JH, 4LP, 4XD, 4YA, 4ZC, 4ZL, 5DA, 5LA, 5WO, 6ANZ, 6EY, 8AGO, 8AHM, 8AIO, 8AJU, 8ALB, 8ALG, 8ALT, 8ANJ, 8AOO, 8APH, 8AQO, 8AQV, 8ARK, 8ASO, 8AUO, 8AVA, 8AVL, 8AWM, 8AWP, 8AWS, 8AWX, 8AX, 8AXC, 8BCQ, 8BDF, 8BDU, 8BFX, 8BIL, 8BK, 8BKE, 8BKZ, 8BLX, 8BMF, 8BNY, 8BOX, 8BPI, 8BSS, 8BUM, 8BUX, 8BZY, 8CAZ, 8CBJ, 8CKM, 8CMM, 8CNA, 8COO, 8DV, 8MI, 8MO, 8NV, 8PT, 8QZ, 8RF, 8RQ, 8SE, 8SP, 8UK, 8VJ, 8VQ, 8VR, 8WR, 8XA, 8XE, 8ZAE, 8ZZ, 9AIY, 9AJA, 9AMB, 9ARK, 9AXR, 9BKY, 9DIO, 9DOF, 9EI, 9IL, 9IO, 9KM, 9UZ, 9WA, Can. 8BP, 8JI.

3BLF, Richmond, Va.

C.W.: 1AGI, (1ASF), (1AZW), (1BAS), (1BBW), 1CHJ, (1CIK), 1PR, (1PT), (1QP), 1VQ, (1XM), 1YB, (1YK), (2AAB), (2ACQ), 2AFP, (2AIF), 2AYV, 2BEM, 2BEA, (2BGI), 2BML, (2BLP), (2BQH), (2BQM), 2BYC, 2CCD, 2DK, 2FP, 2SQ, 3ADT, 3AEH, 3AEV, 3AJD, (3ALN), (3ALL), (3ANY), (3AQH), 3AWH, Can. 3AZ, 3BA, 3BEC, 3BHL, 3BZ, (3CA), 3CXA, (Can. 3CZ), (3FM), 3FS, 3GH, (3HG), 3HW, 3NB, (3QV), 3UX, 3VW, (3ZO), 3ZY, 4BF, 4BY, 4CA, 4DM, 4GL, (4II), (4JH), 4KC, 4LP, 4ZC, 5EK, 5JB, 5OI, 6ZF, 6ZZ, (8AFE), 8AGO, 8AIG, (8AMD), (8ANB), (8APB), (8ARW), (8AUY), 8AVD, 8AWM, 8AXC, 8AXB, 8AVL, 8BCL, (8BDB), 8BEX, (8BJC), 8BKE, 8BLX, 8BNY, (8BO), (8QZ), 8BXH, (8BZY), (8CNA), (8CON), (8COO), 8DV, 8CMM, 8HJ, (8HM), (8LB), 8OZ, (8QZ), (8QB), (8VY), 8WR, 8XAE fone, 8XE fone, 9AGH, 9AIY, (9AJH), 9AAP, 9ANE, 9APH, 9BED, 9BIK, 9BJB, 9CBA, 9CT, 9DCG, 9DGQ, 9DOF, (9EI), 9FM, (9II), (9IL), (9IO), 9PF, (9QF), 9UC, 9WQ, 9XI, 9XM fone, 9ZAF.

Ed & A. Burg, Washington, D. C.

C.W.: 1ADL, 1ARY, 1AZW, 1BBW, 1BKA fone, 1BKQ, 1BLE, 1BQE, 1BWJ, 1CIK, 1HK, 1II, 1JT, 1PT, 1PR, 1QP, 1SQ, 1XZ, 2AAB, 2AJR, 2BCF, 2BEA, 2BEH, 2BEM, 2BNZ, 2BQU, 2BUM, 2BSC, 2CCD, 2DK, 2FP, 2QZ, 2RM, 2XI fone, 2XJ fone, 2ZK fone, 2ZL, 3AAD, 3AFU, 3ALN, 3BU, 3BUY, 3BOF, 3BSP, 3BXA, 3CM, 3IL, 3IW, 3QV, 3RF, 3TR, 3XL, 3ZP, 3ZY, FDQ, 4DQ, 4GH, 4GL, 4IV, 4PL, 4ZC, 5DO, 5EK, 5NT, 5PJ, 5WU, 5ZA fone, 6ZAC (Heard also by 3ALN), 8ADQ, 8AGO, 8ALT, 8AQZ, 8AR, 8ARK, 8ARO, 8AUY, 8AWM, 8AWQ, 8AX, 8BAE, 8BDU, 8BKE, 8BLW, 8BLX, 8BO, 8BWK, 8BXC, 8BFX, 8BK, 8BPX, 8BSS, 8BQV, 8CAM, 8CEZ, 8CFP, 8CHV, 8CO, 8DV, 8GA, 8GW, 8HJ, 8LB, 8LQ, 8LX, 8PT, 8QZ, 8RQ, 8UK, 8XE, 8VY, 8YD, 8ZA, 8ZAE, 9AAR, 9AIY, 9ANE, 9AOU, 9APH, 9ARK, 9ARZ, 9BBU, 9BEO, 9BIK, 9BP, 9BPC, 9BPO, 9BSG, 9BTA, 9BYA, 9CT, 9CMM, 9DGQ, 9DZQ, 9EI, 9FZ, 9HJ, 9II, 9IJ, 9IL, 9RS, 9TU, 9WQ, 9XI, 9XM fone, 9ZAF.

Spark: 1AA, 1ARY, 1AW, 1AZE, 1BVB, 1CID, 1CNI, 2AHU, 2AJ, 2AJE, 2AQI, 2BSC, 2DM, 2EL, 2PU, 2TF, 3AAD, 3ABB, 3ALN, 3ARW, 3ARO, 3ASO, 3BJ, 3CT, 3GX, 3HJ, 3OK, 3PU, 3PZ, 4CX, 8ACF, 8AHH, 8AWY, 8AXY, 8AHQ, 8BAZ, 8CEZ, 8CH, 8EO, 8EW, 8IN, 8JJ, 8LB, 8OW, 8RQ, 8VQ, 8XE, 9AAW, 9ACB, 8AHY, 9ARG, 9AUL, 9AXF, 9AZA, 9BAS, 9CA, 9DMJ, 9EM, 9JJ, 9MC, 9UH, 9UU, 9YB, 9ZB, 9ZC, 9ZJ.

4EZ, Jacksonville, Fla.

Spark: 2EL, 2FP, (2JZ), 2ABB, 3AJD, 3AOV, 8ARN, (4AS), (4BC), (4BI), (4CX), (4DQ), 4DZ, 4EA, (4FD), (4GN), (4HS), (4HW), (4IX), 4SK, 4YA, 5GI, 4HK, 5PE, 5QS, 5UE, (5XA), 5ABY, 8IN, 8RQ, 8SP, 8UC, 8WD, (8ZO), 8ACB, 8AFD, 8AIZ, (8AJV), 8AWU, 8AXB, (8BAZ), 8BFY, 8BRL, (8CPP), 9LF, 9VL, 9ARR, 9ASJ.

C.W.: 1BDC, 2FP, 2CFT, 3BZ, 3CA, 3IL, 4AS, 4AZ, 4BF, 4DC, 4DS, 4EN, 4GL, 4GX, 4II, 4IV, 4KL, 4KM, 5DA, 5KU, 5LA, 5XA, 6EN, 8HM, 8SP, 8XE, 8ANB, 8BYE, 9BHD, 9BLO, 9DYN.

No "Fives"

No calls were received from the Fifth District and but few from the Fourth. 'Smatter—static got you fellows on the run? Come on wid sum lists.—Ed.

6AOR, Berkeley, Calif.

Spark: (6FH), 6GT, 6GD, (6HY), 6IC, (6IV), (6KE), 6LK, 6OD, (6WG), (6AAK), (6AEH), 6AGK, (6AHF), 6AHQ, (6AIN), 6AIO, (6AJH), 6AJR, (6AKL), (6AMN), 6ARK, (6AVD), (6AWX), (6BAJ), (6BDZ), (6BMP), (7BJ), 7BH, (7BK), 7ED, 7HN, (7HF), 7KE, (7KJ), 7GJ, (7GQ), 7GT, 7MF, 7MU, 7OT, (7OZ), 7TQ.

C.W.: 5ZA, (6CU), 6EN, 6JD, 6KA, 6GY, (6GD), (6BES), 6ZA, 6ZX, 6ZZ, 6XAD, 6ZAC, 7RN, 7NF, 7QT, 7WE, 7XF, 8AGZ, 8AIM, 9ANF, 9AMB.

6AWP, Santa Ana, Calif.

C.W.: 2FP, 8FS, 8ALN, 4BQ, 4FT, Can. 4CB, (5ZA), 6AIF, (6AK), (6AKW), (6ALE), (6ASJ), (6AUN), (6AWT), (6BKB), 6DF, 6FH, 6GH, 6IB, (6KC), 6KU, 6NN, 6NX, (6TW), (6XAD), 6XH, (6ZA), 6ZAC, 6ZAE, 6ZAF, (6ZB), (6ZF), 6ZG, (6ZN), 6ZI, (6ZT), (6ZZ), (7DP), 7NF, 7NI, (7OZ), 7XF, (7ZU), 8AGZ, 8BRL, 8JL, 8XV, 9AAV, 9AEG, 9ALG, 9AOG, 9AJS, (9AMB), 9ARJ, Can. 9BD, (9BJI), 9BSG, (9DTH), (9DTM), (9DVA), 9DXN, 9DZJ, 9NX, (9PS), (9WD), (9WU), (9XAQ), 9XM, 9YAE, (9ZAC), (CL8), DD5, phone, XF1.

Spark: 5IF, 5HK, 5XD, 5XU, 5XQ, (5ZA), 6's too numerous, 7BS, 7CB, 7CK, 7GJ, 7GT, 7HF, 7IM, 7IN, 7JD, 7KB, (7LY), 7MF, 7MP, 7NF, (7OT), 7TJ, 7VD, 7WJ, 7XV, (7YA), 7YJ, 7YS, 7ZA, 7ZM, 7ZO, 7ZU, 9AEG, 9AQG, 9AYU.

6ASN, Berkeley, Cal.

5IG, 6BY, 6GT, 6HR, 6HY, 6IV, 6KC, 6LC, 6OL, 6OD, 6OM, 6QR, 6ZM, 6ZZ, 6AAK, 6AAT, (6ACA), 6AEH, 6AEG, 6AHQ, 6AKV, 6AKL, 6AIN, 6AMN, 6AVR, 6AWE, 6ZAQ, 6BJV, 7BH, 7BK, 7GR, 7KE, 7MF 7OG, 7MW, 7OT, 7SN, 7WG, 7WO, 7YA, 7ZM, CL8.

6OL, Glendale, Calif—Spark

Worked: 5ZA, 6AH, 6AK, 6AR, 6AS, 6CP, 6EX, 6FH, 6GF, 6GR, 6GT, 6GX, 6H.C 6IB, 6IC, 6IM, 6KC, 6KM, 6MZ, 6NG, 6OC, 6OH, 6PJ, 6PO, 6PR, 6QK, 6QR, 6QT, 6SK, 6TC, 6TU, 6UQ, 6VK, 6VX, 6WG, 6XH, 6ZB, 6ZI, 6ZU, 6ZX, 6ZZ, 6AAH, 6AAK, 6ABK, 6ABM, 6ABW, 6ADA, 6AEH, 6AEI, 6AFP, 6AGF, 6AID, 6AIH, 6AJH, 6AJR, 6AKL, 6ANG, 6APH, 6AQU, 6ARK, 6ARW, 6ATQ, 6AUD, 6AUU, 6AVX, 6BGL, 6BIU, 6BJV, 6BNN, 7MF, 7TO.

Heard: 5OF, 5XD, 6BM, 6FK, 6GK, 6NO, 6TO, 6TV, 6VZ, 6AAU, 6ABX, 6ACR, 6ACW, 6AFN, 6AFY, 6AHV, 6AIF, 6AIN, 6ALV, 6ANR, 6ST, 6ATH, 6ATU, 6ATY, 6AUC, 6AUP, 6AVB, 6AWH, 6BCJ, 6BCZ, 6ZD, 6ZAM, 7ED, 7BK, 7BP, 7CN, 7GJ, 7IN, 7IW, 7JD, 7KE, 7KB, 7KS, 7MU, 7TJ, 7ZT, 7ZV.

Asa S. Keller, Monroe, Wash.—One Tube

Spark: 5AK, 5CN, 6AJR, 6ARK, 6GR, 6KM, 6TU, 6VA, 7ACG, 7ACN, 7AS, 7BB dahte, 7BH, 7BK, 7CU, 7ED, 7FI, 7FR, 7GE, 7GJ, 7HD, 7IW, 7IY, 7JD, 7JF, 7JW, 7KJ, 7LY, 7MF, 7MU, 7NN,

7NW, 7NZ, 7OT, 7OZ, 7TG, 7TO, 7WG, 7YL, 7YS, 7ZV.

C.W.: 4IS, 5CT, 5WM, 5ZA, 6AAT, 6ADM, 6AIB, 6AK, 6AW, 6AWP, 6AWT, 6BCD, 6BGE, 6EN, 6FH, 6GY, 6KA, 6KI, 6KU, 6NX, 6OO, 6TW, 6VM, 6ZAD, 6ZF, 6ZI, 6ZX, 7BS dalite, 7DP, 7HI, 7HS, 7MF, 7NA, 7NC, 7NF, 7NN, 7QT, 7RN, 7SC, 7WE, 7ZU, 9AMB, 9AYU, 9BBF, 9BJI, 9PI, 9PS, 9WU, 9XAQ, CL2, Can. 4CB fone, 6KU, 7RN, 7ZU.

7ACS, Tekoa, Wash.

Spark: 6AFD, 6AJR, 6ALU, 6AWS, 6LK, 6GF, 6KM, 6ZA, 6ZAM, 6ZQ, 6ZAE, 7BF, 7BH, 7BK, 7FQ, 7FR, 7GE, 7JD, 7JF, 7KJ, 7LY, 7MF, 7NW, 7NZ, 7TG, 7XB, 7YA, 7YL, 7ZM, 7ZK, CL8, Can. 9BD.

C.W.: 6AIB, 6AWP, 6BES, 6EA, 6FF, 6KA, 6KI, 6KU, 6NX, 6XAD, 6XAC, 6XAQ, 6XF, 6ZAE, 6ZAC, 6ZF, 6ZG, 6ZI, 6ZN, 6ZR, 6ZX, 6ZZ, 7BG, 7DP, 7FI, 7NA, 7NN, 7QE, 7SC, 7XG, 7ZU, CL8, 9AMG, 9ASF, 9ASU, 9DVA, 9DVJ, 9DZG, 9QF, 9TI, 9WU, 9XAQ, 9XI, 9YAJ, 9YAW, 9ZAF, 9ZF, Can. 4CB, 4BV, 9BD.

Ridgefield, Pk., N. J.—Indoor Aerial, 1 Tube

C.W.: 1ARY, 1PR, 1XM, 2AYV, 2BGI, 2RC, 3ANQ, 3BLF, 3BZ, 3NH, 3VW, 4DC, 4GL, 4GX, 8ADG, 8AIO, 8AVL, 8AWY, 8BDO, 8BLX, 8BXH, 8KH, 8SE, 8XE.

Robert Whitmer, Battle Creek, Mich.

C.W.: 1AGW, 1AIP, 1BLE, 1IZ, 1JT, 2AY, 2BEA, 2BEN, 2BES, 2BSL, 2BYH, 2CC, 2KPG 3ALL, 3AQS, 3BES, 3BHP, 3IW, 3KPJ, 3RF, 4ANY, 4BQC, 4BY, 4IU, 4KA, 4KC, 4TQ 4VW, 5FIM, 5FS, 5FU, 5QH, 5ZY, 8ANB, 8AWM, 8AWX, 8BIT, 8BKE, 8BLW, 8BNK, 8BU, 8BVX, 8BWK, 8BWS, 8CAY, 8CIA, 8CIH, 8CLS, 8CQ, 8CQL, 8CTZ, 8CV, 8DDD, 8DV, 8PT, 8PTC, 8SE, 8UK, 8VQ, 8VY, 8XE, 8ZAE, 8ZF, 9AIY, 9AJS, 9AO, 9AOU, 9ARK, 9AVA, 9BBF, 9BGD, 9BHI, 9BLC, 9BLO, 9BP, 9DA, 9DHZ, 9DWS, 9DZQ, 9EI, 9GL, 9GLC, 9II, 9IIY, 9IJS, 9IL, 9IO, 9JO, 9LG, 9LO, 9PEF, 9YAM,

Spark: 8AYX, 8AZF, 8CF, 8CA, 8EB, 8JJ, 8LB, 8NZ, 8RT, 8WD, 8YN, 8ZA, 8ZO, 9BAK, 9BSQ, 9DDZ, 9DGX, 9JX, 9TK.

8BKE, Huntington, W. Va.

C.W.: 1QP, (1XZ), 1ZE, 1AZW, 1BRQ, 1CNR, 1XAD, 2WR, (2WT), 2VC, 2AAB, 2AFP, 2ANJ, 2AXK, (2BFX), 2CBG, 2CCD, 2CFT, (3BA), 3BG, 3BZ, 3FS, 3GH, (3IW), 3IZ, 3QV, 3ZO, (3AAD), 3ANY, (3BIJ), (3BOF), 4BY, (4EB), (4EH), 4FP, (4GH), 4GL, 4GS, 4HB, (4II), 4IV, (4LP), 5BO, (5DO), 5EK, (5FO), 5FV, 5LJ, 5OI, 5RL, 5ZA, 5ABM, 8BO, 8BU, 8EA, 8FT, 8GV, 8GZ, 8HJ, 8LW, 8PN, (8PT), (8QB), 8QZ, 8SP, 8VJ, 8VY, (8WB), 8XE, (8YM), 8ABM, 8AGG, (8AGO), 8AIM, (8AIO), (8ALB), (8ANB), 8AQF, (8ARK), (8ARU), (8ASM), 8AUX, 8AVW, 8AWM, (8AWY), 8AXB, 8AXC, 8BCA, 8BCL, 8BDB, 8BEK, 8BGD, 8BGJ, (8BLW), 8BLT, (8BPU), 8BQF, 8BQU, 8BRL, (8BUX), 8CIJ, 8CLD, (8CPF), 8XAK, 8ZAE, 9AL, (9CT), 9DG, 9DX, (9EI), 9FM, 9II, (9IL), 9IO, 9IP, 9KE, (9KM), 9KP, 9KT, (9LE), (9LQ), 9PE, 9PC, (9PI), 9PS, (9SJ), 9SL, (9SO), 9VK, 9WQ, (9WU), (9XI), (9ZL), (9AAP), 9AAY, 9AEG, 9AEQ, (9AFN), 9AIY, 9AJA,(9AJH), 9AOU, 9ARX, (9ARZ), (9ASL), 9AUM, 9AVN, (9AXF), (9BCT), 9BED, (9BIK), (9BJR), (9DGQ), 9DKY, (9DOF), 9DSM, 9DZQ, (9CBA), 9CDA.

8BCW, Rome, N. Y.

Spark: 1AA, 1AW, 1CK, 1GA, 1GM, 1LZ, 1QO, 1RQ, 1RV, 1RX, 1SN, 1WQ, 1YB, 1ACO, 1AHF, 1AKG, 1AMZ, 1ARY, 1ASF, 1AZJ, 1AZK, 1BCF, 1BAC, 1BQA, 1BRQ, 1BVB, 1BWJ, 1CJA, 1CKS, 1CNI, 1COK, 2DI, 2CT, 2EL, 2EU, 2FP, 2QN, 2RM, 2SU, 2SZ, 2TA, 2TF, 2AHU, 2AJE, 2AQI, 2AWF, 2AYV, 2BRC, 3AC, 3BJ, 3FB, 3FC, 3JW, 3PL, 3PU, 3TA, 3YN, 3ZX, 3ABB, 3AGT, 3AJD, 3AQL, 3AWE, 3BFU, 3BYG, 4FD, 8BQ, 8CF, 8CH, 8BW, 8FT, 8KY, 8LB, 8MZ, 8RQ, 8SP, 8TT, 8UH, 8VQ, 8WD, 8WU, 8XE, 8ABB, 8ABG, 8ACF, 8AFB, 8AFG, 8AHQ, 8AHZ, 8AJV, 8AJW, 8AMZ, 8AOZ, 8APB, 8ARD, 8AUX, 8AUY, 8AVJ, 8AVT, 8AWU, 8AXO, 8AXY, 8AZF, 8BAC, 8BAZ, 8BFY, 8BHV, 8BRI, 8BSY, 8BZU, 8CGZ, 8CPP, 9HR, 9MC, 9TV, 9UH, 9UL, 9YB, 9YM, 9AMT, 9ARX, 9AUL, 9AZA, 9AZE, 9DCX, 9DSO.

