

A MAGAZINE DEVOTED EXCLUSIVELY TO THE WIRELESS AMATEUR



JULY 1921



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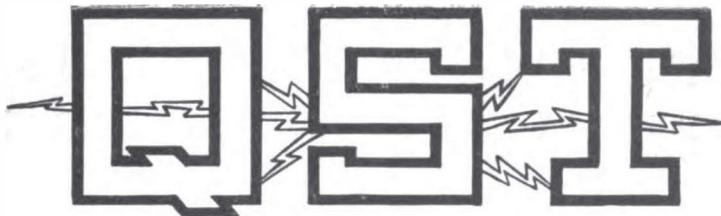
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The Official Organ of the A.R.R.L.

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QST is published monthly by The American Radio Relay League, Inc., at Hartford, Conn.

Kenneth B. Warner (Secretary, A.R.R.L.), Manager and Editor.

Subscription price in United States, Possessions, and Canada, \$2.00 per year.

Foreign, \$2.50. Single Copies, 20 cents.

Entered as second-class matter May 28, 1919, at the post office of Hartford,

Connecticut, under the Act of March 3, 1879.

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A Magazine Devoted Exclusively to the Radio Amateur

Modulation in Radio Telephony

By R. A. Heising *

Presented at Radio Club of America, Columbia University, Feb. 25, 1921.

In Two Parts: Part I.

Here at last is really authoritative information for the amateur on radiophones. Mr. Heising has given the amateurs a splendid paper couched in terms they can understand and we consider it the best article on the subject it has yet been our pleasure to present. Incidentally it should settle once and for all the argument about grid leak vs. constant current modulation.—Editor.

The Modulated Antenna Current

The average radio amateur on entering the radio telephone field, must bear in mind the fact that he has much to learn to make a satisfactory telephone set that was not necessary for a telegraph set. Also, that because the nature of the signals to be transmitted is different, certain methods of operation and certain requirements which were proper for telegraphy are decidedly improper for telephony. Neglect of these facts and a blind effort to apply to telephony the rules for telegraphy will result in a considerably poorer set than should be the case.

Before discussing any of the systems of modulation, it appears desirable to point out some of the essential facts concerning radio telephony. By doing so, the reason for many modulation circuit connections will be better understood and the finer points which distinguish a poor arrangement from a good one will be appreciated. A study of the form of the antenna current as influenced by a signal will give us many pointers as to the best arrangements for a good circuit.

Human speech, which is the signal to be transmitted in radio telephony, consists of an aggregation of frequencies lying largely between 200 and 2000 cycles per second, having various amplitudes, periods of duration, and transients at the beginning and end, so arranged as to convey information to the listener. To convey the human voice

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by radio it is necessary to provide a system which will convey all of these frequencies; that is, it must reproduce each frequency at the receiving end and reproduce it with the proper amplitude in comparison with the others, and reproduce its "transient" or amplitude variation at the beginning and the end, and it must do this for each frequency while doing it for others. This is enormously more difficult than transmitting a telegraph signal. To transmit a telegraph signal it is only necessary to produce some kind of a noise at the receiving station and the signalling is done by varying the duration of this noise. The noise does not have to bear any relation to any noises at the transmitting station but needs only to be something the receiving operator can hear. In telephony, *any* noise will not do, because the noise to be reproduced must be identical with the noise produced at the transmitting station, it must contain the same frequencies, give them their relative amplitudes, and have them last the proper length of time. The complexity of the signal necessitates a control of the radiated wave not necessary in a telegraph system and it is the control which is such an important part of the radio telephone circuit.

An example of a radio telephone wave is indicated in Figure 1. The carrier wave amplitude is here varied according to the wave form of the signal. The precision of control required to cause the proper antenna current, regardless of the millions of forms the signal may take, is quite evident. This signal on being received and rectified

will reproduce the modulating signal, since the rectified current will be substantially proportional to the high frequency amplitude.

In the discussion of a radio frequency current, it is usual to assume a simple signal as the modulating signal, as most of the necessary information can be secured with that assumption. It is assumed that the signal to be transmitted is a single sine wave of some audio frequency such as 800

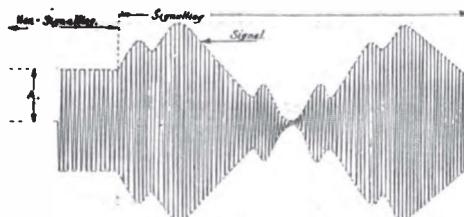


FIG 1 H.F Wave Modulated by a Speech Signal

cycles. A modulated antenna current carrying this signal is represented in Figure 2. This antenna current is expressed by the equation

$$i = A (1 + K \sin p t) \sin wt \quad (1)$$

In this equation $\sin wt$ represents the radio frequency wave and $\sin pt$ the signal frequency wave. K is known as the modulation constant and is usually expressed in percentage form. When no signal is being transmitted the high frequency amplitude is A and the constant K is zero. If a signal of such a loudness as to make K equal to unity is spoken, the term $1 + k \sin pt$ varies between values of 0 and 2 depending upon $\sin pt$ passing through the values -1 and +1 and the amplitude of the high frequency current varies between zero and $2A$. That is, the modulation of the current causes it to rise, as well as fall, and it should rise as much above as it falls below. If the system is so constructed that the amplitude does not rise, but is varied downward only, a speech signal will produce a wave of the form shown in Figure 3. In-

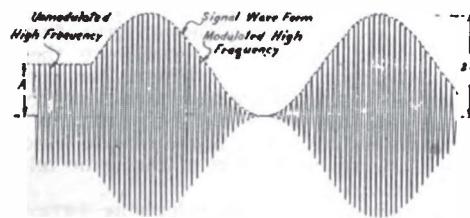


FIG 2 H.F Wave Modulated by a Single Sine Wave Signal

spection of this indicates that a great distortion is produced. The amplitude should vary so as to follow the dotted signal line, but the failure of the system to cause the current amplitude to rise chops off one-half

of the speech signal and gives an imperfect reproduction at the receiving end. This one-sided or improper modulation is to be avoided if possible.

Those who are acquainted with elements of trigonometry will observe that we can change the form of the equation (1). Such a change does not affect its validity at all but does point out one or two new facts. The equation can be changed to:

$$i = A \sin w t - \frac{AK}{2} \cos (w + p) t + \frac{AK}{2} \cos (w - p) t \quad (2)$$

This equation indicates that a sustained wave, such as shown in Figure 2 and represented by equations (1) and (2), can be said to consist of three frequencies—

The radio carrier frequency $\frac{w}{2\pi}$ of amplitude A

An upper side frequency $\frac{w + p}{2\pi}$ of amplitude $\frac{KA}{2}$

And a lower side frequency $\frac{w - p}{2\pi}$ of amplitude $\frac{KA}{2}$

When no signal is being transmitted, $K = 0$ and the only frequency is the radio carrier frequency with amplitude A . As soon as the signal begins to modulate the wave,

the side frequencies $\frac{w + p}{2\pi}$ and $\frac{w - p}{2\pi}$ of amplitude $\frac{KA}{2}$ appear while the carrier

remains unchanged. The modulation of the radio wave thus takes the form of the production of side frequencies. At the receiving station, the beats between the carrier frequency and the side frequencies, when rectified, produce the frequency of the transmitted signal.

If the signal to be transmitted consists of many frequencies such as 200, 500, 1200, and 2000 cycles, the frequencies in the antenna will be the carrier frequency f and the side frequencies $f + 200$, $f - 200$, $f + 500$, $f - 500$, $f + 1200$, etc. In telephony, human speech contains frequencies largely between 200 and 2000 cycles so that to transmit speech by radio we must expect to have in the antenna the carrier f and the side frequencies $f + (200 \text{ to } 2000)$ and $f - (200 \text{ to } 2000)$. That is, if we use a carrier of 50,000 cycles there will occur in the antenna the frequencies—

The carrier 50,000 cycles
 Lower side frequencies between 48,000 and
 49,800
 Upper side frequencies between 50,200 and
 52,000
 giving us a band 4,000 cycles wide necessary
 for the transmission of speech.

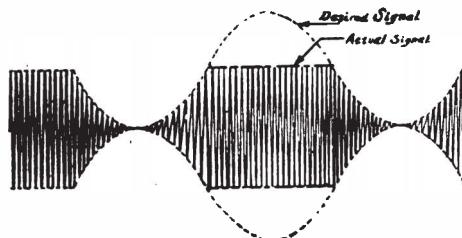


FIG. 3 An improperly Modulated Wave

Having described in detail the important features of a radio telephone wave, we are now in a position to point out a few facts of vital interest to an amateur. In radio telegraphy, it is customary to tune and adjust the set for the maximum antenna current that it is possible to obtain. Signalling is then done by making and breaking the circuit causing the antenna current to fall to zero in the spaces and rise to the maximum in the dots and dashes. The greater the antenna current, the greater is the VARIATION in the current when signalling. The VARIATION in the current is what is desired and the maximum antenna current is tuned for only because the change in current between that value and zero gives the greatest VARIATION. The VARIATION in the current while signalling is thus the factor which determines the loudness of the received signal. In telephony the VARIATION in the antenna current while signalling is also the determining factor as regards loudness of signal or distance to be reached, but the amateur must remember that the determination of the maximum VARIATION is not so easily done as in the case of telegraphy. The antenna current is not merely reduced to zero in spaces and then returned to the normal value, but it varies through all possible values from zero to TWICE THE NON-SIGNALLING VALUE. In telephony the current is either zero or maximum. In telephony it has a certain non-signalling value (A in equation 1 and Figure 2) and takes all possible values between 0 and twice the non-signalling value ($2A$ in equation 1) and the apparatus must be capable of producing any possible value between these limits. Therefore the amateur is warned that when he tunes his set up for the non-signalling value A , he must see that the system that he uses has some variable in

it which when operated upon by the speech will make the set give $2A$ in the antenna. Failure to remember this will result in producing one-sided modulation as shown in Figure 3.

In telegraphy, it is possible to determine with the antenna ammeter alone the VARIATION in antenna current while signalling. When the key is open the current is zero, when it is closed the current is a maximum. In telephony, unfortunately for the amateur, there is no simple apparatus to tell what the variation is, or to tell him when he is getting complete modulation. There are, however, two indicators which will give an operator some idea of his degree of modulation. The first is the variation in the reading of the antenna ammeter. When a wave is completely modulated by a symmetrical signal in a properly adjusted set, the antenna ammeter reading increases by about 22½%. (To be exact, the reading is $\sqrt{1.5}$ times the non-signalling value). This must not be taken as an infallible guide as it is not easy to get a set adjusted so as to make this indicator worth much. A badly distorted wave will give a reading variation of even greater than this amount. Judgment should not be passed upon this evidence alone. The second indicator is the quality of the received signal. The signal from a set which tends to "over-modulate" has a peculiar sound often described as "tinny". It sounds like the voice of a person holding a sheet of paper against the lips. It is caused by the over-modulating action