C.W.: 1II, 1JG, 1LZ, 1PR, 1RD, 1SN, 1TB, 1XM, 1XZ, 1YZ, 1ZE, 1ADG, 1ADL, 1AGL 1AKG, 1ARY, 1ASF, 1AZW, 1BAS, 1BBU, 1BDI, 1BEP, 1BGR, 1BGF, 1BKA, 1BKQ, 1BLE, 1BSD, 1BTL, 1BWJ, 1CAK, 1CJH, 1CNI, 1CNR, 2CK, 2DN, 2EH, 2FP, 2HW, 2RD, 2RU, 2TP, 2XI, 2XJ, 2XK, 2ZK, 2AGB 2AVU, 2AWF, 2AYV, 2BEA, 2BEH, 2BGM, 2BJS, 2BML, 2BNZ, 2BRC, 2BRD, 2CBG, 2CJN, 3CC, 3IW, 3NO, 3XW, 3ZO, 3ZY, 8AJD, 8ANJ, 8APQ, 8BHL, 4BQ, 4BY, 4GL, 4GX, 5FV, 8DV, 8NB, 8OW, 8OZ, 8PT, 8QZ, 8SP, 8TB, 8UK, 8VV, 8VY, 8XB, 8XD, 8XE, 8XV, 8ZK, 8ZZ, 8AAN, 8ADG, 8ACF, 8AFE, 8AIO, 8ALB, 8AQF, 8AQO, 8AWP, 8AWY, 8AXC, 8AYR, 8AYZ, 8BAC, 8BCL, 8BDU, 8BEO, 8BIZ, 8BKE, 8BLX, 8BMA, 8BMU, 8BNY, 8BSS, 8BUN, 8BUQ, 8BWT, 8CIS, 8CKO, 8CLW, 8CNU, 8XAE, 8ZAE, 9BP, 9ARK, 9BNO.

8NB, Rochester, N. Y.

C.W.: 1II, 1ON, 1PT, 1QP, 1RD, 1UN, (1VQ), 1XM, 1YB, 1ADL, 1AIP, 1ARY, 1ASF, 1AVR, (1AZW), (1BBW), (1BDC), (1BDI), (1BES), 1BGF, 1BKA fone, (1BKQ), 1BNT, (1BRQ), 1BSD, 1BYN, 1CAK, (1CHJ), 1CJA, 1CJH, 1CNF, 2DK, 2FC, 2FP, 2KL, 2KP, 2NZ, 2RM, (2SQ), 2XI fone, 2AAB, 2AEH, 2AGB, 2AID, 2AIF,(2AJA),(2ANM), (2AQH), 2AQU, 2AWF, 2AWS, (2AXK), 2AYV, (2AZZ), (2BBB), 2BEA, (2BEH), 2BGB, 2BGI, 2BLP, 2BML, 2BNZ, (2BQU), 2BTJ, (2BTW), 2BUM, 2BXP, 2CBW, 2CCU, 2CFI, 2CFT, 2CJN, 3BA, 3BZ, 3CA, (3CC), (3DM), 3HG, 3IL, (3IW), (3NH), 3NO, (3QV), 3QZ, (3VW), (3ZO), 3AAY, (3ADX), 3AJD, 3AKI, 3ALL, (3ALN), (3ANJ), 3ANY, 3AQH, (3ARO), 3ASW, (3BEC), 3BHL, 3BIJ, 3BLF, 3BNU, 3BRW, 3BTK, 3BUV, 4BQ, 4BF, (4CO), 4DC, 4DF, 4DQ, 4DS, 4EU, 4GL, 4GN, 4GX, 4ID, 4II, 4ZC, 4ADL, 5FV, 5AAM, 6BO, 6XAD, 6BES, 6WV, 6XAF, 7XF, 8BQ, 8BU, (8EA), (8ED), 8EV, (8HJ), 8HT, (8KH), 8LB, (8LT), 8LW, 8NV, (8PN), 8PT, (8QB), 8QZ, 8RQ, 8SE, 8SP, 8UC, (8UE), (8UK), 8VJ, 8VV, 8VR, 8WB, 8XE, 8ABM, 8ACM, 8ADG, (8AFE), (8AGK), 8AGO, (8AIO), 8AJV, (8ALB), 8ALT, 8ANB, 8ANJ, 8AOO, 8AQF, (8AQO), 8ARK, 8ASV, (8AUY), 8AVD, 8AVL, (8AWM), (8AWP), 8AWW, 8AWX, 8BDU, (8BEB), (8BEN), (8BEO), 8BGV, 8BIT, 8BQM, 8BQU, 8BRL, 8BSO, (8BSS), 8BSY, (8BUX), 8CAY, (8CAZ), (8CBJ), (8CCU), 8CCK, 8CFR, 8CID, 8CKO, (8CLW), 8CON, 8CPG, (8CPX), 8CQL, 8ZAE, 9BP, 9EI, 9FZ, 9IL, 9IO, 9KP, 9PI, (9UH), 9WQ, 9AJA, 9AOG, 9AOU, 9ARK, 9AXF, 9BED, 9BFG, 9BGH, 8BJB, (9BLC), (9BTA), 9DAX, 9DIO, 9DKY, 9DYN, (9DZQ), 9YAJ, Can. (3JI), 3JK, 3SJ, 9AL, WHQ.

Spark: (1BOQ), 1COK, 2FP, (2AAF), 2AER, 3PU, 3AAC, 3ABB, 3ARN, 4BI, 4CX, 8CH, 8KY, 8AFG, (8AHQ), 8AIT, (8AMZ), 8AUY, 8AVT, 8AWU, (8AXQ), 8AYC, 8BAZ, 8BLZ, 8BXO, (8BXT), (8CAH), (8CMC), 8CXT, (8ZO), 9OX, 9UU, 9ACB, 9ALE, 9AMT, 9ARG, 9DMJ, 9DSO.

8BIL, Warren, Pa.

C.W.: (1ADL), 1AIP, 1AKG, 1AQW, 1BDC, 1BDI, 1BES, 1BGF, 1BLE, 1BNT, 1BSB, 1BTL, 1BWJ, (1CAK), 1CGS, 1CIK, 1CJA, 1CJH, 1CJZ, 1CK, 1CNF, 1EE, 1HX, 1II, (1PR), 1PT, 1XM, 1YE, (2AAB), 2ABZ, 2AEH, 2AGB, (2AME), 2AMX, 2AWF, 2AWJ, 2AWS, (2AYV), 2BEH, 2BFT, 2BGI, 2BJR, 2BLP, 2BML, 2BNZ, 2BQA, 2BQU, 2BTJ, 2BUM, 2BXP, 2CFI, 2CFT, 2CJN, 2DK, 2DX, 2FP, (2FZ), 2KP, 2LH, 2OF, 2RU, 2RY, 2SQ, 2TP, 2VC, (3AAO), 3AAY, 3AJD, 3ALL, 3ALN, 3ANQ, 3ANY, 3APQ, 3AQH, 3ATZ, 3BEC, 3BHL, (3BIJ), 3BLF, 3BNU, 3BOF, (3BUP), 3BUR, (3BUV), 3BZ, 3CA, 3CC, 3DM, 3FP, (3FE), 3FS, 3HG, 3IL, 3IW, 3NH, 3NO, (3VS), 3ZO, 4BQ, 4BY, 4DC, 4DS, 4EN, 3EU, 4GL, 4GX, 4ID, 4II, 4JL, 4LP, 5DA, 8AGO, 8AIO, 8AM, 8ANB, 8AOO, 8AQF, 8AQO, 8AVD, (8AVL), 8AWM, 8AWP, (8BCL), 8BDB, 8BDO, 8BDU, 8BEF, 8BES, 8BFX, 8BJV, 8BNY, 8BO, 8BPI, 8BPL, 8BVA, 8BXH, 8CAZ, 8CGL, 8CID, 8CKM, 8CKO, 8CMM, 8DU, 8GV, 8HJ, 8HM, 8LX, 8NB, 8OW, 8OZ, 8PT, 8SK, 8SP, 8UE, 8UK, 8VQ, 8VY, 8WR, 8XAE, 8XE, 8ZV, (8YM), 8ZAE, 9AAY, 9AOU, 9APH, 9ARK, 9AYH, 9BED, 9BFG, 9BLC, 9BP, 9BSG, 9DAX, 9DDH, 9DZQ, 9GL, 9HM, 9II, 9IO, 9KP, 9LQ, 9ME, 9SL, 9WA.

8AGO, Pittsburgh, Pa.

Spark: 1AW, (2CT), 2DN, 2TF, 2SZ, (2AJE), (2ARY), 3GP, (3FP), 3RW, (3TA), (3BFU), (3EA), 3LB, 3AFB, 3AIJ, 3ASL, (3AZH), 9DW, 9KI, (9LZ), (9OX), 9UG, 9UH, 9AAW, (9AMT), (9AQA), (9AZE), (9DHZ), (9DMJ), 9DSO.

C.W.: 1XM, 1YK, 1AIP, 1ANM, 1ARY, (1ASF), (1AWB), (1AZW), (1BRQ), 1BYX, (1CAK), 1CGO, (1CIK), (1CIV), 1CNE, 1CNR, 2BG, 2DK, 2FP, 2FZ, 2HI, 2KP, 2NZ, 2SQ, 2VC, 2VH, (2WR), 2WT, 2YE, (2ZK), 2AAB, 2ADV, 2AFP, 2AIF, 2ANM, (2AYV), (2BEA), (2BEH), 2BFX, 2BNZ, 2BTJ, (2BUM), 2BZV, (2CBG), 2CCD, 2CFT, 2CFZ, 2CGX, 3BA, 3CC, (3FM), (3FP), (3FS), (3IW), 3IZ, 3KM, (3QV), 3QZ, (3UX), 3VS, (3VW), 3WF, 3ZO, 3AAT,(3AAY),(3ADX), 3ALL, (3ALN), 3ALU, (3ANJ), (3ANY), (3AVS), 3BAG, (3BIJ), (3BHL), 3BLF, (3BTK), 4BF, 4BQ, 4BY, 4DM, 4EH, 4GL, (4ID), (4IV), (4KU), 4LP, 5EK, 5FV, 5HB, 5JB, 5RL, (5WO), 5XV, 5YG, 5ZA, 5ABM, 6ZZ, 8AM, (8BO), (8BU), (8DW), (8EA), (8GV), 8HJ, (8HM), 8KH, 8LB, (8QB), (8SE), (8UC), (8UK), (8VY), 8XE, 8YD, 8ZG, 8ZH, 8ZZ, 8AAB, 8ADG, 8ALT, 8ANB, (8AQZ), (8ARK), 8ARU, 8AXB, (8AXC), 8AWM, 8AWX, 8BBD, 8BDB 8BEO, (8BGO), (8BJC), (8BKE), 8BLT, 8BQV, (8BUX), (8CAY),(8CCX),(8CMM),(8COO), 9BP, 9CT, (9DV), 9EI, (9GL), 9II, (9IL), (9IO), 9IZ, 9JG, 9KM, (9KP), 9LE, (9OP), 9PI, 9PS, (9QF), 9SO, 9UB, 9VK, 9WA, (9XI), 9YAJ, 9YE, 9ZB, (9AAP), (9AAY), 9ABF, (9AIY), 9AJH, 9AKD, 9ANE, 9ANT, 9AOU, (9ARK), (9ATE), 9AUA, (9AXF), 9BBF, 9BDB, 9BDW, (9BED), 9BHQ, 9BLC, 9BLO, (9DAX), 9DGQ,(9DHZ), 9DIO, 9DKY,(9DOF), 9DTA, Can. (3BP),(3CZ), (9AL),

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9BYX, Jacksonville, Ill.

Spark: 5YG, 8PT, 8BKE, 9AFA, 9AHS, (9ANU), 9AOJ, 9ARX, 9ACA, 9AVH, 9AZA, (9BLU), 9DAY, 9DHZ, 9DQQ, 9DSD, (9MC), 9NO, 9PW, 9SK, 9TV, 9YIW, 9YM, 9YWS.

C.W.: 1DX, 3RF, 3BLX, 4BQ, 4DS, 4KO, 5AA, 5AAM, 5HB, 5HK, 5IR, 5RL, 5WO, 5ZL, 8BK, 8BLV, 8IS, 8XUC, 9AAY, 9ABF, 9AC, 9AJA, 9ASL, 9BCK, 9BDP, 9BD, 9BCW, 9BED, 9BEM, 9BEW, 9BNO fone, 9DSH, 9DTF, 9DZQ, 9IO, (9MC fone), 9PI, 9SL, 9WA, 9WQ fone, 9WU, 9XI, 9XM fone, 9YOH, 9YAF, 9ZJ.

9AVX, St. Paul, Minn.

Spark: 1YB, 2FP, 2OM, 3EL, 3ZV, 4AU, 4BY, 5EK, 5EW, (5FO), 5HK, (5LO), 5QS, (5TC), 5XB, 5XU, 5ZA, 5ZZ, 7ZG, 7ZV, 8CP, 8EB, (8FT), 8HS, (8UC), 8YN, 8ZY, (8ASL), (8AXY), 8AYN, (8BBU), 8BRL, (8BXX), (9AP), (9BP), (9FK), (9GC), 9HT, (9IY), 9JN, (9LF), (9LW), 9ME, (9NQ), (9NR), (9OA), 9OX, 9RY, (9UW), (9VL), 9ZJ, 9AAP, (9AAW), (9ABV), 9AFK, (9AGN), (9AGR), 9AHZ, (9AIF), (9AIG), (9AMQ), (9AMZ), (9AOJ), (9APN), (9ASO), (9AVP), (9ASO), (9AVP), (9AVZ), (9AWX), (9AWZ), (9AXU), (9YAJ), (9YAK), (9AZA), (9AZE), (9DEH), (9DKK), (9DUG), (9DZI), (9DZY), (9BMN), Can. 3BP, 3EI, (3FO), 3GN, (3JL), 3KG.

C.W.: 1ARY, 2CC, 2FP, 2LO, 2AFP, 3CC, 3HG, 4FT, 4ID, 5AT, 5FV, 5IS, 5KP, 5NZ, 5PG, 5TU, 5UU, 8EB, 8II, 8QN, (8VY), 8XI, 8ZV, 8AQZ, 8AIM, 8BOX, 8BZC, 8CAB, 9JL, 9NX, 9YQ, 9ZL, 9ZY, 9AAS, 9AAV, 9ALS, 9AMB, 9BBF.

9APW, St. Paul, Minn.

C.W.: 1BGF, (2FP), 2BEH, 3BTK, 3ZY, 3ALN, 4BQ, 4GL, 5BM, 5CB, 5EK, 5GL, 5HL, 5HB, 5JB, 5OI, 5NK, 5ABY, 6AJH, 5ZZ, 5BES, 7ZU, 8BK, 8BO, 8EA, 8KH, (8OZ), 8QB, 8UC, 8UK, 8VV, 8VY, 8WR, 8XE, 8VC, 8ACF, 8ADN, 8ALB, 8ANB, (8AIO), 8AGZ, (8AWM), 8BBU, (8BDO), 8BDM, 8BEI, 8BJC, 8BLW, 8BFX, 8BZY, 8BKE, 8BSH, 8XAE, 8ZAE, 9CX, 9KM, (9IO), 9PI, 9PS, 9WQ, 9WU, (9AAP), 9AAU, 9ADF, (9AIY), 9AJH, 9APE, (9AJA), 9ARK, 9AMB, 9AOR, 9AOU, (9AOG), (9AYU), 9APE, (9BFA), (9BED), 9BIK, 9BHD, 9BBF, 9BHQ, 9BO, 9BSD, 9DAX, 9DSM, 9DHQ, 9DIO, 9DZJ, 9DUN, 9DTA, 9DTH, 9DWY, 9DXT, (9DZQ), (9DKY), 9DVJ, 9DXN, (9YAJ).

Spark: 5HK, 5HR, 5SM, 5XB, 5UE, 8EW, 8UC, 8EA, 8YN, 9FX, 9KI, (9FK), 9IY, 9LF, 9NQ, 9LW, 9RY, 9XT, (9AAW), 9AEY, 9AFW, 9AFD, 9ALM, 9AQE, 9ATN, 9AVZ, 9AZA, (9BCF), (9BSZ), 9BOF, 9DKK, (9DUG), (9DYY), 9DSM, 9DSO, 9DMJ, (9YAJ), 9YAK, 9ZJ.

9BGD, Kendallville, Indiana

C.W.: (1ARY), (1AZW), 1CNR, 1QP, (1XM), (2AYV), 2BEX, 2BGI, 2BTJ, 2CFT, 2KP, 2VC, 2ZK, 3ALL, (3ALN), 3ALU, 3ANY, 3BA, 3BFU, 3BHL, (3BZ), (3CA), 3FP, 3HG, 3IW, 3QU, 3QV, (3QZ), (3ZO), (4BQ), (4BY), (4DC), (4GL), (4GX), 4XD, 5DA, 5ND, 6NK, 5QS, 8ADQ, (8AIO), 8AIX, (8ALB), (8ANB), (8AQZ), (8ARP), (8ASK), (8AWF), (8AWM), (8AWP), (8AXC), (8BAS), (8BAA), 8BCA, 8BCL, (8BDB), 8BDM, (8BDU), 8BEI, (8BFX), 8BGM, 8BKE, 8BKT, 8BLW, 8BSA, 8BU, 8BWK, 8BXH, (8CAG), (8CAY), 8CAZ, 8CFP, 8CGZ, 8CID, 8CKO, (8DV), 8GV, (8HJ), 8NV, 8OZ, 8PT, 8RB, 8SE, (8SP), 8TB, (8UC), (8UK), 8VE, (8VJ), 8VQ, (8VV), (8VY), (9XE), (8ZAE), (8ZL), (8ZZ), (9AEQ), (9AJA), (9AJH), (9AKD), 9ALK, 9APB, 9AOG, (9ARK), 9ARZ, (9ASB), (9BAF), 9BDB, 9BHQ, (9BIK), 9BKK, 9BLC, 9BTA, 9CBA, 9CT, (9DAX), 9DAY, 9DCT, 9DKY, 9DSG, 9DYN, (DZQ), 9FZ, (9II), 9IL, (9IO), 9KF, 9KM, (9PC), (9UC), 9WU, 9WR.

Spark: 1HG, 3DM, 3EH, (3FB), 3TA, (4BI), 4FD, (5HK), 5JI, 5PE, (8AFB), (8AFD), (8AIZ), 8AOE, (AWU), (8AY), (8BDU), (8BEP), (8BSY), (8ZQ), 8CGZ, 8CH, 8CLF, (8DZ), (8EA), 8EO, (8EW), (8JJ), 8KY, (8LB), 8LQ, 8NO, 8PT, (8RQ), (8TK), (8UK), 8VH, (8WU), (8ZO), 9AAW, 9ACH, (9AEY), (9AFK), (9AGR), 9AKM, (9AMQ), 9AQG, 9ARR, 9ASG, (9ASN), (9ASO), (9AUA), (9AWU), (9AYW), (9AZA), (9AZE), (9AZF), (9BAK), 9BAX, 9BEC, 9BKP, 9BQB, 9DCB, 9DEL, 9DEU, (9DFB), 9DGX, 9DHZ, 9DIO, 9DLQ, 9DMJ, 9DRW, (9DSO), (9DTN), (9DUG), 9DWX, (9FS), (9HG), (9HR), (9LF), 9LU, (9MC), (9ME), (9OX), 9PD, 9PE, (9QR), 9TV, (9UU), 9WE, (9WK), (9ZC).

9DTC, 9DVL, 9BHM, 9BRV, Naperville, Ill.

C.W.: 1PR, 1XM, 1XZ, 1ARY, 1AZX, 2AZ, 2FP, 2NZ, 2ZY, 2AUF, 2AYV, 2BEM, 2BES, 2BFX, 3BA, 3BG, 3BV, 3BY, 3BZ, 3CA, 3FR, 3FS, 3II, 3IW, 3JS, 3ZO, 3ZQ, 3ZX, 3AJW, 3BEC, 3BHL, 3BIJ, 4AS, 4BC, 4BQ, 4BY, 4DC, 4EB, 4FT, 4GL, 4ID, 4IV, 4JH, 4KC, 4LP, 4YA, 4ZH, 4AAV, 5BM, 5EK, 5FO, 5FV, 5HB, 5IG, 5JB, 5KP, 5KV, 5LU, 5MT, 5ND, 5NK, 5RB, 5RL, 5RZ, 5UQ, 5WO, 5ZA, 5ZL 5ZAK, 7AA, 8BO, 8BV, 8EA, 8GV, 8PE, 8PN, 8PT, 8QZ, 8SE, 8UE, 8UC, 8UK, 8VE, 8VY, 8WA, 8WR, 8XE, 8XV, 8XA 8ZH, 8ZZ, 8ACF, 8AFB, 8ACO, 8AIC, 8AIO, 8AIS, 8ALB, 8ALT, 8ALZ, 8ANB, 8ANJ, 8ANX, 8ARD, 8ARK, 8ARW, 8ASM, 8AUE, 8AWM, 8AWR, 8AXB, 8BBU, 8BCL, 8BDF, 8BDO, 8BDU, 8BEF, 8BEO, 8BFX, 8BGF, 8BGJ, 8BKN, 8BLU, 8BLW, 8BKE, 8BQU, 8BZC, 8CAZ, 8CBJ, 8CFP, 8CKM, 8ZAE,

Spark: 5AL, 5EW, 5FC, 5HK, 5LB, 5TU, 5UO, 5XU, 5ZL, 5ZZ, 5ABB, 5ABY, 8XE, 8ZA, 8AFB, 8AFZ, 8AHE, 8AWU, 8BSY.

9AHC, Ellendale, N. Dak.—One Tube

C.W.: 1AZW, 1BKQ, 1BWJ, 1QP, 2CCD, 3ALN, 3BG, 3BIJ, 3BTK, 3IW, 3ZY, 4AZ, 4BQ, 4BY, 4FT, 4YA, 5AAC, 5BM, 5DO, 5EK, 5FO, 5FV, 5IF, 5JB, 5LA, 5ND, 5NZ, 5OI, 5RL, 5ZA, 6ZAA, 5ZU, 6BES, 6CS, 6KA, 6RM, 6XAD, 6ZF, 6ZZ, 7ZU, 8AAX, 8ABO, 8ACF, 8ADG, 8AIO, 8ANB, 8APT, 8AQF, 8ARD, 8ARK, 8ASM, 8AUH, 8AWM, 8AWX, 8AXB, 8AXC, 8BCL, 8BDU, 8BET, 8BFX, 8BGD, 8BJC, 8BKE, 8BLW, 8BO, 8BSS, 8BXH, 8CHC, 8CKM, 8DV, 8IZ, 8ML, 8OZ, 8PI, 8PT, 8QB, 8QZ, 8UC, 8UK, 8VJ, 8VY, 8XAK, 8XB, 8YD, 8YS, 8ZZ, 9DGQ, 9EI, 9IO, and several hundred nearer 9's, AA7, Canadians 4CB. 9AL.

Fones: 9ZA, 9AKX, 9ASF, 9BNO, 9DBM, (9PI), 9ZAF.

Spark: 4BI, 5ABY, 5FO, 5HK, 5IR, 5LB, 5MF, 5NK, 5NS, 5PE, 5QI, 5QS, 5SM, 5TU, 5XB, 5XD, 5XU, 5YE, 5YG, 5ZL, 6ZAM, 7LY, 7MP, 7ZO, 7ZV, 8AIT, 8AJV, 8AWU, 8BAZ, 8BEP, 8BRL, 8BXX 8EB, 8LQ, 8UC, 8XD, 8XE, 8YN, (9BGX), (9BRI), 200 miles full dalite, 1-5 watt and single wire at 9AHC, (9LW), 9OX, and many other 9's heard.

9DQB & 9DRV, Mt. Carmel, Ill.

C.W.: 1IN, 1BME, 2AJA, 2BEA, 2NZ, 2XAI, 2XJ, 3AQR, 3AOV, 3BP, 3BHL, 3BIJ, 3HZ, 3MO, 3QZ, 4AS, 4BY, 4EH, 4FF, 4FT, 4GL, 4HP, 4IV, 4LP, 4ZC, 5ABM, 5AL, 5DO, 5DJ, 5EK, 5EU, 5HB, 5JB, 5OI, 5LA, 5TT, 5XAK, 5XU, 5YG, 5ZA, 5ZAP, 5ZL, 5ZX, 8ANO, 8ARZ, 8AWZ, 8ARU, 8AWX, 8BDU, 8BFX, 8BI, 8BKE, 8BLW, 8BNO, 8CAZ, 8BPO, 8EA, 8OZ, 8QZ, 8XE, 8YA, 8ZZ, 9AK, 9AAS, 9AAV, 9AAW, 9AAY, 9ABU, 9AJA, 9AJH, 9AKD, 9AOU, 9AMI, 9AOV, 9ARK, 9ASL, 9ASY, 9ATA, 9AWA, 9BP, 9BZ, 9BAF, 9BAP, 9BBF, 9BIK, 9BLO, 9BND, 9BRL, 9DCR, 9DGI, 9DGQ, 9DKY, 9DQK, 9DZQ, 9IO, 9EI, 9JR, 9KP, 9LA, 9PS, 9QF, 9VK, 9WA, 9XM, 9YC, 9YK, 9YAK fone, 2XJ, 2XAI, 9MC, 9XM, 9ZAF.

Spark: 3ABB, 3AOV, 4BQ, 4BI, 5DO, 5FO, 5GI, 5HK, 5KC, 5SM, 5XA, 5YE, 5ZL, 5ZAA, 5ZAB, 5ZAR, 8EA, 8YA, 8AG, 9ACB, 9AIY, 9AFX, 9ARR, 9ASJ, 9AXU, 9DDZ, 9AZA, 9DLR, 9DQQ, 9DZI, 9DKK, 9GU, 9IF, 9LF, 9MC, 9PE, 9UU, 9ZJ, 9ZL.

9AOG, Lawrence, Kansas.

C.W.: 1BGF, (2BEH), 2BML, 2FP, 2RM, 3BA, 3BUV, 3IW, 3QV, 3QZ, (4BF), 4BQ, 4BY, 4CB, 4CO, 4EB, 4GC, 4GL, 4KU, 4ZC, (5AAC), (5AAM), 5BM, (5CB), 5DO, (5EK), 5FO, 5FV, (5HB), 5HL, (5JB), 5LA, 5LJ, 5MT, 5MX, (5OI), 5PB, 5RL, (5XU), (5YG), (5ZA), (5ZAT), 6BES, 6JD, 6KA, 6XAD, 6ZAC, (7ZU), 8AGO, 8AIM, 8AIO, 8AIX, 8AJV, 8ALB, (8AMM), 8ANB, 8AQF, (8AQO), 8AQZ, 8ARK, (8AUY), (8AWM), 8AWP, 8BDB, 8BFX, 8BKE, 8BLW, 8BRL, 8BSS, 8BU, 8BZY, 8CFP, 8CKM, 8CLW, 8CMM, 8CQL, (8EA), (8HJ), 8HM, 8OZ, 8PT, 8QB, 8RQ, 8SP, (8UC), 8VQ, 8VY, 8XE, 9AAP, 9AC, (9AEG), (9AEQ), (9AIY), (9AJA), (9AJH), 9AJS, (9AKD), (9AMB), 9AMO, (9AOR), (9AOU), (9APE), (9APW), (9AQR), (9ARG), 9ATE, 9ATU, 9AUA, (9AXF), 9AYU, 9BAF, 9BBA, (9BBE), 9BBF, 9BDB, 9BDP, 8BDZ, 9BED, (9BFG), 9BGH, (9BHD), 9BJB, (9BLC), (9BOA), 9BOW, 9BP, 9BRC, 9BSG, (9BTA), 9BUN, (9BWK), 9BYB, (9CCS), (9CT), 9DAX, 9DDH, (9DIO), (9DJB), (9DKW), (9DKY), (9DOF), (9DPE), 9DPG, 9DPL, (9DR), (9DRW), (9DSK), 9DSM, (9DTA), 9DTS, 9DUG, (9DUN), 9DWY, 9DXE, (9DZQ), 9EI, 9EW, (9FZ), (9IF), 9IL, 9IO, 9IZ, 9JG, 9KP, 9LQ, (9NU), 9OF, (9OO), (9PI), 9PS, (9QE), (9QF), (9SJ), 9SL, 9SO, 9VK, 9WA, (9WD), 9WK, (9WQ), 9WU, 9XAQ, (9XI), (9YAJ), 9ZL, AA7, Canadian 4BV.

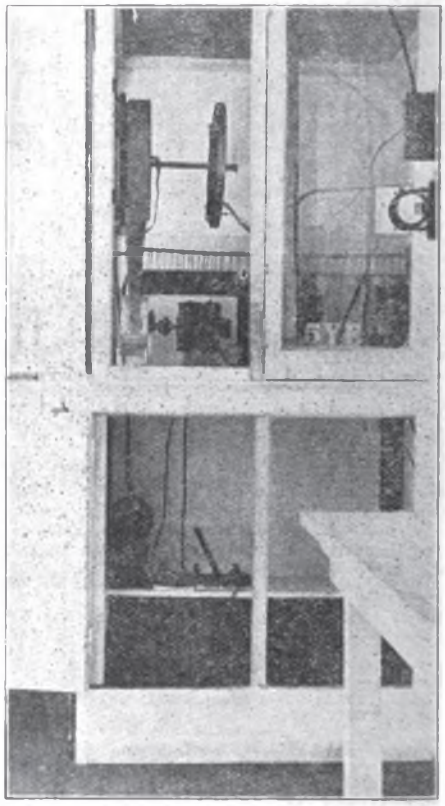
Spark: 3JL, 5ABY, 5BE, 5CA, 5FI, (5FO), 5HK, 5HL, 5IF, 5IQ, 5JD, (5JF), 5MF, 5MR, 5NC, 5NS, (5PE), 5QS, 5SM, (5TC), 5TG, 5TU, (5UE), (5YG), 6EX, 7ZV, 8AHQ, 8AIT, 8ATJ, 8AXN, 8BBU, (8BXC), 8EB, (8JJ), 8UC, 8YN, (8ZO), 9AAW, 9ABV, 9ACN, 9AEY, 9AFK, 9AGR, 9AHZ, 9AIG, 9AIU, 9AJB, (9ANO), 9AOJ, 9APK, (9AQE), (9AQZ, (9ARG), 9ARP, (9ARZ), 9ATN, 9AUL, (9AVH), 9AVK, (9AVX), (9AVZ), 9AWX, 9AXU, 9AYW, 9AZA, 9AZF, 9BIW, (9BKK), 9BLB, (9BLW), 9BNT, (9CAK), 9DAN, 9DAZ, (9DDZ), 9DFA, (9DGW), (9DJB), 9BDD, (9BLC), 9DLU, 9DLY, (9DMJ), (9DPE), 9DPG, 9DRW, (9DOT), (9DSD), 9DSO, 9DUG, (9DVF), 9DWT, 9DZI, 9DZY, 9EV, 9FF, (9FK), 9GP, 9HI, (9KA), 9LF, 9LW, 9MC, 9OX, (9RR), (9RY), 9SN, 9SY, 9TH, 9TV, 9VL, 9VZ, 9WI, 9WT, 9WX, 9XI, 9WT, 9WX, 9XI, (9XT), (9YAJ), 9YM, 9YO, (9YU), 9ZH, AA7.

5YE, UNIVERSITY P. O. MISS.

(Concluded from page 59)

equipped with a Magnavox, DeForest wavemeter and all switches for charging the batteries without moving.

In the "Calls Heard" column of QST 5YE has been report d from Battle Creek, Montana, Hartford, Conn., Roswell, N. M., and has been reported QSA in thirty-three states. Sustained communication has been kept up with Ellendale, N. D., and with Tela, Honduras. The station is maintained by the Physics Department of the University of Mississippi under the direction of Prof. W. L. Kennon, A.R.R.L. District Supt.



for Mississippi, and operated by a corps of students always ready to handle relay traffic.

Wouldn't It Be Wonderful—

If we had been born rich instead of with brains?

If the predictions come true about movies by wireless?

If someone admitted that A. L. Groves was right for once?

If somebody would invent a wire hairnet to be worn with a pair of Murdock phones?

If people would see the A and L in A.R.R.L. emblems and stop asking you what railroad you worked for?

If visitors on listening to KDKA would quit asking you to tune out static so the music would be heard plainly?

If Round's round ground could be installed in 30 minutes?

If nobody sent "CQ", including 8ACS?

If you didn't occasionally hear your own call being signed off by some other bird?

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.

Check!

Chicago, Ills.

Dear Editor:

More and more are we being reminded of the presence of the novice, with his broadcasting receiver. They are taking our air, and taking our magazines.

I have just finished reading the May "—— ——", and notice that while the magazine is larger it is entirely turned over to the novices and their broadcasting. Not one line is left for the old A.R.R.L. gang who originally put the magazine on its feet. Probably they will make more money from the novices, so I suppose it is their privilege to throw us out. But gosh, old boy, don't let 'em have our QST. I notice our new "With the Radiofone" department. While it is not very big it, is a step toward giving the novices our QST. We'll divide the air with them, and divide our magazines —but not QST! That's sacred ground, and "they shall not pass!"

Sincerely,
R. W. Wahlstrom, 9RC.

Bum Fist?

2012 Metts Avenue,
Wilmington, N. C.

Editor, QST:

Howcum station 4EW is being reported all over the eastern part of the country when said station is not even in operation? In the last few weeks I have received cards from about fifty stations reporting my C.W. sigs QSA in about fifteen states. Having been advised by Inspector R. Y. Cadmus that call 4EW has not been reissued by mistake, I cannot but think that some bird is using my call either through ignorance or intentionally.

Several of the cards received were from amateurs who had worked this station, and one letter stated that the name given him by radio was Edwin Y. Webb. Upon reference to the call book he of course found my name and address, and accordingly sent the letter to me.

I shall be duly thankful to Mr. Edwin Y. Webb if he will communicate with me and get the matter straightened out, or to anyone who can give me his address so that I may communicate with him.

Very truly yours,
Albert Davis, 4EW.

Tell 'Em

Jamestown, N. Y.

Dear Ed—

Now that there are about 600000 "novices" who care nothing or comparatively little about the work of the A.R.R.L. and its members at large, I sugest that each and every member of our organization, whether he has a call or not, get out his paint brush and make a sign that can be read from some little distance. Have the would-be sign painter paint in bold and vivid style the letters, "A.R.R.L." and if he has a call have him plaster that on the nameplate so that all the world can read it without glasses. Then after the paint has set, let him hunt up the family hammer, procure some nails and march to the tree that shades his front lawn and absorbes nine tenths of his antenna current and "hang up his shingle".

With this done, it is an easy matter for a brother from a neighboring city to locate a real Radio Man instead of one of some three or four months experience, who persists in calling these poor excuses we now have for tubes "globes", etc.

Yours truly,
Ex-8AAI (2nd).

Home-Made Knobs

Box 287, Gastonia, N. C.

Editor, QST—

Here is a "kink" that may be useful to some fellow amateur who needs some knobs right away and is either "broke" or has no wireless supply store near by. This was my plight and I solved it in the following manner.

My father is a dentist, and consequently has a good many pieces of Kerr's Impression Compound lying around the laboratory. This compound is a maroon-colored substance that is easily softened by hot water, and when in this condition it can be easily molded with the fingers or prest into a mold to make any style or size knob. While it is hot a set screw can be forced in from one side and when the knob is cold the threads will be found inside of the hole as if cut with a tap. It would be well to be sure that the compound is prest tightly about the screw while hot as the threads will hold the strain better and be stronger.

When cold the compound is of reddish

color, hard, and a very good insulator. Used pieces of this compound may be obtained from any dentist who makes false teeth. It may be used over and over again by softening and re-molding.

So long, O.M.,
Dan McConnell.

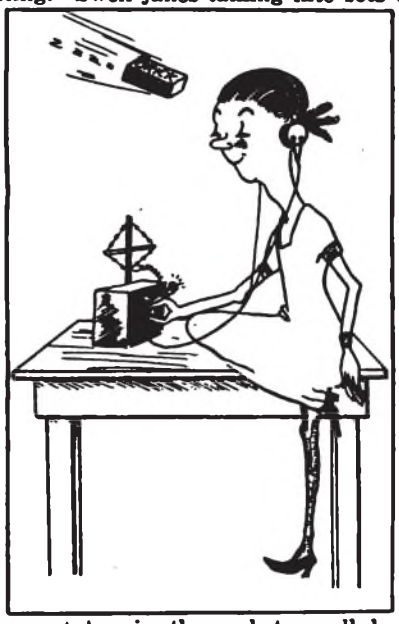
P.S. Any inquires will be gladly answered. Some of you bugs in other parts of the country write me.

These Radio Photographs

Podunch, N. J.,
April 1st, 1922.

Dear Editor:

This radio game is getting punk lately. Why, pick up any newspaper and take a look at some of the radio pictures they are printing. Swell janes talking into sets that



have no tubes in the sockets, well known men listening in on receivers that have nothing connected to them, faithful Fido listening to his master's voice coming from a six foot loud talker connected to a $16 crystal set, and wotinellnot. The one that got my nanny was one showing a sweet young thing listening in, the cans clamped on her toostie ears, and her face registering love, longing, sighs, etc. The caption to the foto was—"Receiving her morning kiss by the wireless"—note the "the wireless." Accordingly, I took my trusty pen in hand and penned this missive, also the cartoon attached. Print it, and let the public know something of the farces that are being put over on them.

Your brass pounder,
Amplifier Ambrose.

—(Reproduced from "The Modulator," of New York City, the Second District's amateur magazine.)

De Pearson fm Ardrossan

The following is a letter to Paul Godley from Mr. Pearson who, it will be remembered, was checking operator with "Paragon Paul" at Ardrossan and whose picture appears along with the account of the A.R.R.L. Transatlantic Tests described in our February issue.

S. S. Saturnia,
At Portland, Maine.

Dear Friend:

I have been extremely busy as most of my spare time has been devoted to association work, and when I get home at night I have not had the heart to write. How are you, auld friend? Now that I am on your native soil I am filled with longing to see you and have a chat. It seems ages ago since our Ardrossan affair. Was delighted to know of the warm and enthuastic welcome you received. It was due you as you certainly stuck it well.

I was seriously thinking of coming down to the "village" from here, but when I calculated how many bottles of Scotch food I could buy with the cash I would spend on train fares, I be-grudged the fare. There is not much danger of getting a New York boat from Glasgow, as all of the passenger boats from there are operated by the Radio Corp. The ship goes to Montreal until the end of the season, about November, and I fancy this will be my home from home until then. Though not much of a liner she is up-to-date with good gear, having a C.W. transmitter type A1, direction finder 11A, valve receivers, etc., etc. Our principle cargo is whisky and as you know "where the body is there shall be the vultures". My predecessor got fired owing to lack of capacity.

Did you get your cash from the custom's at Southampton all right? Your full report in the QST was extremely interesting to me. It recalled dirty nights but on the whole I enjoyed it and would not mind turning to again. Next year I presume some one will be visiting the old country with a "phone". I hope I am on the job. There have been dozens of visitors abroad wanting to see the set and yours truly. Somehow it has been circulated that I am aboard "Saturnia" and long explanations (dry work) has been my unhappy lot. The enthusiasm is keener than mustard round this district; even the ladies are seriously interested. Three of them yesterday stayed over an hour listening to a concert.

If you are writing to Mr. Warner, be good enough to thank him for the copy of QST which he forwarded to me. I shall be pleased to assist in any way this summer. It might be interesting to know how many stations can be heard. When we are off Labrador coast coming through Straits of Belle Isle I will tune in for amateurs (if work permits it) every fourth hour for

20 minutes commencing midnight 75th meridian time (three days after boat sails from Montreal we will be in Belle Isle Straits). Perhaps your friend Mr. Armstrong will send "MGES". Gee. it makes me smile even yet.

We are sailing today for Halifax, then dear old dirty Glasgow, due about 24th inst. Sincerely trust this finds you in the best of health. Will be delighted to hear from you at your earliest convenience. Kindest regards.

Yours sincerely,
D. E. Pearson,
30 Stirrat Place,
Barrhead, Renfrewshire, Scotland.

Defending Cages

Schenectady, N. Y.

Editor, QST:

Seeing Mr. Braden's letter in the April QST concerning cages and flat-tops I should like to say a few words in favor of the cage.

I have had several transmitters including 1 K.W. spark and 100 watt C.W. sets. I have been using a flat-top 50 feet high and 75 ft. long of 3 wires 8 feet apart, for several years. The antenna current on spark was 4 thermocouple amperes with the flat-top and a buried ground system.

Using 2 U.V.203 Radiotrons supplied with 1250 volts at 375 mils on the plates and 10 volts on the filaments the maximum antenna current was 3.2 thermocouple amperes with ground and 4.0 with 1300 foot radial counterpoise. The greatest DX on the C.W. was Washington, D. C.

About 5 weeks ago I put up a cage antenna 50 feet high and 60 feet long, 2 feet in diameter and consisting of 6 stranded wires. Temporarily I used a single wire lead-in and the antenna current was 4.6 T.C. amps. On the first night I had the cage, almost any station that I called came back with report of "QSA vy."