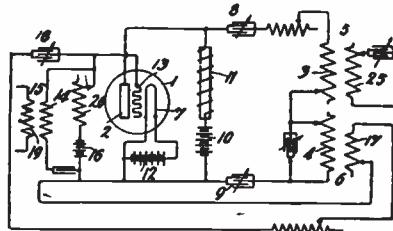


FIG 4 Colpitts System

cutting off the peaks of certain loud signal waves. The identification of this kind of distortion can be learned by observation. The amateur must not let his imagination get the better of him and confuse microphone distortion or other noises and distortions with this over-modulation distortion as many do. He should learn to identify the sound under conditions that will not give him the wrong impression of its character. This indicator is the only cheap indicator of complete modulation at present available to the amateur. It is much more reliable than the antenna ammeter method,

but indicates only over-modulation. It will be found, however, to be useful.

Having discussed the nature of a modulated antenna current, we are now in position to discuss some of the systems which produce it.

Colpitts System

Among the systems of modulation which may be of interest may be mentioned Colpitts' system shown in Figure 4 and a modification of it, the Logwood system shown in Figure 5. This system is

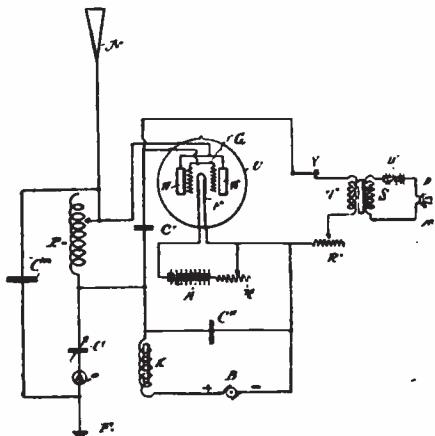


FIG 5 Logwood's Circuit

primarily an oscillator upon the grid of which the speech signal is impressed. In this circuit the grid acts as control member for the amplitude of the oscillation. However, as the grid is also used for controlling the current through the tube while oscillating, it is compelled to perform two different functions simultaneously and unless the circuit is very carefully adjusted, it fails in either one or the other. Usually the amateur will adjust the oscillator to get the most power into the antenna and then impress the signal upon the grid expecting perfect operation as easily as is secured in telegraphy by opening and closing the key. Such, however, is not what results. This system gives about 20% modulation, which is quite poor. To adjust this circuit to give complete modulation requires much more complicated apparatus than the amateur is likely to possess, and there is added the fact that the adjustment is not only difficult to obtain, but is difficult to maintain. The efficiency of such an arrangement is not very high. For an amateur who wishes to secure good range the system is not advised. If, however, one is merely interested in something which will talk a short

distance, it is one of the easiest systems to construct.

Van der Bijl System

A system which we have used in many of our experiments is shown in Figure 6 and is known as the Van der Bijl system. It falls under a classification of systems known as "amplifier systems" in which a small amount of power is modulated and then the modulated current is amplified into the antenna. The modulation is done in this circuit by means of a tube in which we make use of its curved characteristic. In Figure 6 will be observed a small high frequency voltage with the time axis running downward, which is impressed upon the grid and whose position on the characteristic curve is varied by the signal to be transmitted. The varying slope of the characteristic curve causes the high frequency current in the plate circuit to change, depending upon what part of the characteristic curve this small voltage wave operates. If it operates around the point marked B, it produces the amplitude indicated directly to the right of the letter B. If it operates around the point marked C, it produces a much greater amplitude as is indicated to the right of that letter. If the signal should slide this wave down to the point A, practically no alternating space current occurs. We thus have the phenomenon of being able to get any alternating space current we desire by merely sliding the high frequency input up and down the curve. If we use the signal to slide this small input up and down, the amplitude produced in the plate circuit is such that a line drawn through the peaks (the envelope of the peaks, so to speak) is the wave form of the signal desired. Having once secured a small amount of modulated high frequency current, it is only necessary to amplify it up to the

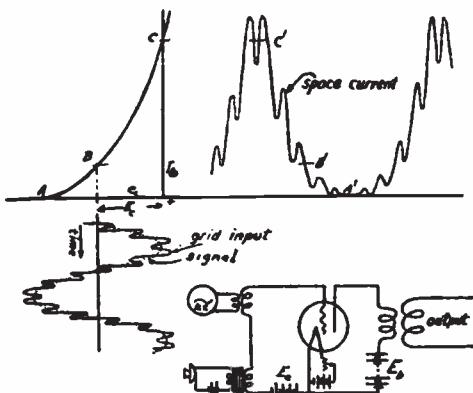


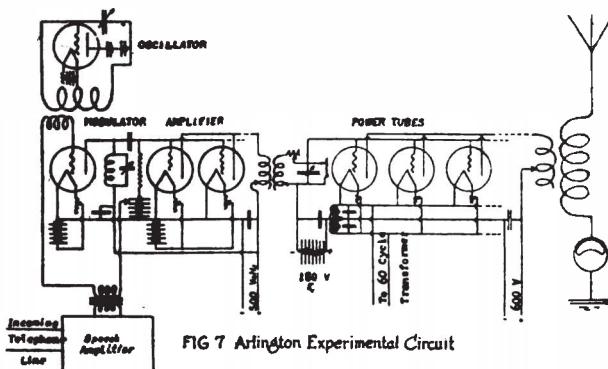
FIG 6 Van der Bijl's System

desired power and put it on the antenna. This type of system, though fairly simple, is not as good as some to be described later. It is however, as good and as efficient as any other amplifier sys-

E_c , of figure 13) finding the values at which he gets maximum current and minimum current in the antenna. After having determined these values, he should set the negative voltage at about the value half-way between these limits, the value being that which will give $\frac{1}{2}$ the maximum antenna current.

The circuit is then properly adjusted for speech since the non-signalling value is $\frac{1}{2}$ the maximum possible. He must not feel that he is cheating himself out of some power when he reduces the antenna current to half the maximum, because he is not. The speech signal coming in and being impressed will momentarily oppose the battery at times and cause the power to rise to the maximum, and at other times will momentarily aid the battery, causing the power to decrease to zero.

He has a value about which the antenna current can both increase and decrease by the mere changing of the potential of the grid. This gives him a circuit adjustment which will produce an antenna current as indicated in Figure 1 or Figure 2. It can rise to a higher value as well as decrease to a lower value by a mere potential change which in this case is his grid potential, and he can get a properly modulated, if not a completely modulated, antenna current. The natural inclination of the amateur is to leave the value of E_c such as to give him the maximum antenna current. If he does this, he can only secure an improperly modulated current such as in Figure 3. His signal impressed from the transmitter and the transformer has alternating potentials which in some instances aid the battery



tem. That is, it is as good as any system in which a small amount of power is modulated by some means and then amplified to the desired point. The efficiency in these systems is determined by the efficiency of the amplifier and has very little connection with modulating arrangement itself.

The circuit which we used in our test at Arlington, 1915, is given in Figure 7. The average amateur should be able to pick out the oscillator, modulator and amplifiers in this circuit without much trouble.

Modulating Amplifier System

A modified form of the Van der Bijl system is that indicated in Figure 8. It is known as the "modulating amplifier" system. It differs in detail from the previous arrangement in that the high frequency wave impressed upon the grid is equal to or much larger than the signal wave, instead of being much smaller, and in that the modulator not only modulates, but amplifies and delivers the modulated high frequency current directly to the antenna. This system should be of some interest to an amateur because it is one he can quite easily construct. It requires, however, two or more tubes. One of the tubes must be used to generate the high frequency oscillations, while the other is used as the modulating amplifier. These tubes may be of different sizes; the one generating the high frequency oscillations does not have to be over 1/10 the power rating of the modulating amplifier tube. If the tubes are of very large size, it may be necessary to use a speech amplifier between the microphone and the modulating amplifier.

In a system of this kind, it is desirable to have a high frequency amplitude several times the signal frequency amplitude. The experimenter should vary the negative voltage (E_c of Figure 8 or

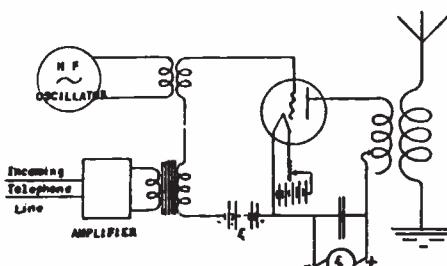


FIG 8 Modulating Amplifier Circuit

E_c , and other instances oppose it. At those instances where it aids the grid battery and makes the grid become more negative, the antenna current will be modulated in a downward direction. But in those instances when it opposes the grid battery and reduces the grid potential it should raise the antenna current. If he does not

make the non-signalling antenna current half the maximum by increasing the negative grid battery he will be operating about the point of maximum antenna current and nothing he can do on the grid can ever make the current any greater. Since his speech signal contains equal amounts of

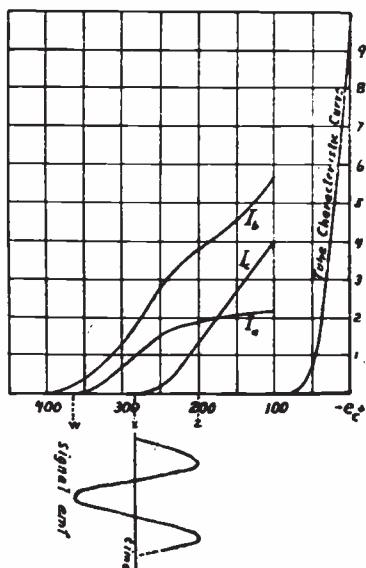


FIG. 9 Behavior curves for the Modulating Amplifier

positive and negative potentials which alternately aid and oppose the battery, he will get modulation only for that half of the signal which aids the battery, giving him the identical improperly modulated signal represented in Figure 3. To secure the complete radio signal, he must increase

his negative grid voltage to such a value, as mentioned previously, as will allow the incoming speech signal to oppose the battery and increase the antenna current at times as well as to aid it and decrease it at other times.

A set of curves such as a person would get from a modulating amplifier is indicated in Figure 9. The curve for antenna current (I_a) was secured by slowly varying the negative grid potential and taking readings of the antenna current at the same time. As we approach the value of 100 volts on the grid, it is seen that the antenna current is rising so slowly that it is not desirable to go any farther in that direction. In fact, for most work, it is better not to go to a smaller value than 200 volts. This is marked by the letter Z. Half way between this value and that value W at which the antenna current is reduced to zero is marked the value X which is the amount of negative voltage we would apply to the grid when not signalling. If now, we produce by means of a microphone and transformer the simple signal indicated with the time axis running downward, we can cause the potential of the grid to vary. The potential of the grid is the sum of the constant negative potential 280 volts and the varying signal potential, and the grid's potential will range between the points W and Z, causing the high frequency antenna circuit to vary between the maximum and minimum values.