Next day I put a 4 wire cage lead-in on and the antenna current went up to 5.3 amps., where it has remained. Inside of a week I received 32 cards from as far west as Chicago, from 1VT and 3BAG. A card from 2CAH said that I came in like local stuff right thru QRM from New York City. I had never been able to do such DX work and I expect that with further improvements in the set itself that I can get out better still.

I give all the credit of doubling my range to the cage antenna. The cage lead-in, it seems to me, gets the juice into the antenna and the cage seems to be a better horizontal radiator of energy than a flat-top.

Hoping this will interest some of the gang, I am,

Respectfully yours,
Charles E. Gardiner,
Radio 8TB.

"Violet Rays"

Hico, Texas.

Editor, QST--

In looking through March QST I came across a letter by one Eoline R. Hand, which dealt with the violet ray machine as a radio transmitter (see page 62). I do not know that there has ever been any previous mention of this but I can hardly conceive of any one having to go to the trouble he took to find out whether it would affect radio receivers. I am using a short wave regenerative receiver without amplifiers, and I can say without exaggeration that whenever a violet ray machine in one hundred yards of my set starts to "reach out" I might as well quit trying to receive for not even a 1 K.W. set 20 miles from here can be read. It does not make any difference whether the applicator is brought near a conductor or not, the effect is the same.

When the first of these nuisances made its appearance in our town I was at a loss to find a way to account for the rather mysterious "signals". The machine was some distance from here, and did not, therefore, come in very loud. It sounded like some "ham" with a plain aerial hook-up sitting on his key. We, a friend "bug" and myself, thought it was some one installing a spark coil set with a plain aerial, but we listened in vain for his first sigs. Later two or three others made their appearance, none of them very close to either of us. It was not till the OM at our house purchased one that we found the solution to the mystery. And I for one would have preferred to remain in ignorance. I think there are a dozen or more here now, some of them pretty close.

For the benefit of those contemplating experimenting with these machines I will say that the violet ray machine is just a spark coil of small size connected to an oscillating circuit in which is the primary of the high frequency transformer of a few turns. The secondary has a great many turns and hence the output is high frequency high voltage current. It is a well known fact that a high frequency electrical discharge when passed through a rarified gas will cause that gas to glow, the color depending on the kind of gas used. The term "Violet Ray" is derived from the fact that the output passes through a tube of gas which gives this distinctive color when operating. Naturally the good to be derived from this machine comes not from the violet rays as such but from the fact that there is a high frequency current present. In fact, it is probable that the same results would be accomplished if the violet rays were entirely eliminated. But I am digressing from the subject. It will be readily seen from the above description that the machine is simply a minature radio transmitter the whole of which is contained

in the case and the output of which instead of being connected to an antenna and ground is connected through the violet ray tube, the patient's body, (and the operator's body in some cases) returning by leakage through the air or by the condenser effect of the patient's body and the terminal of the secondary not otherwise connected. It is not at all surprising then to find that it can be used as a transmitter. Nor should one be surprised to learn that its wave is very broad and probably of a multiple character, as well as very high decrement. I think the wave of the ones here extend up to about 1000 or 1500 meters and down as far as the tuner can tune. Their decrement seems to be about "*1000*". So I would not advise anyone to use these machines for radio transmitters unless the "oscillation transformer" is removed and a real one properly coupled and adjusted is substituted in its place. In its original form it is certainly a QRM factory de luxe. It may be that it can be so adjusted that it can be used to advantage for short distances and possibly for directional sending though I do not think it likely that it can be used for more than a few miles at the best.

I am writing this with the hope that it will be published so as to give the radio fraternity a little more knowledge on a line that bids fair to become a great nuisance as the machines in use increase in number. Not that I claim to know it all for I confess that I do not by any means, but my letter may be the means of getting some one who does know to give us his information. I would very much like to know how to stop the QRM it causes, if perchance some kind fellow-bug will enlighten me. I have tried everything I know of but the only plan discovered so far is to cut off the "A" & "B" batteries, lay the phones on the table and QRT until it is finished.

Wel, OM, CUL Best 73's de "SOL".

Theron Eakins.

Expert Testimony

Noroton Heights, Conn.

Editor, QST—

I presume you have read in the papers of the wave of crime that has swept New York. It has extended even to the "radio departments" of several of the papers. The other evening the "radio expert" of the Evening Mail told in beautiful language of the functioning of the detector. He said that it was just like a one-way door. It allowed the radio frequency current to pass in one way only, and the result was that one half of the oscillations were cut off, and the reduction of the radio frequency wave by 50% thus converted it into audio frequency, so it could be heard. In the same issue, another author (?) claimed that the antenna was the "door" of the receiving set. Pity the poor tyro. I guess he'll be ready to think that the peep holes in front of the tubes are the "windows" through which the carrier waves come into the little receiving house.

And the enclosed is, to me, mighty interesting. According to the writer, messages leave our transmitters from the end of the aerial, and "enter" on the *end* of the ground, which is the same as the trailer of the 'plane. Please tell me where the end of my ground is. I'd like to locate it as, if I could bring it closer to my set, it would undoubtedly make the path of the incoming messages shorter, and, by the same line of reasoning the messages would be louder, and there would be no need of amplifiers. Great stuff to feed the newcomers on.

With best regards,

P. E. Fansler, 1XAA.

Radio Phones—and Honesty

By L. Q.

NOT so very long ago an acquaintance of mine drove up to the shop with an old car.

"Well George, what do you think of my $400 car?"

"She'll do for a couple of seasons if we can get rid of that crankshaft knock and patch the radiator and put in a new rear end."

"Well, here's an honest man and a friend. You're the first one that has *knocked*" this old wagon."

Moral—When a radiofone asks you "Hrrow ishrr mrryr modrrulatiourr" be an "honest man and a friend" to him and to Radio and say—

"You have a savage commutator roar and need a filter, also the set overmodulates and rattles badly. Want me to come and help fix it?"

There is a Prest-O-Lite Battery for Radio Use

Especially designed for radio purposes, it comes in a handsome box, mahogany finish, with rubber feet to avoid scratching furniture. It harmonizes with the decorations of any home.

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Choose a Prest-O-Lite for your radio equipment. Ask for it at any Prest-O-Lite Dealer, or your electrical dealer will get it for you.

We advise the selection of a battery of ample capacity to avoid frequent recharging—when it needs recharging there is a Prest-O-Lite service station in your vicinity.

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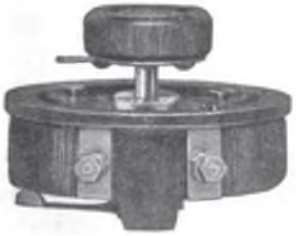
BATTERY
FOR RADIO USE

To A.R.R.L. Operators
A Chat Among Ourselves

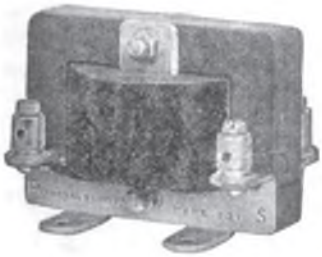
TYPE 156
Vacuum Tube Socket
Price $1.50

Prior to 1917, the radio experimenter was looked upon as a sort of pest. When the war broke out and the radio operators were needed, he was one of the first to be called to the colors. After the war came the fight to regain the pre-war transmitting privilege. This victory won and conditions stabilized, so that serious thought could be devoted to relay routes and Trans-Atlantics; then came the broadcasting. With it the inflation of radio.



TYPE 214A
Filament Rheostat
Price $2.50

The radio pest again became a hero. He was called upon daily to build sets or recommend instruments for the newcomers. What is he doing? He is using and recommending the same make of instruments that gave him reliable service prior to 1917, during his wartime service, and since the re-opening of his station.



TYPE 231A
Amplifying Transformer
Price $5.00

The General Radio Company supplied you with instruments of quality before the war, during the war, and ever since. The enormous demand that you have made on us by recommending our instruments to the newcomers has, naturally, taxed our plant to the extreme. We are doing our best to meet the demand. We are not cheapening our instruments. You have relied on them in the past and you may continue to do so in the future. Every instrument that we have ever manufactured has been guaranteed. Continue to buy instruments where quality counts.

Send for Free Radio Bulletin 911-Q

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—have been designed and are now under production by the Monarch Telephone Mfg. Co. These new Head Sets reproduce vocal and musical sounds with remarkable distinctness. They are high grade throughout; not a cheap product in any way. We have built high grade telephone equipment for over 20 years, and are well qualified to manufacture high quality Radio equipment. Plugs, keys, jacks, cords and binding posts can also be furnished.

If your jobber or dealer does not have Monarch Head Sets in stock, let us hear from you.

Code No. 2-A 2000 ohms..$8.00
Code No. 1-B 2500 ohms..10.00
Code No. 1-C 3000 ohms..12.00

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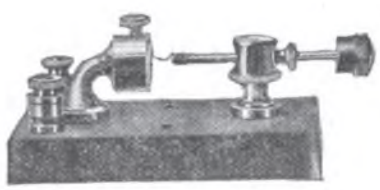
Monarch Telephone Mfg. Co.
FORT DODGE, IOWA

EMSCO RADIO PRODUCTS - MADE BY EXPERIENCED ELECTRICAL MANUFACTURERS



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Decidedly the best detector so far produced. Sturdy and well made of the best materials. "Turret-Top" swivel adjustment permits the greatest range of adjustment and holds the phosphor-bronze "cat whisker contactor" steadily in any position. Thumblock assures permanent adjustment. Locking-notch feature of binding posts exclusive with this detector. Unbreakable base. A fair example of EMSCO quality and value.

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Single and Double Wound Rotors 8"—8½"
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3/16 x7 Extension Threaded
Weatherproof Strain Insulators
Vario Couplers
Single Slide Tuners 6"—8"
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Double Slide Tuners 6"—8"
Enamel Wound Coils 6x8" 8x8" 8x8½"
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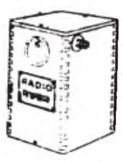

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Gives Clear Uniform Delivery
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Immediate Delivery
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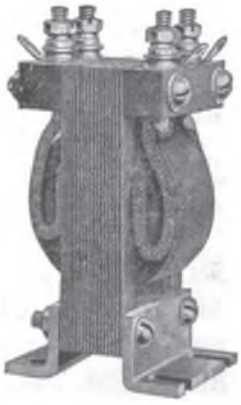
The most efficient and conveniently arranged Microphone for Radio Telephony is the No. 260-W Hand Set illustrated above. All exposed metal parts are nickel plated and highly polished, and a metal hook is provided for hanging up. The handle is made of corrugated hard rubber and of a size easy to hold. On account of the novel shape and position of the mouthpiece the Microphone is always in proper position for best results.
Fitted with 6ft Cord, Price in U.S.A.....$7.00 each

The FEDERAL JR. is, in itself, a complete receiving set requiring nothing more than the aerial wires for its operation. It is most ruggedly and simply constructed, beautiful in appearance, simple in its operation and absolutely reliable. No batteries or other source of power are required for its operation nor are replacements of any kind ever required.

The FEDERAL JR. radio telephone receiver is built of highest grade material throughout; it has been designed with the highest type of engineering skill with the aim of making it of highest possible efficiency compatible with ruggedness of construction and simplicity of operation. It is built with the same careful attention to detail that has given FEDERAL apparatus its high place in the electrical world for the last 20 years.

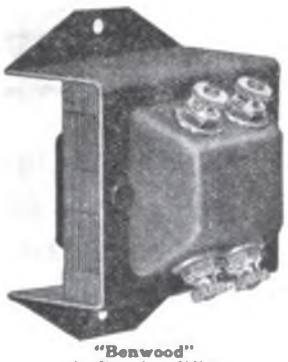
AUDIO FREQUENCY TRANSFORMERS

The amplifying qualities of the FEDERAL No. 226-W Transformer can be attested to by thousands of satisfied users. The impedance at 500 cycles is the same as the internal impedance of the standard tubes available today. The flux leakage is kept at a minimum, reducing the tendency to oscillate, due to stray fields between circuits in cascade amplification. Price in U.S.A.....$7.00



Federal Telephone & Telegraph Company

BUFFALO, N. Y.



"Benwood"
Audio Amplifier

Full 4 to 1 Amplification

Without Howling or Squealing

THE new Benwood Transformer is especially made to get maximum amplification when used with any bulb on the market.

It is completely sheathed in metal, avoiding all inductive effects, so that it gives full 4 to 1 amplification without howling or squealing. The base is 2⅝"x3¾", height only 2"—ideal for either base or panel mounting. The core is best laminated steel, giving highest transference of energy—it will bring in your phone signals loud, strong and clear. The "Benwood" Amplifying Transformer, each **$5.00**

FINER TUNING—
Signals Louder and Clearer

A PROPERLY designed variometer brings in signals very much louder and clearer than the various other types of inductances on the market. With this fact in mind we have designed the "last word" in variometers—the "Benwood." Inductances are wound with double cotton covered wire and no shellac, paint or varnish is allowed to cover the wire and diminish the effectiveness.

The "Benwood" features are—minimum distributed capacity, minimum distance between stator and rotor, large size wire on both coils, positive contact bearings and proper design. This variometer will get splendid results on wave lengths from 150 to 650 meters with the average variocoupler. Price, each.... **$5.00**

"Benwood" Variometer

The New, Improved "Benwood" Dial Controls

THE "Benwood" dial controls all have solid Bakelite knobs of extra large diameter, which minimize all bodily capacity effects, and the new tapered design fits the fingers perfectly. The knurling is particularly fine and sharp.

Solid Bakelite Knob and Dial

Graduated 0° to 100°—all markings clearly defined in white and stamped into the solid Bakelite—won't wear off. Rib on reverse side prevents turning too far. Set screw deeply countersunk and easily reached.

	Diam.	Depth	Knob		Each
BC-7 "Benwood" control	4"	1⅝"	2"	at base	$2.00
BC-8 "Benwood" control	3¼"	1 1/16"	1⅝"	at base	$1.75

Specify whether ¼" or 7/32" drilling is required.

Solid Bakelite Knob—Metal Dial

Has the same tapered solid Bakelite knob as BC-7 and BC-8 but has metal dial. Finely graduated from 0° to 180°

BC-9N "Benwood" control—Nickel Plated Dial 3 7/16 Diam. Each, 80c
BC-9 "Benwood" control—Black Metal Dial 3 7/16 Diam...Each, 80c

Specify whether ¼" or 7/32" drilling is required.

Send for Catalog

Send 10c in stamps for the Benwood Catalog and price list, also complete catalog and price list of DeForest Radio Equipment.

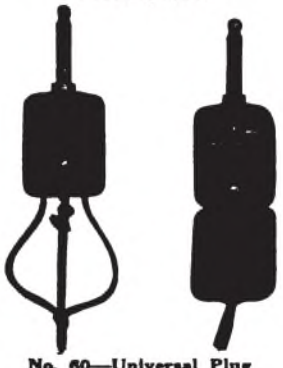
Dealers—
We manufacture high grade apparatus in our own factory, and have stock ready to ship. Write or wire for our attractive agency proposition and liberal dealers' discounts.

The BENWOOD RADIO Co. INC.

"WORLD-WIDE MAIL ORDER SERVICE"

1114 OLIVE STREET - ST. LOUIS, MO.

No. 2-A Radio Headset
Price $7.50



No. 60—Universal Plug
Price $1.25

No. 147 Radio Jack $0.85

No. 148 Radio Jack $1.00

Radio Comfort

The thrills of wireless entertainment **in the home are enjoyed only where high grade receiving apparatus is installed.**

You can ensure the maximum of radio **pleasure and comfort** by insisting upon having **your receiving outfit** equipped with—

Stromberg-Carlson Radio Parts

There is the Stromberg-Carlson "Radio Head Set" with—its pleasing fit, its quick adjustment, its fine tonal qualities and its ability to faithfully reproduce even the faintest long distance signals.

There is the Stromberg-Carlson "Universal Radio Plug" which should be attached to every Head Set. It fits any standard jack, takes any type or size of conductor; takes wire loops, tinsel loops, pin tips or spade tips.

And there are the Stromberg-Carlson "Radio Jacks" which are adapted to all standard radio plugs and which are designed to mount neatly, without washers, on panels that are of varying thicknesses between ⅛ and ¼ inches.

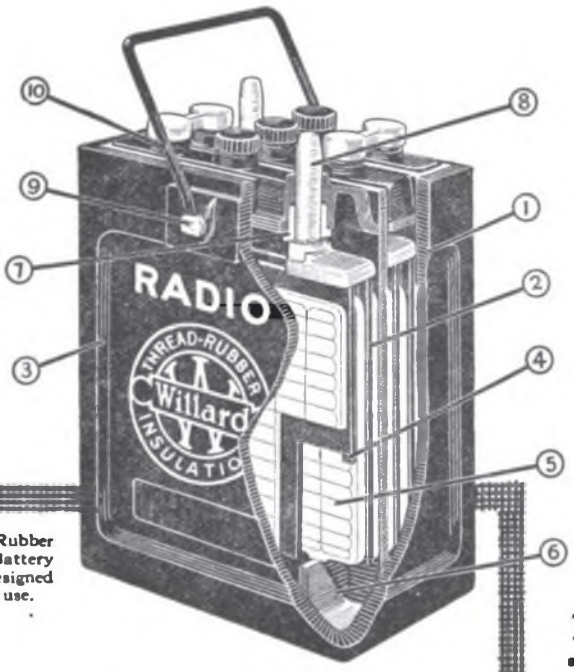
Stromberg-Carlson Radio Products are backed by a firm that has had twenty-eight years experience in the design and manufacture of radio and telephone apparatus.

Order Stromberg-Carlson Radio apparatus through your dealer in electrical merchandising or write for free Bulletin No. 1029-Q.

Stromberg-Carlson Tel. Mfg. Co.

Rochester, New York

Chicago Address Nearest Office **Kansas City**



The Willard All-Rubber Radio "A" Battery (shown here) is designed especially for radio use.

Ten Reasons Why The Willard All-Rubber Radio "A" Battery is Better

These reasons, back of the success of this specially designed battery, are as definite as those responsible for the success of the Willard Threaded Rubber Battery, which is now standard original equipment on 195 makes of cars and trucks. Ask for particulars from your dealer or at the nearest Willard Battery Station.

The Willard Radio "B" Battery is a 24-volt rechargeable storage battery, with leak-proof glass jars and Threaded Rubber Insulation. Assures freedom from frying and hissing ground noises.

WILLARD STORAGE BATTERY CO.
Cleveland, Ohio

Made in Canada by the
Willard Storage Battery Company of Canada, Limited, Toronto, Ont.

Willard THREADED RUBBER BATTERY

1 The rubber case is made in one piece, thoroughly insulating the battery from cells to ground and from cell to cell, and effectively preventing all ground noises.

2 Plates are insulated with Threaded Rubber Insulation, which by reason of its uniformity allows every part of each plate to do an equal share of work.

3 Battery is shipped in absolutely Bone-Dry condition so that it is brand new when you get it.

4 Insulators are made with special heavy ribs to meet the special requirements of the radio battery.

5 Plates are extra heavy to provide current at steady voltage for considerable periods.

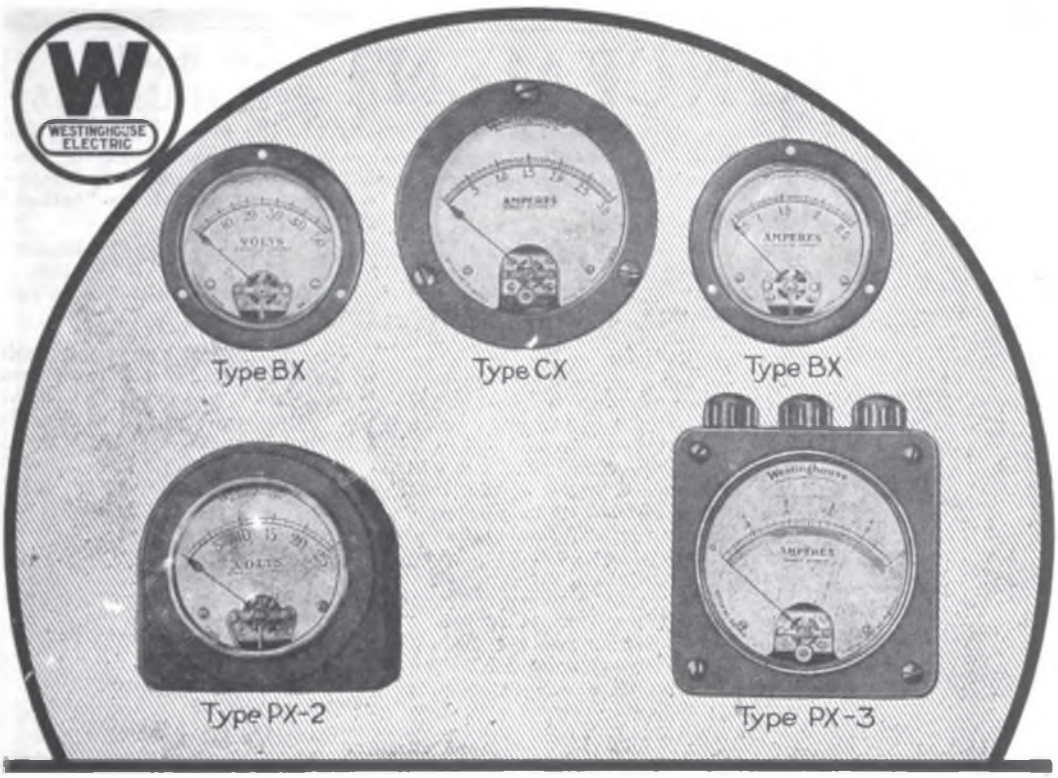
6 Sediment chambers are large to eliminate all possibility of short circuits at plate bottoms.