(Part II, in our next issue, will deal with the constant current system and master oscillators, and concludes with circuits, specifications and constants of systems particularly suited to amateur use. If you're at all interested in radiotelephony, don't miss it.—Ed.)

The Troubles of a Trouble Shooter

By Radiotron Mike

PHILLIP ALGERNON FITZDOODLE was an Inquisitive Youth with a Homely Mug who got mixed up with a Farmers' Line telephone company because he needed a pair of shoes and Some Other Things. It was for this reason that he became a Sticker and in due time secured a fair knowledge of Dry Batteries and Pony Insulators. One day he felt a sudden urge to gain Distinction and he applied for a job of Trouble Shooter with a Big City Exchange where he found Higher Poles to climb and More Trouble to shoot for about the Same Money. This grieved him and he looked about for some One to share his Troubles with him. After he had received his Seventh Check he met a Baby Doll. In a short time they were Married and went to

live on the Third Floor. Phillip thought that his troubles had greatly Diminished bus such was not to be the case.

One day a Squeak Box Pounder interested Phillip with a flow of Wireless Lingo and in a few hours he was talking about spark-gaps, oscillation transformers, radio calls, amplifiers, loose couplers and rheostats. The Wireless Bug had nibbled him and Bit Hard. Of course Phillip thought he would be Satisfied with 'most any kind of a set but such was not to be in the life of Phillip Algernon Fitzdoodle.

The Local Relay League was on the job. Soon an Amateur who was short of Cash but long of Wind appeared in the Scenery with a Home Made Set which he would gladly Sacrifice at a 1914 Figure because his Pa and Ma were going to move to

California. Opportunity had surely taken Phillip's door to Wirelessdom off its hinges. He eyed the Outfit like a little Sod Buster does his first Pin Wheel and managed to scrape up enough Cash to call the Static Collector his very own. It looked like he was soon to become the sole owner of a Beautiful Collection of Junk but such was not to be.



Fitzdoodle's next problem was to get the Sweetest Girl to permit him to install Signor Marconi's Invention in the kitchen. So taking a chew of Ever Sweet and with his Rotary gaining in speed he started homeward looking like a Moving Van. When Phillip arrived at the Proper Address the Sweetest Girl met him on the First

Flight with an Icy Stare. She thought he had robbed a Freight Train and the Wild Look in his eyes indicated to her that the Authorities were hot on his trail. Of course her fears were without a Ground and she was only Up In The Air. Phillip told her what had happened from the time the bug had Sampled him until it had socked in its stinger to the hilt. He explained that by hooking up the instruments Properly which he understood Perfectly that both could hear the zippy zips of wireless operators many meters away. The only meters she knew anything about were Gas Meters and they were very expensive. She thought that all meters were alike. Phillip received the Coolest Reception that had ever been held in his Honor. He knew that the Great Out Of Doors was very much crowded in his neighborhood and that His Landlady would land on him if he attempted to erect an aerial in her Roof Garden. So he promised his Unknown Factor everything that he could not deliver from a High Powered flivver to a Seal Skin coat next winter but she would not budge. Phillip Algernon Fitzdoodle who had been Master of the Apartment was now an Unwilling Slave to a Beautiful Blue Eyes who was often too lazy to punch holes in her own dough-nuts. This could not continue with Phillip Algernon Fitzdoodle.

As Phillip sat looking out of the window wondering what he could do to make his Bitter Sweet oscillate the telephone bell rang. The Voice of a member of the Local Relay League said that he had heard Phillip was interested in Wireless and invited him to call and "Listen In" on a Real

(Concluded on page 17)

Power Factor in Oscillating Circuits

FEW articles in QST have started so much deep thinking and so much violent discussion as the "Wherefores" of Mr. M. B. West in February's QST. We published a few communications on the subject in the April number but they were merely the advance guard of an army of letters of such proportions that we just had to stack them up in the corner until we had a holiday to dig into them and see what all the shooting was about.

We acknowledge particularly interesting communications from Messrs. S. E. Anderson, Brooklyn; M. B. West, Waukegan, Ills.; E. W. Stone, San Francisco; John K. Andrews, Pittsfield, Mass.; Fred. Winkler, Jr., New York; J. A. Morris, New Britain, Conn.; F. F. Hamilton, Indianapolis; and E. L. Powell, Washington, D. C. Chief

discussion has centered on the question of power factor in oscillating circuits—certainly a thing that every radio man *ought* to know about—and we have been enjoying the spectacle of two about equal groups of well-versed men, most of them engineers, taking diametrically opposite views of a vital subject, one side insisting that power factor in an oscillating circuit can be nothing other than unity, while the other side just as strongly contests that it is zero. Now textbooks define the matter pretty well, but all of these men are intelligent, so it isn't likely that we would find half of them just uninformed—the matter isn't nearly that simple. The trouble is largely in that half of the time they aren't talking about the same thing! Surprising, however, is the confusion regarding fundamental A.C. theory and

definitions, and wonderful have been some of the combinations of vector diagrams for parallel resonance circuits accompanying formulae for series circuits, and vice versa, and great has been the dispute! All over the country there have been signs of activity, and, as we know from experience, if there's anything that will drive a man looney it's to attempt to review A.C. theory at one sitting—or even in a week. But cobwebs have been brushed off the old textbooks, "slip-sticks" broken out to light of day, headaches acquired with the sudden realization that even simple algebra was a forgotten language; wives, sweethearts and radio sets have been neglected, two chaps have even come to Hartford to argue the matter; and surely much good has come of all of it.

We are not half sure in our own minds that enough light has been shed on the subject but certain things do stand out and should be realized in clearing the air for further discussion of possible practical improvements in circuit arrangement:

(1) The theory of power factor in radio frequency circuits isn't different from that applying to A.C. power circuits—the well known formulae and practices still hold.

(2) The closed oscillating circuit of a spark transmitter is a series circuit, not a parallel circuit, and such a series circuit has but one "current" flowing thru it.

(3) In such an oscillating circuit the capacitive reactance volts are numerically equal to and opposite in polarity to the inductive reactance volts, whereby the two

reactances cancel. The only remaining voltage drop occurring is that across the apparent resistance of the circuit, which voltage (supposing a perfect condenser without phase displacement) is always exactly *in phase* with the current. The power factor is therefore *unity*, not zero.

(4) It is true that there are large voltages across both the inductance and capacity but they exactly offset each other at resonance and the true power is found by multiplying the current (there is but one current in a series circuit) by the voltage *across the circuit* (not across either inductance or capacity). No amazing values of watts will then be found.

(5) This should not be confused with the fact that there truly is a phase angle of 90 degrees between the current and the voltage across either inductance or capacity. It is this phase difference that has sent so many good men on the wrong track, but it has no bearing on the power factor of the circuit as a whole which must be computed on the resultant voltage across the circuit as a whole and not on that across any one part of it.

(6) We could discourse somewhat similarly upon a parallel circuit, where again the power factor at the resonant frequency is always close to unity and cannot be otherwise.

With which we take pleasure in presenting the following article which by correcting any misimpressions concerning the fundamental *theory* will, we trust, settle the dust for further discussions relating to improved design.

Some of the Whereso'res of Radio

By S. E. Anderson

WE all remember the articles by Mr. M. B. West in the February number of QST, in which he frankly invited discussion of a number of the perplexing everyday problems of radio. The opening salvo of this discussion appeared in the April number, and certainly emphasized the fact that there are a number of things in this great game of ours that it will pay us to stop and think about.

I am writing this article in order to throw what light I may on some of these problems, which I have endeavored to discuss in the light of my own experience, tho I wish it thoroughly understood that I am laying no claim to infallibility. The larger part of the discussion has been concerned with that elusive young scamp, power factor. I think our chief trouble has been that we are a bit afraid of it, just because we are dealing with a few more cycles than most of the text books talk about.

To touch briefly on the other points of Mr. West's article, his first question is, "Why is there an optimum wave length

for any given antenna?" The letter, if not the spirit, of Mr. Stone's explanation in the April QST is, I think, entirely correct. We have a number of factors involved, some increasing with wave length, and some, notably the radiation resistance, being much smaller for the longer wave lengths, and the point at which the sum of these various factors is a minimum is the best operating wavelength. But I most certainly agree with Mr. West that in view of the extremely varied conditions under which amateur antennae are erected it is almost impossible to calculate this optimum wave length in advance. From the waves one hears on the air, it is generally more than two hundred meters!

I will not attempt to discuss the apparent greater efficiency, measured in miles per watt, of C.W. apparatus. I must admit that I have never been entirely satisfied with the usual explanations offered, but I have none that are any better, and the factors involved are so numerous that it

could well form the subject matter for a series of articles by someone with experience in the C.W. field.

Now let us look at this matter of power factor, avoiding mathematics as much as possible, but not being afraid to use it where it will help. I have of necessity assumed that we are all either familiar with the proof of the fundamental relations which I state or else we don't care anything about this proof. These relations, in the final analysis, can be developed only by the use of The Calculus, for which I am sure we all have, to say the least, the most wholesome respect.

It can be safely assumed, I think, that we are all familiar with the fact, as explained in Mr. West's article, that with

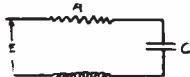


Figure 1.

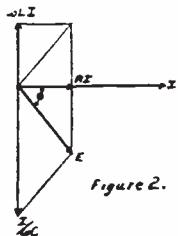


Figure 2.

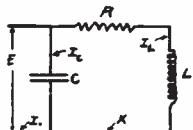


Figure 4.

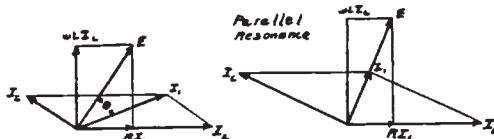


Figure 5.

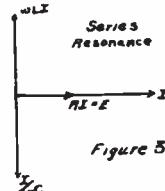


Figure 3.

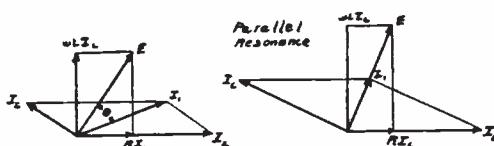


Figure 6.

alternating current the current flowing through an inductance lags behind the voltage across it, while the voltage across a condenser lags behind the current flowing through it. If we have a simple series circuit as shown in figure 1, consisting of a resistance of R ohms, an inductance of L henries, and a capacity of C farads, and apply to the circuit a sinusoidal E.M.F. whose effective value is E volts, and whose angular velocity is ω radians per second, where ω is 2π times the frequency in cycles per second, it may be shown that the effective value of the current through the circuit will be

$$I = \frac{E}{\sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}} \quad (1)$$

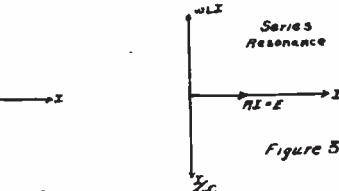
A vector diagram will be most helpful in our discussion, and one is shown in figure 2. Starting with the current I , we draw the vector representing it, and in phase with it the vector RI , the voltage across the resistance. 90° ahead of the current is the voltage across the inductance, ωLI , and 90° behind the current is

the voltage across the condenser, $\frac{I}{\omega C}$.