7 Posts are sealed by soft rubber gaskets, so that solution cannot seep out between post and cover.

8 Terminal posts are high to permit easy grip of battery clamps.

9 Brass knobs sunk into the sides of the rubber case provide a firm hold for the handle.

10 Handle made of a heavy rod furnishes easy means of carrying the battery.



EVERY RADIO SET

Should have its proper equipment of

Westinghouse Measuring Instruments

The D-C. Ammeter in the filament circuit indicates the current flowing through the filament, thus avoiding overloading. It prolongs the life of the filament, reducing expense. Also, it facilitates duplicating previous settings, irrespective of a change in battery voltage.

The D-C. Voltmeter gives a sure indication of the condition of the battery.

The Radio Frequency Ammeter tells at a glance the amount of electrical energy being radiated, thus showing the strength of the signals.

These instruments possess, to an unusual degree, the qualities essential to satisfactory performance. The line is distinctive and harmonious. The important characteristics of readability, ruggedness, ease of maintenance and repair have been given careful consideration. These features are obtained by a refined design and precise construction, resulting in exceptional accuracy over long periods of service.

The Portable Types are of miniature size and are strictly high grade, accurate instruments. The cases are made of moulded composition, which is acid resisting, and of pleasing appearance.

Write our nearest district office for a copy of folder 34471 which completes, describes and lists these instruments.

Westinghouse Electric & Manufacturing Company
Newark Works, Newark, New Jersey

Westinghouse

OUR POLICY

is to carry only the most efficient and satisfactory goods on the American and European market.

The selection of our apparatus is made by experienced engineers who have been in the radio business for more than 20 consecutive years. We are, therefore, eminently qualified to select and offer reliable and high quality equipment.

A few representative lines follow:

Cutting & Washington Co. of N. Y.
A complete regenerative receiver and two step amplifier in a single, highly finished cabinet, very selective and sensitive. Designed by the engineers of a famous commercial wireless telegraph company **$125.00**

Acme Apparatus Co., Boston

Detector and two step amplifier, $45.00

Simplex Radio Co. of Phila.

Single unit panels, variometers, variocouplers, detectors, amplifiers. Appearance, efficiency and workmanship of the very best.

Distribution is made to dealers by mail or by our salesmen. Our men handle radio goods exclusively (not as a side line), and are therefore in a position to render valuable service to the dealer.

BEAUMONT RADIOPHONE CORP.

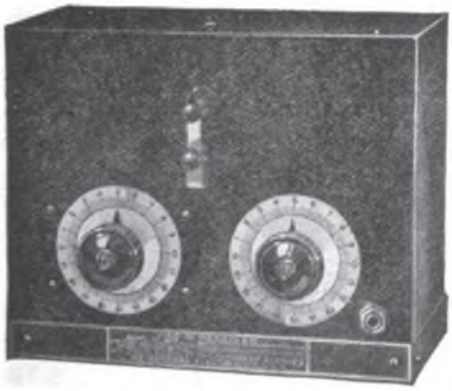
DISPLAY ROOMS,
1326 ARCH ST.,
PHILA.

WHOLESALE DEPT.,
319 ARCH ST.,
PHILA.

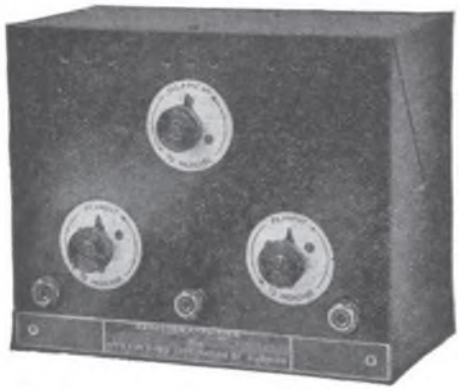
DISTRIBUTORS FOR

Cutting & Washington Radio Corp.—Complete receivers.
Acme Apparatus Co.—Transformers, panel sets, receivers.
Simplex Radio Co.—Single unit panels.
Western Electric Co.—Head sets, loud speakers.
Electric Storage Battery Co.—Storage batteries.
Weston Electrical Instrument Co.—Ammeters, voltmeters, etc.

Crystal or Vacuum Tube Detection with the same set



Model AR-1300



Model AA-1400

These two sets (radio receiver Model AR-1300 and Detector Amplifier Model AA-1400) meet the demand of the novice who wishes to start with a simple crystal detector and later to pass on to vacuum tube detection and amplification at minimum cost.

Radio receiver Model AR-1300 is a new tuner for the broadcast enthusiast. Used as a crystal detector it is a complete receiver. Used with Model AA-1400, here shown, the crystal detector is switched off and amplification is controlled by regeneration.

Detector Amplifier Model AA-1400 consists of a vacuum tube detector and two stages of audio-frequency amplification. It is especially adapted for use with receiver Model AR-1300 to increase the strength of broadcasted concerts. The individual filament control permits close regulation of the received energy. Distortion of broadcasted music is avoided by a special high-frequency resistance across the secondaries. Three telephone jacks insure ideal selectiveness ranging from simple tube detection to two stages of amplification.

PRICES (NOT INCLUDING ANTENNA, TUBES, AND BATTERIES)

Radio receiver Model AR-1300	*$50.00*
Detector Amplifier Model AA-1400 . .	*75.00*
Total for Combination	*$125.00*

See these New G. E., Products at Your Nearest Dealer

Radio WORLD WIDE WIRELESS Corporation of America

Sales Department, Suite 1803

233 Broadway, New York City

Rain Won't Injure Your Formica Panels!

FORMICA does not absorb moisture so its insulating quality is never affected by weather or even by soaking in water. It does not swell or shrink and never warps. The handsome high gloss finish does not deteriorate. It looks good for years—and is good!

Formica has been approved as Radio Insulation by the navy and the signal corps. It is by far the most widely used Radio insulating material.

Formica is easy to machine, and helps you do a workmanlike job on your panel. You can buy it cut to size for a standard Radio panel. All you need to do the work is a drill.

Dealers: We supply you with display cards for your store and Formica printed matter. We cut panels to size for you if you wish—and co-operate in every way possible. Extensions to our plant have just doubled our capacity.

The Formica Insulation Company
4620 Spring Grove Ave., Cincinnati, O.

SALES OFFICES

50 Church Street, New York, N. Y.
9 South Clinton Street, Chicago, Ill.
414 Finance Building, Cleveland, Ohio
1042 Granite Building, Rochester, N. Y.
415 Ohio Building, Toledo, Ohio.
422 First Avenue, Pittsburgh, Pa.
Sheldon Building, San Francisco, Cal.
932 Real Estate Trust Bldg., Philadelphia, Pa.
321 Title Building, Baltimore, Md.

FORMICA

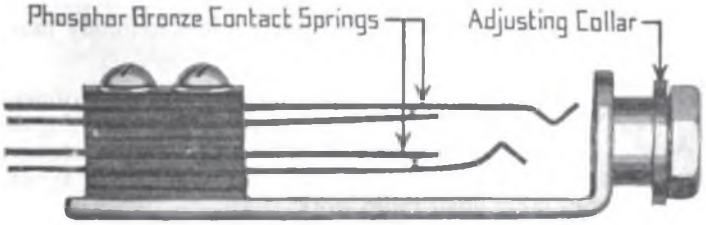
Made from Anhydrous Redmanol Resins

SHEETS TUBES RODS

Champion Radio Company

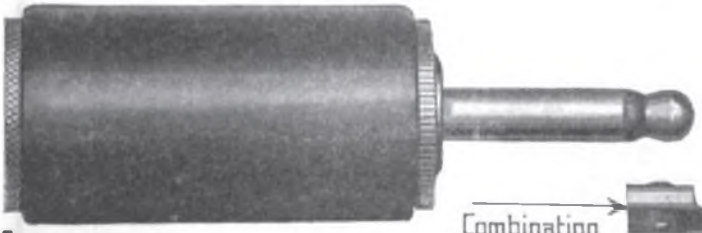
4446 WOODWARD AVENUE

DETROIT, MICH.

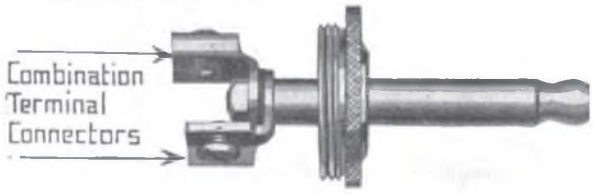


(Cuts Actual Sizes)

No. 10 Jack—Price $1.00



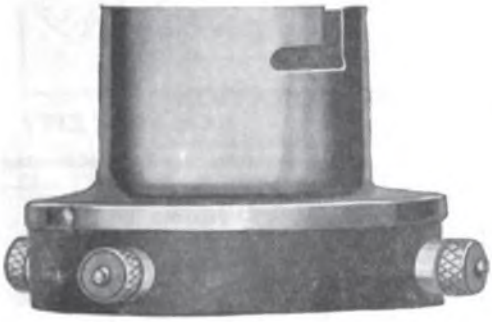
(Cuts Actual Sizes)



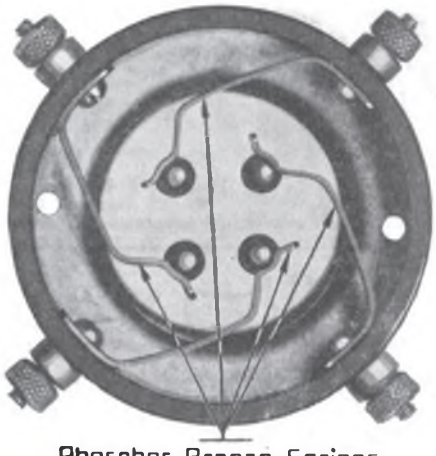
No. 10 Plug

Price $2.00

Combination Terminal Connectors will Accept Straight Tip, Horseshoe Tip or Wire.



Side View

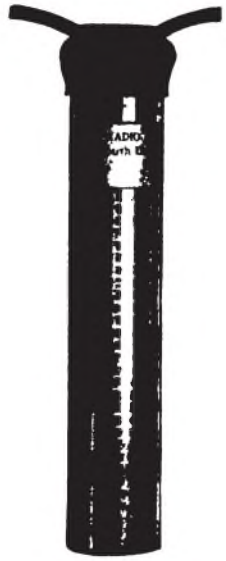


(Cuts Actual Sizes)

No. 10 Audion Socket, nickel finish, black base—Price $1.00

IMMEDIATE DELIVERY. ATTRACTIVE DISCOUNTS TO JOBBERS

"Chi-Rad" Apparatus



Price per cell $0.50
Add PP on ½ lb. per cell.

New Storage "B" Battery

A real storage "B" Battery for your Radio Set at a price every Amateur and Experimenter can afford to pay. Can be used on receiving apparatus as source of plate potential on both Detector and Amplifier tubes. Ideal as source of energy on small Radio Telephones or C.W. Transmitters.

Simple and easy to re-charge from your lamp socket and will last for years with ordinary use.

SPECIFICATIONS:

Cut shows cell one half natural size.
Voltage per cell 2 volts.
Pasted Plates—ready formed for initial charge.
High Ampere Hour capacity—will operate one detector tube 1000 hours with one charge.
Shipped dry with simple directions for preparing the electrolyte.

Mahogany Tray for holding ten cells $1.00 extra

Dealers:—Get our discounts on this new Battery—your customers will want them!

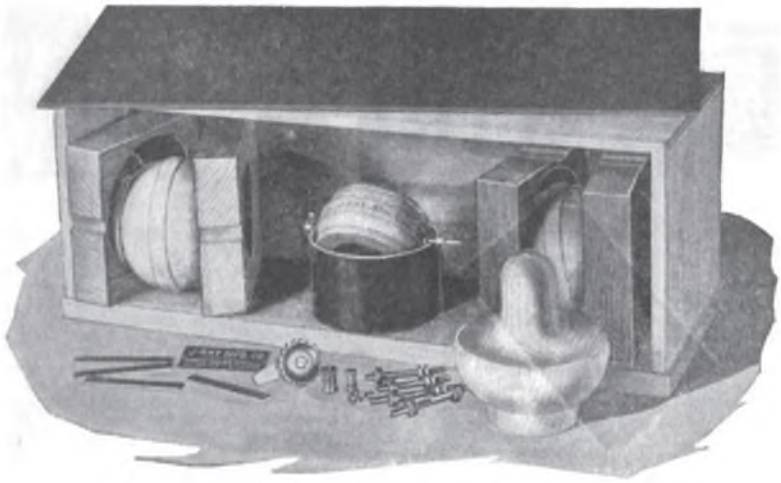
REMOVAL NOTICE

About April 1st we will move to 415 South Dearborn Street where we will open a High-Grade Ground Floor Salesroom. With greatly increased space we will carry every make of good Radio Apparatus and will endeavor to have

"The Finest Radio Retail Salesroom in Chicago."

CHICAGO RADIO APPARATUS CO., Inc.

415 South Dearborn Street, Chicago, Ill.



J-RAY UNASSEMBLED RECEIVING APPARATUS

Self Assembling Saves You 50 to 75 Per Cent.

JR-1. $19.00 Unwound. $23.00 With All Windings

We herewith present our new line of Radiophone Receivers, Vacuum Tube Detectors and Amplifiers, in knock-down or unassembled form.

Each set comes with all holes drilled, directions furnished, etc., making it a very simple and at the same time highly interesting and instructive process assembling the various parts. Each piece of apparatus mounts directly to the drilled Formica Panel, by means of the screws and nuts provided. Wire supplied for making connections.

JR-1—Unassambled Receiver. Consists of the following parts: Polished Oak Cabinet, 18½x7x7 inches, hinged top; 6 Binding Posts; Polished Formica Panel to fit (all holes drilled); 7 Contact Points; Grid and Plate Variometers and Variocoupler, complete ready to assemble; 3 J-Ray White Enameled Dials (not shown); 1 Switch Lever; 2 Stops; all necessary brass parts, screws, etc., for completely assembling the set with directions. Price (with winding form for stator windings)..**$19.00**

JR-2—Same as above, but with all Vario Windings in place.....**$23.00**

JR-3—Unassembled Receiver with V. T. Detector and 1 Stage Amplifier, all in one cabinet. Consists of the complete set of parts for JR-2, plus 2 Crosley or J-Ray Sockets; 2 Fada Rheostats, 1 Amplifying Transformer, 1 Grid Condenser; extra Binding Posts; brass parts, etc., complete with directions. Extra holes provided in panel for mounting Rheostats and Sockets. Price.....**$33.00**

JR-4—V. T. Detector and 1 Stage Amplifier. Consists of Stained Oak Cabinet, 9¼x7x5, hinged top; drilled Formica Panel to fit; 2 Sockets; 2 Rheostats; Grid Condenser; Amplifying Transformer; Binding Posts, etc.....**$16.50**

JR-5—V.T. Detector and 2 Stage Amplifier. Same as JR-4, but with extra Tube Socket, Rheostat and Transformer.....**$22.50**

JR-6—Two Stage Amplifier, without Detector.....**$20.00**

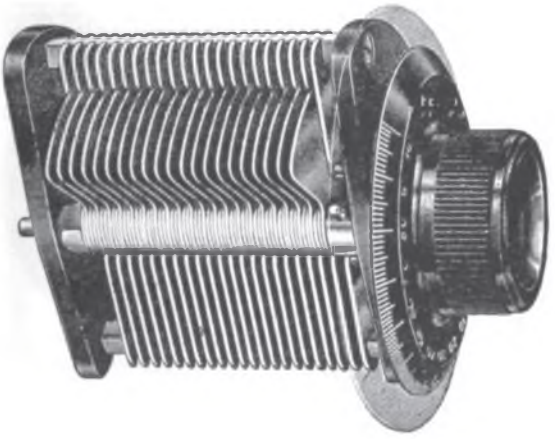
Receiver Cabinet only.....**$5.50** Panel.....**$2.25**

Detector and Amplifier Cabinet..... **2.85** Panel..... **1.15**

J-RAY MFG. CO. 1618 CHESTNUT ST., ST. LOUIS, MO.

WRITE FOR BULLETINS

CONDENSERS



3 Plate	$2.25
11 Plate	3.25
23 Plate	4.00
43 Plate	4.75

Add 75c to above list for condenser with dial.

CAPACITY

3 Plate vernier	.00004
11 Plate	.00025
23 Plate	.0005
41 Plate	.001

Each condenser is equipped with ground shield which eliminates all hand capacity losses. No accumulated error due to poorly cut spacing washers.

BAKELITE DIALS BAKELITE

Furnished in either 3/16 or 1/4 inch shaft sizes. 3″ outside diameter with large and clear numerals. 0-100 degrees.
Price $1.10

This dial is made of genuine bakelite and is guaranteed not to warp. The knob is knurled to prevent slipping of fingers.
Price $1.10

STERN & COMPANY, Inc.

308 Asylum St., Hartford, Conn.

Catalog 10c.

F E S C O

Dealers Propositions Entertained

Signal is Not "Side-Line"

Wireless Apparatus

In the days of rapid Radio development, many companies, with an eye to the "easy markets" have brought out Radio equipment as a sort of "side-line".

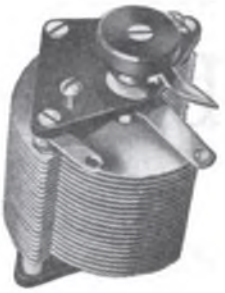
"Side-Line" apparatus is the kind to "side-step," if you want to take pride in your outfit and you are building for permanency.

Whether you are in Radio for profit, or pleasure, it is good to know that

SIGNAL WIRELESS APPARATUS

is manufactured according to best commmercial and government standards—by a company specializing in Radio equipment. SIGNAL Wireless Apparatus has been developed by Signal Radio experts in Signal Laboratories—and is *built for business.*

SIGNAL BACK MOUNTED VARIABLE CONDENSER



You can drop Signal Condensers, No. 76 & 77, to the floor from a considerable height without damaging plates or spoiling adjustment. They are rigidly built. Instead of using aluminum but *.015"* in thickness for the plates, as is usual with ordinary amateur construction, Signal plates are *.026"* thick.

Cut Out and Mail Coupon Now

New Signal Wireless Bulletins describing Signal Wireless Apparatus are free for the asking. Simply fill in and mail this request-coupon.

SIGNAL ELECTRIC MANUFACTURING COMPANY

Menominee, Michigan

COUPON

Send me the new Signal Wireless Bulletin W.

Name .....

Company .....

City .....

State .....

"Read 'Em"
Binding Posts

"Radio's Greatest Convenience"

17 Styles—Packed in Cartons 25 to 50 Each Style

Antenna	**Ground**	**Condenser**
Tickler	**Plate**	**Detector**
Secondary	**Phones**	**Primary**
A-Battery—	**Grid**	**Filament**
A-Battery+	**B-Battery—**	**B-Battery+**

Variable Condenser **A Positive and B Negative Battery Posts**

QUALITY

The quality built into every post is consistent with the high Marshall-Gerken standard. "Read-Em" binding posts are a distinct aid to correct hook-up and add materially to the appearance and efficiency of any set. They are standard with discriminating users.

Complete Post and Knob 15c each

Ask for "Read 'Ems" at Your Dealers

The Marshall-Gerken Co.

Quality RADIO Products

MANUFACTURERS—DISTRIBUTORS

Toledo, Ohio, U.S.A.

WHITALL ELECTRIC CO., WESTERLY, R. I.