The vector sum of these three potentials is the total impressed voltage, represented by vector E . In general this voltage will not be in phase with the current, the cosine of the angle θ between them being called the power factor, and it may be shown that the power is

$$W = I^2 R = EI \cos \theta \quad (2)$$

Now it is obvious from equation (1) that if we make ωL equal to $\frac{1}{\omega C}$, the current will be a maximum and equal to $\frac{E}{R}$,



and the vector diagram will be of the form shown in figure 3, the current and voltage now being in phase and the power factor unity.

Let us now consider the case of parallel resonance, in which we have an inductance, resistance, and capacity connected as shown in figure 4, the constants being represented and measured in the same manner as for equation (1). With a sinusoidal E.M.F. applied at E , the current through the condenser will be

$$I_C = -\omega CE \quad (3)$$

and the current through the inductance and resistance will be

$$I_L = \frac{E}{\sqrt{R^2 + \omega^2 L^2}} \quad (4)$$

The vector sum of these two currents is the total current, or

$$I_T = E \sqrt{\left(\omega C - \frac{\omega L}{R^2 + \omega^2 L^2}\right)^2 + \left(\frac{R}{R^2 + \omega^2 L^2}\right)^2} \quad (5)$$

The vector diagram of this circuit is shown in figure 5. Starting with the current through the inductance, I_1 , we draw the vector representing it, and in phase with it the vector RI_1 , the voltage across the resistance. 90° ahead of the current is the voltage across the inductance, ωLI_1 , and the vector sum of these two potentials is the total impressed voltage, E . The current through the condenser, represented by vector I_c , is 90° ahead of this voltage, and the total current, I_t , is the vector sum of I_c and I_1 . In general this will not be in phase with the impressed voltage, and as before the cosine of the angle θ between them will be the power factor.

It is apparent from equation (5) that if we make

$$\omega C = \frac{\omega L}{R^2 + \omega^2 L^2}, \text{ the current has its minimum value of } I = \frac{ER}{R^2 + \omega^2 L^2}.$$

and will be in phase with the applied E.M.F., while the vector diagram will be of the form shown in figure 6.

It will be noted that in these equations, the effective resistance of the condenser has been neglected, tho not that of the inductance. The losses in any but the poorest paper condensers are negligible for any analysis which does not require extreme precision, but the resistance of many of the large air core coils used in radio work is frequently of considerable magnitude. In many circuits, however, the resistance may be neglected, and if this is true we have the condition that for either

$$\text{series or parallel resonance } \omega L = \frac{1}{\omega C}$$

and at the resonant frequency the voltage across the series circuit is zero and the current is infinite, while with the parallel circuit the voltage across it at resonance is infinite and the current is zero, as is apparent from an examination of the equations.

Now if we take the circuit shown in figure 1 and connect a spark gap at E , we have the typical oscillating circuit of the spark transmitter, which is the same circuit as would be obtained by taking our "parallel resonance" circuit of figure 4 and inserting a spark gap at X . I think this is one point where some of us have been getting off the track. The ordinary spark transmitter circuit looks like a parallel resonance circuit at first glance, but it is apparent, once it is pointed out, that as far as the radio frequencies are concerned it is a series resonant circuit.

When free oscillations occur in such a circuit as is represented in figure 4 with a spark gap at X , there being no external potential applied at E during the period of oscillation, it may be shown that the instantaneous value of the current is

$$i = I_0 e^{-\alpha t} \sin \omega t \quad \dots \dots \dots (6)$$

where I_0 is the initial current, α is the damping factor, and t is the time elapsed since the starting of oscillations. Taking E_0 as the initial potential across the condenser, the values of the constants are as follows:

$$I_0 = \omega C E_0, \alpha = \frac{R}{2L}, \omega = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}} \quad \dots \dots \dots (7)$$

In any oscillating circuit worth mentioning, the ratio of inductance to resistance is large, so the last term of the expression for ω is negligible and it may be written

$$\omega = \frac{1}{\sqrt{LC}}, \text{ which is identical with } \omega L = \frac{1}{\omega C}$$

which, from equation 1, is the condition for resonance of the series circuit, or the frequency of a circuit in which there exist free oscillations is the frequency for which the circuit is resonant, or has unity power factor.

To consider this from the practical man's viewpoint, let us assume for the moment that the circuit did not oscillate at the resonant frequency. The impedance of the circuit is a minimum at this frequency, so if it were oscillating at some other frequency we would have the impossible condition of a current flowing in an electric circuit which was less than the maximum possible current. This oscillating circuit is entirely self-contained with nothing external to it to control the frequency, so it will naturally be the frequency which will permit of the maximum current, or the resonant frequency.

In Mr. West's article, referring to his figure 3, I think his error is in not considering the proper voltages and currents when he talks about power factor. We have a simple series circuit, in all parts of which the same current is flowing. The voltage across the inductance is 90° ahead of this current (with zero resistance), and the voltage across the capacity is 90° behind. Mr. West asks us to consider the power factor at some point such as A, but I know he is thinking of the voltage across the circuit, as shown by his arrows, and the current in the circuit, which have no relation to each other at all. The power factor of this circuit at resonance is unity, and the power in the circuit is the product of the current by the voltage AROUND the circuit, which is only the drop across the resistance of the inductance and the spark gap, if present, and is very small. Thus even tho the current may reach enormous values, its product by the proper voltage gives us a reasonable value for the power. If we have a parallel resonant circuit (figure 4 of this article) such as

occurs with tube hookups, its power factor will also be unity. The voltage E across the circuit will be very high, and although the current through the condenser (I_c) and that through the inductance (I_L) may be very large, the current through the circuit (I_t) is very small, so multiplying it by the voltage across the circuit does not give us ten kilowatts from a five watt tube.