IMMEDIATE DELIVERY

Clapp-Eastham HR and HZ sets in the new mahogany cabinets list $40.00 each LIST

Clapp-Eastham Variometers with dial	$6.50
Clapp-Eastham HRF Sets 175-600 meters	35.00
Clapp-Eastham HRA one stage amplifiers	15.50
Federal Telephones Type 2200 Ohms	8.00
King Amp-li-tones	12.00
Electrose Insulators, all types	
WECO All Moulded Bakelite Sockets	.75
WECO Rheostat Dials, latest production, ¼" shaft	.90
WECO 3" Dial for variometers, etc., ⅛ or ¼" shaft	1.00
Electrose Dials Type S, ¼" shaft	1.50
New style Antenna Wire, 16 strand braided cable, will greatly increase both receiving and transmitting range, has very large conducting surface, per C	2.50
ACE Batteries, any style	
BRACH Lightning Arresters, inside type	2.50
Western Electric Telephones	12.00
Paragon Sockets Type No. 50	1.00

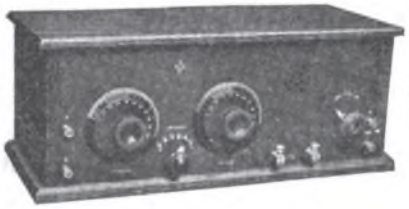
We are distributors for Radio Corporation, Clapp-Eastham, Federal, Ace, Remler, Baldwin, Chelsea, Conn. Tel. & Elect. Co., Eveready, Witherbee, DeForest, Electrose, General Radio, Frost, Murdock, General Apparatus, Wireless Press, Consolidated Call Book Company, King Amp-li-tone and many others.

Dealers write for discounts on above material, and our catalogs.

QUALITY THE WHITALL ELECTRIC CO. WECO WESTERLY RHODE ISLAND **SERVICE**

"YOU WILL LIKE TRADING WITH US"

If QUALITY counts, bear in mind that ACE equipment speaks for itself. An Ace type TRU Concert Receptor can be placed in your parlor, and is in a class with your piano or finest phonograph.

$50  $50

Licensed under Armstrong Patent No. 1,113,149

For electrical efficiency we claim our TRU to be equal or superior to any similar equipment now on the market.

A very important point to be considered in purchasing a Concert Receiver is the proposed change of wave lengths of broadcasting stations. The majority of Radio receivers now on the market would be worthless should this change be effected. Our receiver is arranged for immediate adaption to this change by even a most inexperienced person.

Better investigate—we have literature for the asking.

THE PRECISION EQUIPMENT CO.
2437-39 Gilbert Ave., Cincinnati, Ohio

IN DETROIT

The Radio Center

THE SAY "NATIONAL!"

for

Transmitting and Receiving Equipment

DISTRIBUTORS

A complete stock of high-grade Radio sets and Radio Equipment

PANELS MACHINE CUT TO SIZE

Mail Orders Filled Promptly and Accurately

A 20% deposit required on every order. Satisfactory service assured. Write today!

Every consideration given to dealers.

NATIONAL Electric Supply and Fixture Co.
1338 Broadway, DETROIT, MICH.
"Nationally Known for Radio"

The dials here illustrated are of German Silver, made according to Government Specifications. Anti-capacity type, illustrations ½ actual size.

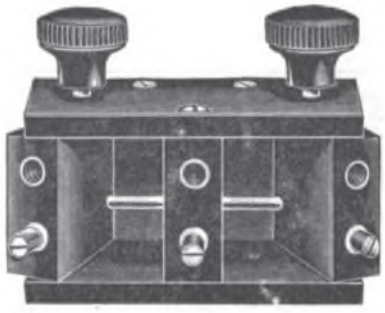
Variocoupler Dial **$1.20**
Grid Variometer Dial **1.40**
Plate Variometer Dial **1.40**
Condenser Dial **1.20**
Condenser Dial, without knob **0.90**

BAKELITE

Genuine XX Bakelite, all sizes and widths, cut according to your requirements ..... **$2.25** per lb.
Cabinets 6x6x12 ..... **$2.50** up

Aetaco Inductance Coil Mounting

The AETACO 3 Coil Inductance Coil Mounting is manufactured from Genuine XX Bakelite—not moulded. Consists of three Bakelite standard plugs held in place by Bakelite frame. Plugs mounted on bearings allows for changing coupler between coils. All metal parts nickel plated. Connecting wire soldered on rear of plugs makes connection easy. Shipping wt. 1 lb.
PRICE **$5.00**



New Model Aetaco Crystal Detector

The AETACO new model Crystal Detector is mounted on Genuine Bakelite XX Grade base —not moulded. Double rubber tip binding posts. Supplied with a super-sensitive mounted galena crystal. Over-all dimensions of detector 2½"x2"x2". Net wt. ¼ lb. Shipping wt. ½ lb.
PRICE **$2.00**

Write For Catalog!

American Electro Technical Appliance Co.

227-229-235 FULTON STREET, NEW YORK CITY

May 1, 1922

Warning to Patent Infringers

Various types of crystal detectors, renewals therefor, and crystal detector radiophone receiving sets now being offered for sale employ the inventions of one or several of the following United States patents (commonly referred to as the Pickard patents) the property of the Wireless Specialty Apparatus Company.

836,531	904,222	924,827
886,154	912,613	1,104,073
888,191	912,726	1,137,714
13,798 (reissue of 877,451)	963,173	1,225,852
933,263	1,104,065	1,257,526
1,213,250	1,118,228	1,136,044
1,136,045	1,136,046	1,136,047

The above patents cover, among other things, the most efficient circuit arrangement of apparatus commonly used in crystal detector radiophone sets, various kinds of crystal members, means for mounting the crystals and holding the mounting, special forms of contacting conductors for the crystals, and mechanism permitting the user's selection of contact points of the contacting conductor on the crystals.

Authorized crystal detectors now are available through the distributors of the Wireless Specialty Apparatus Company, also renewals therefore, and complete crystal detector radiophone receiving sets, all in large quantities, which are sold under the various above-mentioned patents.

The Wireless Specialty Apparatus Company purposes to prosecute, vigorously, all infringers of its patents, and therefore, those manufacturers, distributors, jobbers and dealers who have not been authorized as yet are warned to cease the manufacture or the sale or distribution of crystal detectors, renewals therefor, or crystal detector radiophone receiving sets or any other radio devices which infringe these patents.

Unauthorized distributing or selling, wholly independent of manufacturing, is just as much an infringement as the manufacturing itself, and any seller is separately liable to suits for accounting for damages or profits in addition to injunction.

For their own protection, the distributors, jobbers and dealers who yet may be offering for sale unauthorized crystal detectors, renewals therefor, or complete crystal detector radiophone receiving sets, should demand a guarantee from the manufacturer from whom they purchase radio equipment holding them harmless in case of damage suits arising through their distribution and sale of radio apparatus which infringes the above-mentioned patents.

Crystal detectors, renewals therefor, or crystal detector radiophone receiving sets made and sold with the authorization of the Wireless Specialty Apparatus Company can bo readily identified by the data of the above patents and restriction notices prominently marked on the apparatus.

Wireless Specialty Apparatus Company

BOSTON, MASS. Established 1907 U.S.A.

GIBLIN REMLER

A NEW COIL DEVELOPMENT

1

Assume that the above single layer coil consists of 1000 turns and that the capacity between turns is Y. Then 1000 Y is the total self capacity of this inductance.

2

20 layers high
50 turns per layer
20x50 = 1000 turns

Reduce the length of coil 1 by winding a multi-layer compact inductance of 1000 turns (20 layers of 50 turns). The inductance will be greater than coil 1 due to the greater mean diameter of the turns. The capacity between turns is still Y, but an additional capacity between layers equal to 50xY (the mean of the number of turns in each two layers) has been added. This increase in internal capacity makes the coil unsuited for use as an inductance.

3

The capacity between layers and between turns is reduced by spacing, but this results in a loss of inductance.

4

Maximum inductance is obtained by winding the turns close together. This is the method used in the new Giblin-Remler Inductance, combined with a new method of separating the layers.

GIBLIN'S NEWEST AND GREATEST DEVELOPMENT OF A COMPACT INDUCTANCE COIL

Thomas P. Giblin, originator of the Honeycomb and Duo-Lateral Coils has been working for years to produce an even more efficient inductance coil. Success has at last been achieved in the Giblin-Remler Inductance Coil.

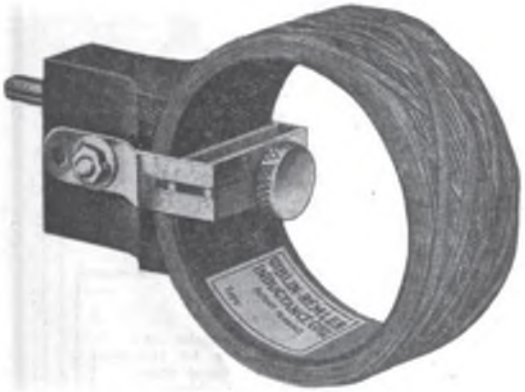
REMLER RADIO MFG.

248 FIRST STREET, SAN FRANCISCO, CAL.

E. T. Cunningham, General Manager

INDUCTANCE COILS

INTERCHANGEABLE WITH ALL COIL MOUNTINGS



Made by an entirely new process, Giblin-Remler Inductance Coils are infinitely more effective in operation and superior in workmanship to any coil on the market today. Its performance for concentrated inductance cannot be approached—it is equally efficient on all wave lengths. The self capacity of the new Giblin-Remler Inductance is far less than any previous compact inductance—this low self capacity gives selectivity and sharp tuning for a given coil. This is especially advantageous to the amateur who usually has an antenna of low capacity. The high frequency resistance is lower than any previous type.

Giblin-Remler Inductance Coils are patentable—they are manufactured by patented machinery. You can purchase them from any authorized Remler Dealer.

5

In the new Giblin-Remler Coil Cotton Yarn is wound into the form of a lattice and simultaneously the wire is wound into the coil in parallel turns. The cotton yarn separates the layers of wire with cotton and air cells. The air cells are extremely important in reducing the high frequency resistance. This method of winding gives maximum copper space and insulation space in a given volume. The insulation between layers is greatest at the points of maximum potential difference.

Type and Number of Turns, Mounted	Price, Mounted	Type and Number of Turns, Unmounted	Price, Unmounted	Inductance in Millihenrys at 1000 cycles Accuracy ½%.	Natural Wave Length in Meters, Accuracy ½%.	Distributed Capacity, in micro-micro-farads, Accuracy 1%.	Wave Length Range in Meters using Condenser of .001 max. and .00004 mfd. min.		High Frequency Resistance in Ohms at Wave Length shown.			
							Min.	Max.	200	500	1000	2000
RG 20M	1.50	RG 20U	.70	.030	39	14.3	63	334		1.1		
RG 25M	1.50	RG 25U	.70	.041	47	15.2	75	389		1.5		
RG 35M	1.50	RG 35U	.70	.063	87	25.4	128	550		3.5		
RG 50M	1.60	RG 50U	.80	.169	114	21.6	185	785		8.8	4.4	
RG 75M	1.65	RG 75U	.85	.377	163	19.8	266	1170		28.3	12.1	6.2
RG 100M	1.70	RG 100U	.90	.666	217	19.9	358	1550		80.3	26.8	12.6
									1000	2000	5000	10000
RG 150M	1.75	RG 150U	.95	1.503	281	14.8	512	2320	69.8	23.8	7.1	
RG 200M	1.80	RG 200U	1.00	2.68	374	14.7	690	3110		50.6	12.5	
RG 250M	1.90	RG 250U	1.10	4.20	424	12.1	860	3880		87.5	19.9	
RG 300M	2.00	RG 300U	1.20	6.11	494	11.2	1030	4680		141	29.3	13.8
RG 400M	2.10	RG 400U	1.30	11.04	618	9.7	1380	6300			54.6	22.3
RG 500M	2.30	RG 500U	1.50	17.50	747	9.0	1730	7900			93.1	34.9
									2000	5000	10000	20000
RG 600M	2.40	RG 600U	1.60	29.2	1024	10.1	2260	10250		111	43.8	
RG 750M	2.65	RG 750U	1.85	39.0	1249	11.3	2660	11850			64	
RG1000M	3.40	RG1000U	2.50	71.6	1620	10.3	3570	16000			123	
RG1250M	3.80	RG1250U	2.90	108.0	1930	9.7	4380	19700				
RG1500M	4.40	RG1500U	3.50	159.8	2300	9.3	5300	23800				

These tests have been made by Robert F. Field of Cruft High Tension Electrical Laboratory, Harvard University, Cambridge, Mass.

Order Giblin-Remler Inductance Coils at once from your nearest dealer—or send direct to us. Learn how remarkably they will improve the performance of your set.

COMPANY

184 W. LAKE ST., CHICAGO, ILL.

Apparatus That Radiates Quality

THE NEW REMLER COIL MOUNTING

SIMPLE TO MOUNT. TIGHTENING BAND BUILT INTO MOUNTING. ELIMINATES FIBER BAND. MOLDED BAKELITE. INTERCHANGEABLY USED WITH REMLER COIL AND PANEL TYPE PLUGS.

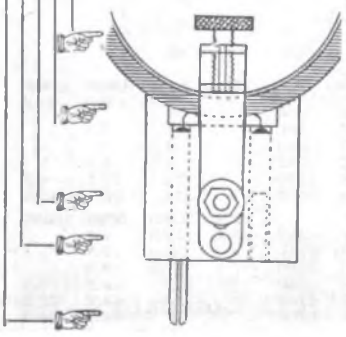
The plug terminal is slotted twice at right angles, insuring smooth, easy plugging

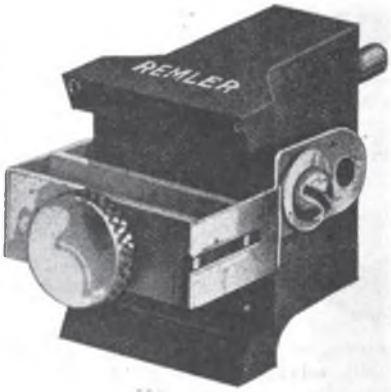
The tightening band is nickel plated. Three holes provide the necessary adjustment and prevent any slipping.

The plug is molded bakelite, buffed finish. The contour is shaped to the coil.

The solder terminals are countersunk, eliminating possible injury to coil winding.

The slot in the tightening band holds the pressure plates in alignment.





This new Remler Coil Mounting with its improved and original features is built especially for the new Giblin-Remler Coils. The plug can be used interchangeably with all Remler coil and panel type plugs.

The metal tightening band—an important Remler feature—eliminates the annoying fibre band and assures perfect tightness at all times. By simply turning the thumb screw the coil is rigidly fastened to the coil contour of the bakelite plug. There is no fibre band to become damp and stretch or to loosen the coil from its mounting.

Built complete by Remler, every operation is checked to insure a smooth working, simple operated plug—a plug with a Remler Guarantee.

PRICE

No. 48—20 to 750 turn coils 70c
No. 49—1000 to 1500 turn coils 80c

Amateurs:—Write for catalogue and name of nearest Remler Dealer.

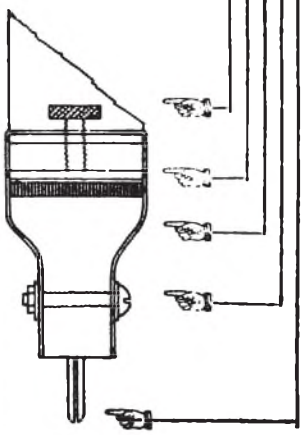
The plug and jack terminals are interchangeable with all standard plug and panel mountings.

The tightening band is securely held to the plug

The lower plate absorbs the pressure on the coil

The upper plate applies tension to the tightening band parallel to the sides of the coil

A turn of the thumb screw separates the pressure plates and securely clamps the coil to the plug



REMLER RADIO MFG. COMPANY

248 First St., San Francisco, Calif.

E. T. CUNNINGHAM, General Manager

154 W. Lake St., Chicago, Ill.

Radio panels

and radio parts

Start right. The panel is the very foundation of your set. High volume and surface resistance are essential factors. Make sure that you get them in both the panel and parts that you purchase. To make doubly certain look for the dealer displaying this sign

CONDENSITE
CELORON

Radio Panel Service

Condensite Celeron Grade 10—approved by the Navy Department Bureau of Engineering—is a strong, handsome, waterproof material, high in resistivity and dielectric strength. It machines easily, engraves without feathering and is particularly desirable for panels. It is also widely used for making many other important radio parts such as tube bases, platform mountings, variable condenser ends, tubes for coil windings, bases, dials, knobs, bushings, etc. We are prepared to make these various parts to your own specifications.

Where economy is a factor we can supply panels of Vulcanized Fibre Veneer made of hard grey fibre veneered, both sides with a waterproof, phenolic condensation product. This material has a hard, smooth, jet-black surface, machines and engraves readily and will give excellent service where very high voltages at radio frequencies are not involved.

Shielded plates (patent applied for) are made with a concealed wire shield. This shield, when properly grounded, effectively neutralizes all howl and detuning effects caused by body capacities.

Send today for our Radio Panel Guide

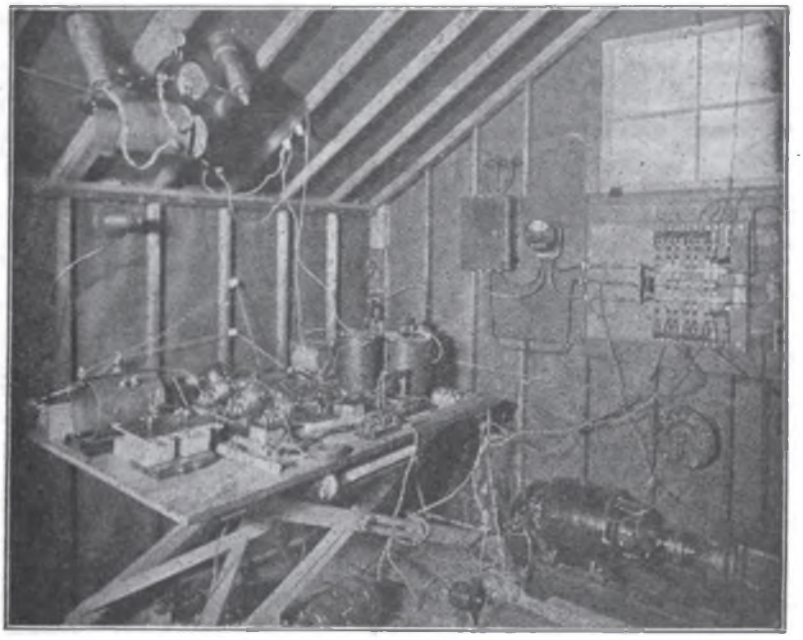
Are you an enthusiast? This Guide describes our panels in detail—gives tests—and tells just how much the panel you want will cost.

Are you a Radio Dealer? Let us tell you how easily and profitably Celoron Radio Panel Service enables you to supply your customers with panels machined and engraved to their specifications. Write today for our Dealer's Proposition covering panels, dials, knobs and tubes.

Diamond State Fibre Company
Bridgeport (near Philadelphia), Pa.
Branch Factory and Warehouse, Chicago.
Offices in principal cities
In Canada: Diamond State Fibre Company of Canada, Ltd., Toronto.

Dubilier Condensers Helped to Make Radio History

"No circuit is stronger than its weakest link." When 1BCG sent its now historical message across the Atlantic, a perfect co-relation of parts and apparatus was necessary. Everything from the commutator on the generator to the lead-in insulator in the roof had to function "just so". During the preliminary tests, the operators of 1BCG were constantly confronted with condenser trouble. One after another, the condensers would break down. It is always best to use the right thing in the right place, so two Dubilier Mica Condensers were placed in the circuit and the weakest link was immediately repaired. From that moment on, the condensers were forgotten because they could be trusted—they were reliable.



Are your condensers the weakest link in your circuit? There is a Dubilier Condenser to meet your every need. Dubilier Condensers are different because their construction is patented and they are manufactured by a controlled process. Send for literature describing them today.

The next time you visit your radio dealer, ask to see Pacent Radio Essentials. We sell apparatus plus service.

Pacent Electric Company, Inc.

150 Nassau Street, **New York City**

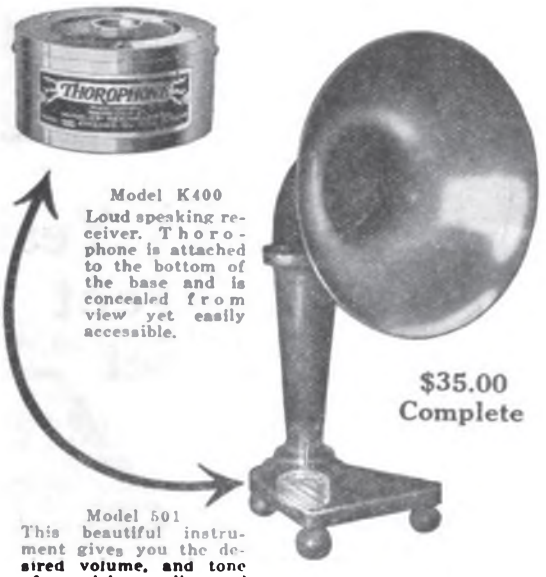
Member Radio Section Associated Manufacturers of Electrical Supplies.

Enjoy the Great Radio Concerts No Matter Where You Live

THOROPHONE

(THUNDERPHONE)

TRADE MARK REG. U.S.PAT. OFFICE



Model K400
Loud speaking receiver. Thorophone is attached to the bottom of the base and is concealed from view yet easily accessible.

$35.00 Complete

Model 501
This beautiful instrument gives you the desired volume, and tone of exquisite quality and musical excellence.

Will Bring America's Popular Orchestras and Most Renowned Soloists Into Your Home

Winkler-Reichmann Co., America's OLDEST manufacturer of Loud Speaking Telephones, offers the THOROPHONE for RADIO CONCERT WORK as its latest success.

In bringing out the THOROPHONE with Concert Horn—beauty and clarity of tone—ample volume—and mechanical perfection have been made outstanding features of design. Lay aside your head receivers—invite your friends in—enjoy with them a real musical treat. Use the THOROPHONE also for detecting and tuning.

The Thorophone requires better than the average radio receiving set to give a great, big powerful volume, but just give it the power and its musical qualities will astonish you.

THOSE DESIRING TO USE THEIR OWN PHONOGRAPHS CAN DO SO BY ATTACHING OUR ADAPTER WITH THOROPHONE DIRECT TO PHONOGRAPH TONE ARM.

The Loud Speaking Receiver— THE THOROPHONE

Has a controlled mica diaphragm, and carefully designed sound box nickel plated throughout. Does not use up your storage battery. Simply connect it on in place of your head receivers.

THOROPHONE
Model K400—$20.00
Phonograph adapter extra
Model 350— .40

THE CONCERT HORN

Is a beautiful musical instrument, highly ornamental to any home. The base and tone arm are of mahogany finish wood, the neck of heavy metal and the bell of extra heavy spun aluminum. It has great brilliancy, WITHOUT METALLIC TONE.

CONCERT HORN
Model H300—$15.00
Height 25 inches.

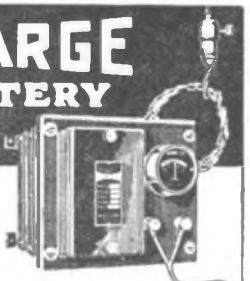
WINKLER-REICHMANN CO.

4801 South Morgan St., Chicago, Illinois

Dept. Q

DEALERS: We have a REAL loud speaker and a REAL proposition for you.

HOMCHARGE
YOUR BATTERY
for A Nickel



No muss, trouble, dirt—no moving of batteries—loss of time—no effort on your part—no technical or professional knowledge needed.

THE
HOMCHARGER

successfully meets all charging conditions, and is the only rectifier combining the following essential Homcharging features.

1. Self polarizing. Connect battery either way and it will always charge. No danger of reverse charging, ruined battery or burnt out Rectifier.
2. No delicate bulbs to break or burn out. Only one moving and two wearing parts. These are replaceable as a unit, after thousands of hours use, at small cost. Cannot be injured by rough handling.
3. Operation stops and consumption of current ceases immediately upon disconnecting battery.
4. The only charger costing less than $100.00 that will fully charge a battery over night. Gives battery a taper charge—exactly as recommended by battery manufacturers. Guaranteed not to harm your battery even though left connected indefinitely.
5. Highest efficiency of any three or six cell charger made.
6. No danger of fire. Approved by the Underwriters.

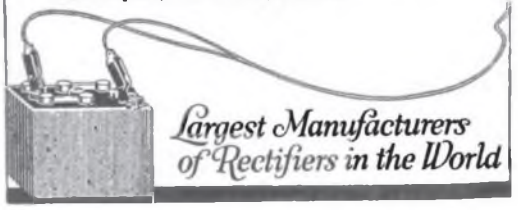
ATTENTION MOTORISTS

Will charge your auto battery as well as radio battery. Send for Bulletin No. 58 for further information.

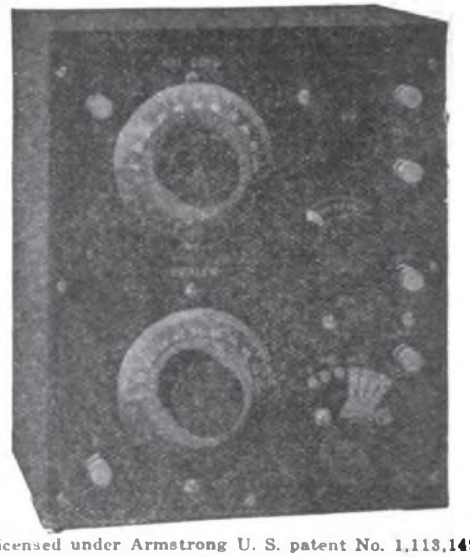
For sale by all radio, electrical and accessory dealers or shipped express prepaid for purchase price $18.50
$20 West of the Rockies

The Automatic Electrical Devices Co.
127 West Third St., Cincinnati, Ohio.

Branch offices: New York, Chicago, Pittsburgh, Los Angeles, New Orleans, Detroit, Philadelphia, Baltimore, Dallas.



Largest Manufacturers of Rectifiers in the World



(Licensed under Armstrong U. S. patent No. 1,113,149)

It Took 14 Years to Perfect This Set

WE have specialized exclusively in radio for more than fourteen years. Every one of those years has contributed something important to our latest Type H. R. Regenerative Receiving Set. We sincerely believe it to be the best set of this type on the market today—regardless of price.

Novices and experienced radio men alike praise its simplicity of operation, its sharp, clear tones, its wide range, its careful workmanship, its neat appearance. And invariably they express surprise at its unexpected performance. 6c stamps will bring you our new Radio Catalog—containing full information regarding this set and other radio equipment.

CLAPP-EASTHAM CO., 139 MAIN STREET
CAMBRIDGE, MASS.

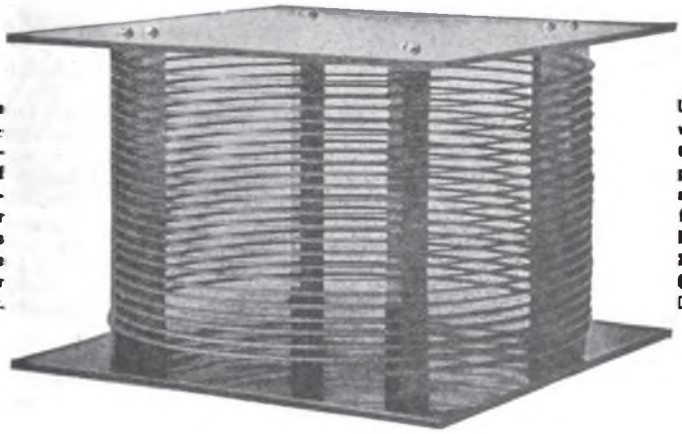
Clapp-Eastham
Type HR
Regenerative Receiving Set

SPECIFICATIONS:

CABINETS: Solid mahogany, dull finish.
PANEL: Condensite, dull finish, machine engraved white lettering.
DIALS: Indestructible metal, black with white lettering.
CONDENSER: Balanced type, built as a Vernier; 2 rotary, 3 stationary plates.
ANTENNA INDUCTANCE: Wound on formica tube.
PLATE INDUCTANCE: Wound on molded ball.
BINDING PARTS: Black rubber covered.
SWITCH: Fan blade.
RHEOSTAT: Clapp-Eastham type H 400.
CIRCUIT: Single circuit regenerative.
"B" BATTERY: Contained in inside compartment or external, as desired.
PRICE: $40.

We can't make ALL of the radio apparatus — so we just make the BEST of it

The use of the WIMCO INDUCTANCE assures you of maximum results from your C.W. outfit. Its low resistance means greater antenna output.



Used everywhere where the best apparatus is desired. Order from your Dealer. Price 25 turn size $10.00. Grid Coil $2.00 extra.

WIMCO C.W. 100 INDUCTANCE

The following data on the resistance of the WIMCO C.W. INDUCTANCE was furnished by the Washington Radio Laboratories, Washington, D. C. It was measured for ten turns, this being the average number of turns in use on most amateur aerials at 200 meters wave length;

Wave Length	H. F. Resistance
150	.71 ohms
200	.85 ohms
250	.95 ohms

(effective inductance 80.5 microhenries at 200 meters)

Full description of this inductance, and circuit diagram is contained in the WIMCO catalog, mailed anywhere on receipt of 15 cents in stamps.

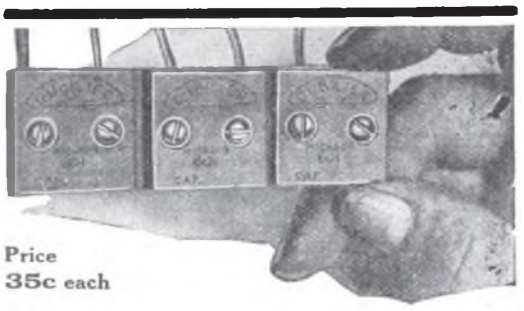
ANNOUNCING THE "STANDARD" AUDIO FREQUENCY AMPLIFYING TRANSFORMER. We are distributors for the new Standard amplifying transformer designed for Cunningham and Radiotron tubes, 9 to 1 ratio, equal to any transformer on the market, and are in position to make immediate deliveries. Price $5.00 fully mounted and thoroughly guaranteed. DEALERS—JOBBERS WRITE.

REMLER APPARATUS—CUNNINGHAM TUBES—FROST REGENERATIVE RECEIVING SETS—CLAPP-EASTHAM AND FEDERAL PRODUCTS—HIPCO PLATE BATTERIES—WORKRITE VARIOMETERS AND COUPLERS—KLOSNER VERNIER RHEOSTATS–FADA APPARATUS–BRANDES AND BALDWIN HEADSETS

8ZV WIRELESS MANUFACTURING CO. 8ZV

CANTON, OHIO

JOBBERS—MANUFACTURERS



Price
35c each

Better Reception With Micadons 601

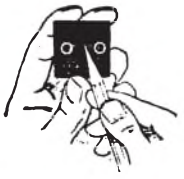
Dubilier Micadon Type 601 is made like the famous larger, Dubilier mica condenser, which is the standard equipment of 95% of the governments and radio companies of the world.

Dubilier Micadon Type 601 is a little larger than a postage stamp. Use Micadons Type 601 to build up any capacity by connecting them in series or parallel. Buy Micadons by the dozen and keep them on hand.

Dubilier Micadon Type 601 insures perfect broadcasting reception. Because the capacity is permanent, tube "howls" and noises are reduced.

Price 35 cents each for capacities .0001 to .0005 mfd; by the dozen $4.00. Price 40 cents each for capacities .001, .002, and .0025 mfd; by the dozen $4.50.

MAKE YOUR OWN GRID-LEAK WITH A LEAD PENCIL



Sandpaper the surface of Dubilier Micadon Type 601 between the terminals. Next rub the point of a black lead pencil over the roughened surface as here shown. To adjust the grid-leak thus made rub away as much of the graphite that has been deposited as may be necessary. Every tube should have an *adjusted* grid-leak, and this is the way to make one simply and cheaply.

Order from your dealer

DUBILIER CONDENSER AND RADIO CORP.

Department Q. S., 217-219 Center St., New York

Munsey Building, Washington, D. C.

LICENSEES:—
Canada: Canadian General Electric Co., Toronto
England: Dubilier Condenser Co. Ltd. London
Germany and South America: Telefunken Co., Berlin

MAGNAVOX Radio

Everyone will envy you these evenings of pleasure

INCREASE to the utmost the enjoyment and use you now get from your receiving set—equip it with a Magnavox Radio, (the perfected Reproducer.)

The Magnavox Radio does away with the restrictions of headsets—its clear, powerful tones are enjoyed by all.

With the Magnavox Radio the hookup is simple, and no extras or adjustments are required.

Without a Magnavox Radio no wireless receiving set is complete.

Radio brings it, MAGNAVOX tells it

Any radio dealer will demonstrate for you, or write to us for descriptive booklet and name of nearest dealer.

The Magnavox Co.
Oakland, California
N.Y. Office: 370 Seventh Ave.

MURDOCK

radio necessities

No. 56 Phones

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

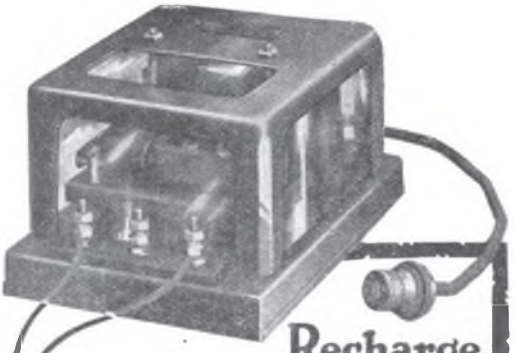
Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices $5.00 to $6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

Buy Murdock apparatus from your dealer.

WM. J. MURDOCK CO.



Recharge Your Battery at Home

Charges both A and B Radio Batteries

Don't be without the use of your Radio Receiving Set while your battery is being charged. Get a **Valley Charger** and charge your battery right at home.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick, tapering charge which just exactly charges your battery, but cannot overcharge it or harm it in any way.

Will charge the A 6 volt battery at a 5 ampere rate, and the B 22½ volt battery at the required ½ ampere rate. 45 volt B batteries may be connected in parallel so that they can also be charged

SATISFACTION GUARANTEED. If your local distributor cannot supply you, write direct to

VALLEY ELECTRIC COMPANY,
Department Q, ST. LOUIS, MO.

- - - - - - - Mail the Coupon- - - - - - -

Valley Electric Co., Dept. Q, St. Louis, Mo.

Gentlemen: I am enclosing money order (or check) for $18.00, for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory, I will return it and get my money.

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Name

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Address

$18.00
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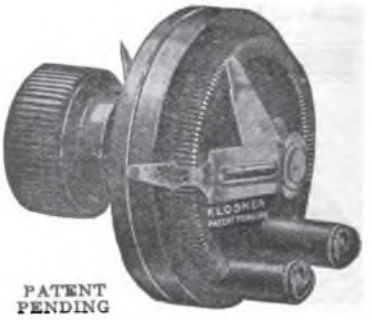
MAKE NO MISTAKE

THE

KLOSNER VERNIER RHEOSTAT



PATENT PENDING

is the only Vernier Rheostat made having the exclusive feature of using but

ONE SINGLE KNOB

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and, at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C.W. signals.

We invite comparison with any other filament rheostat now made. Look for the name KLOSNER moulded on the base.

Your dealer has them or send direct to us.

PRICE $1.50

Shipping weight, One pound.

A two cent stamp brings interesting literature.

Made only by the Originators.

The Klosner Improved Apparatus Company

Dept. Q4

2024 Boston Road, New York City N. Y.

Get the best results from your Radio outfit with the famous DICTOGRAPH HEADSET

Here is the headset that gives you clear distinct tones that reproduces perfectly the most sensitive radio signals. Try it at your dealer's. Be sure its the Dictograph Headset.

DICTOGRAPH has always stood for the most accurate and sensitive sound transmission. The Dictograph Products Corporation has for many years taken an active part in the development of radio transmitting and receiving units.

All Dictograph radio headsets are made, complete, in the famous Dictograph factories, using the same materials and workmanship that have made the Detective Dictograph, the Acousticon for the Deaf, and the Dictograph System of Telephones the standard of the world for sensitive receiving and loud speaking.

No other headset is like the Dictograph. You will be amazed at the clearness, the accuracy and the delicacy of its sound transmission. The headset is one of the most important parts of your outfit and unless it is made by experts of long experience in the making of the most sensitive instruments, you cannot get the best results from your radio outfit no matter how good it is.

Ask for the Dictograph Headset at your dealer's. Examine it, try it. Be sure it is a Dictograph.

DICTOGRAPH PRODUCTS CORPORATION

Charles H. Lehman, President

220 West 42nd Street, New York City

JEFFERSON
Amplifying Transformers

No. 45

No. 41

Secure maximum amplification by using Transformers designed especially for the new audiotron and Radiotron Tubes.

Jefferson Transformers are the result of exhaustive tests of every kind, and are positively unequalled for audibility and amplifying power.

Our No. 45 Navy Type is the most widely used transformer in the country. If you are not getting maximum amplification try it and note the improvement, the absence of distortion and the clearness of tone.

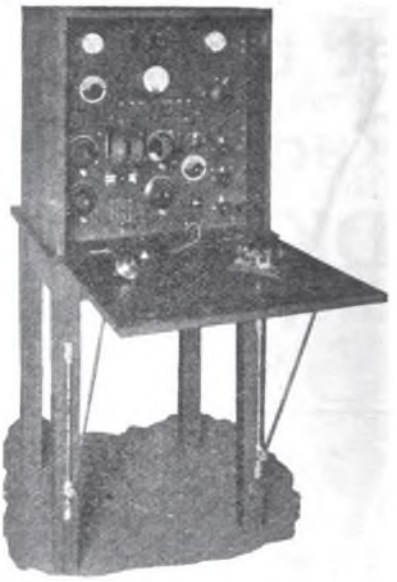
The No. 41 Transformer is also a very popular type. It is wound with No. 40 wire while the No. 45 is wound with No. 44 wire. Otherwise the construction is identical. The highest grade 36 gauge Silicon Steel is used for the core. The Primary Resistance of the No. 41 is approximately 900 ohms, of the No. 45 approximately 1800 ohms. Secondary Resistance: No. 41, approximately 5000 ohms, No. 45 approximately 8500 ohms.

Transformers are mounted in attractive brass frames with genuine Bakelite panels which carry the primary and secondary terminals. These Transformers are also furnished unmounted.

Send for Radio Bulletin

Jefferson Electric Mfg. Co.

425 S. GREEN ST., CHICAGO, ILL.



FOR SALE—COMPLETE 150-25,000 meter RECEIVER and 100 WATT TRANSMITTER. Guaranteed as good as new, with brand new receiving and transmitting tubes. Cost $820.00 to build. First certified check, draft, or money order for $385.00 takes it.

Receiver

Complete variometer or honeycomb tuner with throwover switch. Radiotron detector and 2 step amplifier. 120 hr. storage battery. 120 volt "B" battery. Brown imported phones. Excellent for DX work or music reception.

Transmitter

2 new 50 watt tubes. Radio Corporation instruments used. Can be converted into phone set by addition of motor generator or Kenotron rectifiers. Automatic antenna control. Wave change switch.

Cabinet

Fumed oak case and pedestal. Front completely encloses set. Storage battery compartment.

Reason for selling
Putting in DeForest 1 K.W. Oscillion Set

Wire or Write R. Karlowa, 313 E. 29th St. Davenport, Iowa

Radio Telephony For Amateurs
by STUART BALLANTINE

Formerly Expert Radio Aid U.S.N.

is the book that tells the how and why of radio telephony. Written so you can understand it fully. The biggest help to the amateur operator. 200 pages, fully illustrated.

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Variable Condensers, Variometers, Variocouplers, Loose Couplers, Tuning Coils, Amplifying Transformers, Sliders, Switches, Switch Points, Binding Posts, etc.

We are large manufacturers. Gorton machine engraving or manufacturing special parts to order.

F. JOS. LAMB COMPANY
1938 Franklin St., Detroit, Michigan

Type "Q" Receiver

AN IDEAL RECEIVING SET FOR LONG AND SHORT WAVE AND RADIO TELEPHONE RECEPTION

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector **$35.00**

Duck's New Radio Catalog No. 16

Send 25c in coin carefully wrapped today for copy of the greatest radio catalog ever put between the pages of two covers.

275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed. The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many books selling for $2.00, and $1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

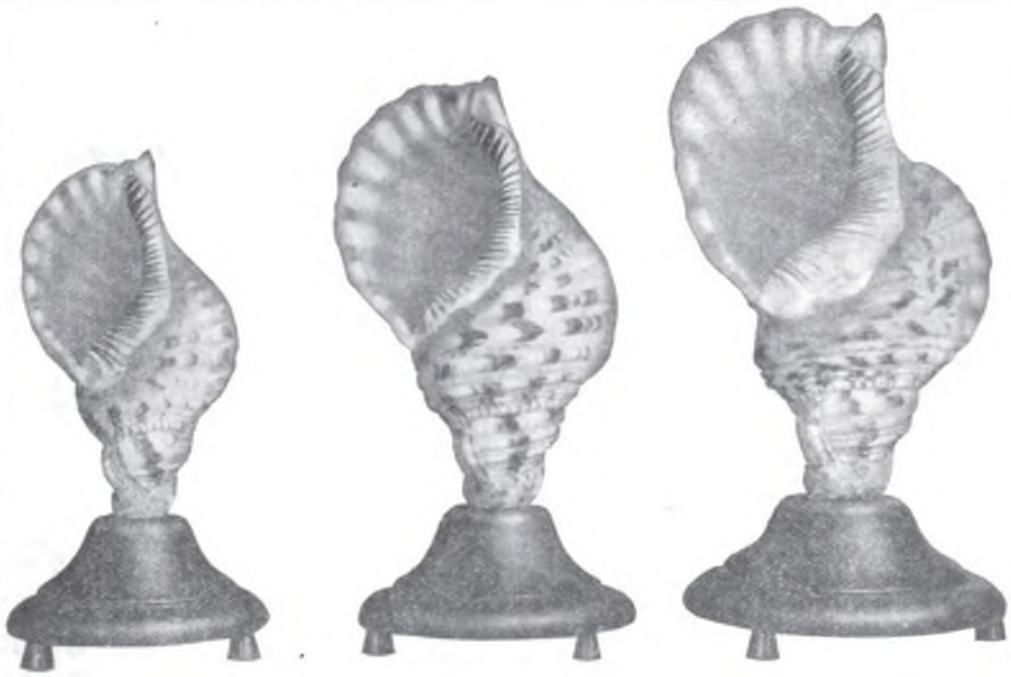
A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send 25c in coin, (carefully wrapped) for new catalog. The great cost of this elaborate catalog prohibits distribution on any other basis.

The William B. Duck Company

243-245 Superior Street **Toledo, Ohio**



SEA HORN LOUD SPEAKERS

NATURE'S PERFECT AMPLIFIER

THE BEST AMPLIFYING HORN OFFERED
SPLENDID DEFINITION

Artistic and Ornamental Genuine Sea Shells mounted on rich mahogany finished bases complete with phone clamp. 12 to 13 inches high $8.00; 13½ to 14½ inches high $12.00; 15 to 16½ inches high $15.00.

☞ FOR IMMEDIATE DELIVERY AND MONEY BACK IF YOU ARE NOT SATISFIED. ORDERS FILLED IN ROTATION AS RECEIVED.

Precision Condensers Without Dials

43 Plate	$4.00
23 Plate	3.50
11 Plate	3.25
3″ Dials	.85
Vacuum Tube Sockets Unbreakable	1.00

May be used for either panel or base mounting.

Phone clamps for Victor and Columbia phonographs enable you to use the horn on tone chamber of phonograph for a Loud Speaker $1.50.

The above articles are ready for immediate shipment with the understanding that money wil be refunded if goods are not satisfactory.

THE ORO-TONE CO.

Mfr's of Phonograph and Wireless Equipment

DEALERS SEND FOR SPECIAL FOLDER

1000 to 1010 George St., Chicago, Ills.

CLASSIFIED ADVERTISEMENTS

Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 10th of month for succeeding month's issue.

FOR SALE: 1KW spark transformer in good condition $20. 1CBC Harold M. Baker, 85 West St., Reading, Mass.

TRIPLE GEAR honeycomb coil regenerative receiver including coils and Radiotron Detector $60.00. Box 205, Williamsport, Pa.

SELL: 1KW Type R Thordarson twenty five dollars; Oil Immersed Condenser fifteen dollars; Thordarson Rotary Gap five dollars; C.W. set two 5 watt capacity —(the original first prize set—see Sept. QST, page 25), sixty dollars. Will exchange for 50 watt set. 419 Cottage Ave., Glen Ellyn, Ill.

STOP! Look at these prices! Atlas amplifying transformers, $3.50; Atlas sockets, $0.85; Atlas rheostats, $0.85; Luma closed circuit jacks, $0.90; Our own make apparatus below employs the above equipment. Detector and two stage amplifier, $35.00; Two stage amplifier, $30.00; Detector and one stage amplifier, $20.00; One stage amplifier, $15.00; Detector, $5.00; These amplifiers are on formica panels. Send for price list of other apparatus. We give twelve hour service. Loh's Radio Shop, 1004 E. Indiana St., Evansville, Ind.

MR. AMATEUR, MR. PROFESSIONAL, QST EVERYMAN INTERESTED IN RADIO: That radio concert! That music! That speech! you received via the Radiofone! You hear it once and it's gone forever! Wouldn't you like to make a permanent record of it? Your own amplifier can make it! Your own amplifier can reproduce it! Any time, any number of times! No change of circuit,—no extra wiring. No sound methods requiring High Amplification. Direct recording of speech, music, voice, code! Listen to the "traffic." Record what you wish. Then at will, reproduce it exactly in same tones as original! The one thing needed to make your radio complete. You build it yourself. Three dollars for complete literature and clear set of building plans. Enclose the three with your name and address to Radio Mail Club, New Bedford, Massachusetts. "Don't let that music get by."

A FEW MORE Bargains in Edison Batteries: 6.5 volt 225 ampere hours, $29.00; 10.5 volt, $44.00; Single cells 1.3 volts 225 ampere hours for $5.50 each F. O. B. New York City. Edison elements for B Batteries, 6c per set. A. J. Hanks, 606 Montgomery St. Jersey City, N. J.

RADIO STORAGE BATTERIES at lowest prices. Send for price list. Lloyd E. Clark, 383 Broadway, Everett, Mass.

FOR SALE QUICK, Magnavox, never used, $40.00; Paragon 6 regenerator complete with bulb $40.00; Universal Arc Receiver $30.00; Portable Tungar charger $20.00; 1 K.W. Thordarson, type R, $30.00; 25000 volt Dubilier Condenser $35.00; Hyrad Rotary $20; switch-board, meters, keys, wavemeters, all like new. E. H. Hartnell, Salem, Wis.

WANTED: Phones, charger, amplifier parts, battery, large insulators, changeover, etc. What have you? Orville Hujsh, 140 Byron St., Youngstown, Ohio.

SPECIAL: Formica panels, 6x12, $1.00; 6x21, $1.75; Mahogany finished cabinets, to fit, respectively $3.25 and $4.25. Immediate delivery on Radiotron and A.P. tubes, Holtzer-Cabot phones, $8.00, Stromberg-Carlson, $7.50, No. 56 Murdocks $5.00. We handle all kinds of apparatus and supplies. Get our prices on sets. Home Radio Company, 140 Liberty St., Bowling Green, O.

THE STANDARD Radio Log and Record—A continuous diary and record of all station activities. Provision for recording calls received and sent with location, distance, wave length and other information. Sections for keeping records of calls frequently used, station data, license numbers, equipment inventory, Notable performances, etc. Flexible binding, 48 pages and cover. Price 30c prepaid or from your dealer. Metcalfe Publishing Company, 56 Harrison Ave., Springfield, Mass.

RADISCO VARIO-COUPLERS—Moulded bakelite. Single turn variation. Just the thing for that new short wave set. Large stock. Immediate shipment. Special price $6.75. With new Corwin dial $7.75. Prepaid. Order now. Dept. Q. The Practical Supply Co., Binghamton, N. Y.

WHO WANTS a 900 cycle 200 watt Generator for either spark or ICW? Price $25 with HV transformer, and set of rotors for sink gap. Dope on request. V. Bowers, Fairfield, Ohio, Box 132.

BUILD YOUR OWN WIRELESS Telephone and Musical Receiver, Don't Wait for a Set. We hear Chicago, 900 Miles. Fine on good nights. Pittsburgh, Newark and New York Come in Good and Loud—You Can Do the Same on a Single Bulb. There is Radio Music in the air each evening, and the living voices of the artists can be reproduced in your own home and enjoyed by you and your friends. Are you satisfied with your receiving set or would you like to build one that will receive over 6,000 miles on a single bulb and quit experimenting? One that will be equal to any regardless of claims and price—with which you can hear Honolulu, California, German, South American, French and English stations and practically all of the high powerful foreign and domestic stations, as well as amateur stations as far west as New Mexico, and the phone and music. Anyone can assemble this outfit and wire it up, and the remarkable ranges that may be obtained will surprise you. Why not make a set up to date and efficient? Don't experiment with unknown circuits. We will promptly mail you our sample diagram of a complete short and long wave receiver, 175 to 20,000 meters, together with complete instructions for wiring and assembling, price of each part and where they can be bought, leaving nothing to guess about, on receipt of fifty cents in coin or stamps. Here is a diagram no one can afford to be without. Virginia Novelty Company, Desk A, Martinsburg, West Va.

SELL QUICK: complete transmitter, best condition, 1 K.W. Thordarson transformer, oil condenser, large O.T. Enclosed gap with variable motor, key and Thermo-couple ammeter, value $145.00, make offer. Howard English, 221 Pine St., Shamokin, Pa.

WANTED: QST, March, June, August 1916 and "Midget"—"Everyday Engineering," Vol. 1, Nos. 1 and 2—"Pacific Radio News," June, 1921.—W. A. Mason, Avon Lake, O.

QRA? 4DC—Not Atlanta but William Boyst, Greensboro, N. C.—Please correct your call book O.M.

BURGESS "B" BATTERIES—Large stock. Ready for immediate shipment. Absolutely noiseless. Just the thing for amplifiers, Long Life. Large size 22½v. Tapped. Special price $2.75. Prepaid. Order now. Dept. Q. The Practical Supply Co., Binghamton, N. Y.

RADIO CABINETS, Any size, any quantity, write for prices. R. G. Kund, 106 Pasedina St., Pittsburgh, Pa.

SACRIFICE ½ Kilowatt Thordarson, $10; also violin. Write. Russell Martin, Mt. Carmel, Ill.

THIS MONTH'S SPECIAL: Complete aerial outfit—100 feet hard drawn copper wire—50 feet rubber covered wire—four 4" antenna insulators—1 lightning switch—1 porcelain tube—1 ground clamp—$2.50 complete postpaid—Remit postal or express money order to M. J. Winkler, 220 West 42 Street, New York.

FOR SALE: Grebe CR-3 and Grebe RORD detector and two step, complete with Radiotron tubes, latest model with vernier controls, one pair Baldwin phones, "B" batteries and 6 volt 60 ampere storage battery, 100 ampere ground switch, 43 plate variable condenser, General Radio Hot wire ammeter mounted, lead in insulator. Everything listed is brand new and in perfect condition. Price $125.00. W. M. Bruce, c/o Morrilton Cotton Oil Co., Morrilton, Ark.

RECTIFIER PLATES—$0.75 pair. Charge your batteries yourself. Rectifer blueprints—$0.25. Write us your wants. Western Wireless Supply Company, 2317 Milwaukee Avenue, Chicago, Illinois.

NOISELESS—That describes Burgess "B" Batteries. Large stock. Immediate shipment. The Practical Supply Co., Binghamton, N. Y.

SELL: ½ K.W. Murdock Condenser $10; DC 0-150 Voltmeter, 0-135 Ammeter $10. Each 6x2¼. M. Littlefield, Pittsfield, Maine.

ANTENNA WIRE 7 strand #22 tinned copper $0.65 per 100 ft; DeForest Home sets each, $30.50; Westinghouse set, $120.00 or will swap one of them for Grebe; have 5 in stock. Also Clapp-Eastham, Acme, Western Electric and others. Henry Kulikowski, Ansonia, Conn.

SELL: Amrad Induction Coil, 6 Volt, $13; Amrad ¼ K.W. Quenched Gap, $6.00; 3 Sections Murdock Cond., $6.50; Complete transmitter, $28.00, with O.T. and key. Gail Wade, Manitowoc, Wisc., 9DQI.

LOOK: Quarter kilowatt sending set for $21.00. Nearly new, not home made. Jack Forrest, Dixon, Ill.

EDGEWISE COPPER .033x.295x3¼" diameter 50 turns $3.50 Postpaid. Radio Specialties Co. Connellsville, Pa.

EDISON ELEMENTS, insulators and connecting wire 10c per pair with information for making B batteries. E. A. Pierson, 728-7th St. Niagara Falls, N. Y.

IMMEDIATE DELIVERY 2 UV 217 Kenotron tubes $26.00 ea. Westinghouse "B" Batteries (storage) 22 volt $8.80; WUBCO rechargers for storage "B" $1.90 ea Shipped PP paid. Chesaning Electric Co., Chesaning, Mich.

WE SELL only High Grade Radio Apparatus. Send us your orders. Satisfaction guaranteed. The Practical Supply Co. Binghamton, N. Y.

TRADE: New Holton-Clarke Cornet for good Radio apparatus. Roy Fix, Marshall, Ill.

NO AERIAL NECESSARY. Connect the Wolf Aerial Attachment to any electric light socket and receive messages. Can be used wherever you have electric sockets. Save cost of all aerial construction. No danger from wind or lightning storms. The Wolf attachment comes to you ready to use; just connect one end to electric socket and other end to receiving set. Postpaid $3.50. ($4.00 west of Rockies). Wolf Radio Co., 208T Scherer Bldg., Detroit, Mich.

WANTED: ½ Kilowatt non-resonant transformer .006 condenser. State lowest price. Leiter, 1338-41 St., Brooklyn, N. Y.

TINNED STRANDED WIRE $0.70 per 100 feet; Magnet wire 18 to 22 S.C.C. $1.00 pound; Vacuum Gaps, $2.00; 2000 Meter Loose Coupler, $4.00; 6 Volt generator, $10.00; 1/10 A.C. Motor, $8.00. France Battery Charger, 6 and 12 volts $14.00; Discount on all sizes of wire. J. J. Smith, 113 Stoughton St., Boston 25, Mass.

SELL: Packard half K.W. Murdock molded condensers, Rotary gap and O.T. $25.00. Absolutely not blown. My DX with this set 1200 Mi. Marshal R. Sanguinet, Jr., Fort Worth, Texas.

WANTED for spot cash, High grade Radio outfits, parts, attachments and materials of standard makes. No home made apparatus will interest us. Address Box L, c/o QST.

5HK 1KW Spark for sale—heard in 40 states—sell for $100.00—LeRoy Moffett, 312½ North Broadway, Oklahoma City, Oklahoma.

NEVER USED: ½ KVA. Stamp for details $45.00. Wilfred Picking, Somerset, Pa.

FOR SALE: Single tuned Regenerative, detector and one step amp. $42.00 complete in cabinet less bulbs. 2 step amplifier in cabinet $28.00. Photo on above sets on request. Arthur Walser, Chesaning, Mich.

C.W.—R.C. Power transformer No. UP-1016 and 2 UV-217 Kenotrons with sockets, used only 30 hours. Price $75.00. Radio 9WQ, Carthage, Ill.

8ZAC wants sell Saunders loose-coupler, beautiful instrument, $12; short wave regenerative with two-step amplifier $54.00. Bargain. Clifford Galloway, Barnesville, Ohio.

RADIO SUPPLIES. We carry in stock a complete line of radio supplies. Everything from complete sets to aerial wire. Send us your orders for Cunningham Tubes, Eveready B Batteries, Magnavox R 3, Loud Speakers and Power Amplifiers, Head Sets, Marshall-Gerken Vario-Couplers and Variometers, Detector and Amplifier Panels, Crosley Sockets and Rheostats. Write or wire for real service. Recum Motor Co., Mitchell, S. D.

WANTED—A few Western Electric VT-1's, VT-2's and head sets for use in our laboratory. Must be perfect. State quantity and lowest price. Reading Radio Shop, Box 6, Reading, Massachusetts.

SIMPLIFIED SHORT WAVE REGENERATOR. Ideal for radiophone reception. New $35.00. Detector and two-step with plug control. Unused $35.00. The two in combination $65.00. Short wave regenerator with detector control. New $35.00. Act quickly. Can Ship immediately. W. B. Butcher, Waynesfield, O.

EDISON B BATTERY ELEMENTS. Make your own. Can be recharged and lasts for years. 200 ampere hour A batteries, guaranteed, $35.00. Harry Morrell, 52 Goffe St., New Haven, Conn.

SELL: D.C. motor generator, 500-v. 100-w. 8-v, $75.00. DeForest OT3, 3 UV202, Federal Microphone $75.00. O-2.5 HWA $4.50. Milliammeter O-500 $5.50. Modulation transformer, $4.00. Field Rheo, $5.00. Tuska Filter $9.00. Rhodes, 40 West 86th, New York.

FREDERICK RADIO APPARATUS. Frederick Radio enthusiasts in Central States are listening in nightly to concerts, press reports, etc., broadcasted by Eastern Stations. You can do the same. Write for catalogue Series 3. Frederick Radio & Parts Co., 807 Sycamore St., Cincinnati, Ohio.

TESTED GALENA CRYSTALS From our own Mines—shaped, and tested at the mine in best standard hookup—direct to user. A real crystal—not a pinhead. Twenty-five cents postpaid, five for $1.00 to group buyers. Ozark Crystal Co., Box 1, Morrelton, Mo.

PEERLESS SWITCH POINTS—The finest and highest grade switch point obtainable. Regulation size but with rounded edges. Heavy satin nickel silver finish. Same as used on all high grade Radio apparatus. Threaded 6-32. Special price. Only $0.50 dozen. Prepaid. Dept. Q, The Practical Supply Co., Binghamton, N. Y.

SELL—One new UP-414 Modulation Trans.—Universal tuning cabinet, short wave regenerative, change over switch, three honey-comb coil mount, two variable condensers, all in beautiful cabinet. Photo and additional information on request. Arthur Walser, Chesaning, Mich.

REGENERATIVE TUNER & DETECTOR in cabinet, $20.00; Two step amplifier (cost $45), $35.00; Short wave variometer Detector—two step in cabinet, $75.00; Single tuner regenerative detector in cabinet, $25.00; Marconi code records, $4.50; Loading coil tapped 3000 meters, $2.50; V. P. Kodak and case, $5.00; Baldwin phonograph attachment, $12. Everything new. H. DeNyse, 203 Speedwell Ave., Morristown, N. J.

TWO VARIOMETERS, 1 Variocoupler assembled, $13.50; Radio supplies at bargain prices. Radio Supply House, West Mansfield, Ohio.

BKUMA YRLSBUG. Beginners do master Wireless Code thirty minutes to two hours after limited practice do pass Govt. examination obtain license. Forty page Booklet information and reports from 240 self instructed beginners mailed for ten red stamps. Dodge, Box 210, Mamaroneck, N. Y.

—FOR YOUR CONVENIENCE—

QST'S INDEX OF ADVERTISERS

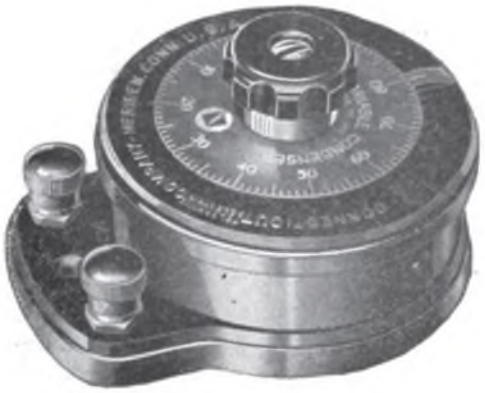
IN THIS ISSUE

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

CONNECTICUT RADIO

What Determines Signal Strength in Variable Condensers

Strength of signals, when you use a variable condenser, depends on *low* "effective resistance." In most ordinary commercial types this resistance lies between two and fifteen ohms.



The CONNECTICUT Variable Condenser
(About ⅝ actual size)
Portable Type

Compare this with the CONNECTICUT Variable Condenser, about 0.2 ohms. This low comparative resistance not only permits, but insures, strength of signals.

There are other advantages—compactness, fine adjustments, stable in any position, sensitiveness—any one of which should make the CONNECTICUT type your choice of variable condensers.

Write for bulletin A8, showing condensers and other radio apparatus.

CONNECTICUT TELEPHONE & ELECTRIC COMPANY
Meriden Connecticut

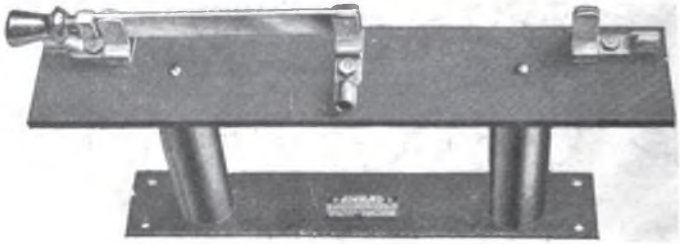
AMRAD

The Recognized Symbol of Superior Performance

An Accurate Wavemeter

Range 150-400 Meters

No. 2793 Price $20.00



No. 2796 The Approved Lightning Switch $5.00

Price, $2.50

In the mad scramble to meet the demand for broadcast receivers, we have not forgotten requirements of veteran enthusiasts.

Here are some of them: A WAVEMETER, fine for tuning CW or phone sets, always useful as single circuit tuner, variable condenser or impedance coupler for r.f. amplifiers. A real LIGHTNING SWITCH and Navy Type SEND-RECEIVE SWITCH to complete your station. A GROUNDED SHORT GAP for your receiving aerial.

Ask your dealer or write for free Bulletin H, descriptive of these essentials.

Price, $10.00

AMERICAN RADIO AND RESEARCH CORPORATION

205 College Avenue
MEDFORD HILLSIDE, MASS.

New York District Office
13 PARK ROW

Chicago District Office
602 SO. DEARBORN ST.