With these facts in mind it is apparent that we gain nothing directly from such an arrangement as is shown in Mr. West's figure 4. Any transformer functions by virtue of its inductance, and the phase relations in the transformer windings will be the same whether the windings contain one turn or ten.

From exactly the same considerations, the power factor of our antenna circuit will be unity when it is tuned to resonance. I have never studied the theory of the multiple tuned antenna, but I am sure that its increased effectiveness is due to something other than an improvement in power factor, such as the increase of the ratio of inductance to capacity and ohmic resistance, and the better resulting current distribution over the entire length of the antenna.

Mr. Winkler in his discussion gives us a very good picture of the negative power loops which occur when the power factor is not unity. I think his error is in considering an oscillating circuit as a parallel circuit when he drew the vector diagrams, and then considering it as a series circuit when he wrote the equation, while he also seems to lose sight of the fact that when the resistance is small the frequency of a freely oscillating circuit just naturally has to be the frequency for which the circuit is resonant.

Referring to paragraph 3 of Mr. West's discussion in the April number, it might be well to emphasize that we have resonance when the inductive and capacitive reactances are equal, and that the constants of the latter occur in the denominator. We all know that if we want to obtain the same frequency with twice as much inductance, we require only half the capacity, so we have an infinite number of combinations of inductance and capacity for any given frequency, but only one pair of values of inductive and capacitive reactance. I think the other points in this paragraph have been covered.

Referring to paragraph 4, Mr. West is perfectly correct in stating that there is always a critical combination of inductance and capacity which gives the best results for any given wave length. The reason for this is our old friend—resistance. The optimum combination of inductance and capacity for a given wave length is that combination for which the time constant of the inductance is a maximum, when this time constant is defined as the product of

the inductance and the angular velocity, ωL divided by the resistance. (Written $\frac{\omega L}{R}$).

The rigorous proof of this fact is somewhat involved, but its truth is obvious. It simply means that the more efficient we are able to make our inductance coils the better our circuits will be, and that we should choose a coil which has the highest possible time constant over the frequency range it is desired to cover. I had convincing proof of this in some recent work with vacuum tube oscillators, in which replacing a coil by another of the same inductance, but with a time constant about four times that of the first resulted in a great increase in output, as well as a much improved wave form and greater stability, the net improvement being much more than proportionate to the increased time constant of the new coil.

In conclusion I wish to say that I have tried to maintain throughout this article the same spirit which prompted Mr. West's original speculations. It is only by thus sharing our problems and opportunities that we can make any real progress. I have covered most of the major points raised, the space does not permit as detailed discussion as the subject deserves. I have tried to avoid mistakes, but as this is impossible, I shall be glad to have them pointed out, and will welcome additional ideas.

THE TROUBLES OF A TROUBLE SHOOTER

(Concluded from page 13)

Set. Could Phillip turn down an offer such as this? He could not, and his promise to appear at a certain place at a certain time was rarely ever a Brass Brick.

It would be easy to tell how it all Happened but let us make a Short Story of it. Phillip did induce his Storm and Strife to accompany him and in an hour both were sitting in front of the Bakelite. A few adjustments by Friend Indeed brought in a few zippy zipps and another little Twist and the sweet strains of "Carry Me Back To Old Virginny" floated in from KDKA. Phillip handed his Sour Grapes another set of phones and both listened to the Music until they had to be Kicked Out.

The Sweetest Girl has given up her Sewing Table on which rests a Short Wave Set. Over the sink swings a box aerial. A loud speaker dangles from the spot where a picture of Bread Pudding previously decorated the wall. A shelf in the cupboard is devoted to batteries and Mrs. Phillip Algernon Fitzdoodle is again devoted to her husband.

Phillip often comes home with a pocket full of Trouble Tickets and a Grouch but he tunes up a Real Set and floods his Happy Apartment with Music long after he has finished washing the dishes.

The Ideal Relay Spark Station

By R. C. Denny, 6CS

In Two Parts: Part II.

The Spark Gap

This is another part of the apparatus that is generally not so well understood. The spark frequency and the quenching are vital factors in the success of the transmitting set. In the great majority of relay stations the rotary spark is used, and it is generally acknowledged to be the best all-around gap. It gives a fairly good smooth tone over a considerable range of voltages and spark frequencies, and besides is quite easily cooled, in fact is self cooled; and may have very good quenching characteristics also.

Synchronous rotaries are indeed the most desirable, but unfortunately are most impossible to get hold of except at considerable expense. Their speed holds in step with the frequency of the supply current, and the sparks may be timed to occur at the most favorable points of the voltage wave. This condition can be very closely approached with a non-synchronous motor in connection with a rotary gap, if certain conditions are observed.

Spark frequencies of from 500 to 600 per second are quite effective, and besides being pleasant to the ear, are generally high enough to work the condenser up to the power rating of the transformer. A rotary for operation on a 60 cycle system, should be equipped with a rotor having a number of studs equal to some sub-multiple of 60, say 12; and be operated at a speed that will give a spark frequency equal to some multiple of the current frequency, say 600. Thus the 120 alternations or waves per second may be divided up equally, and the spark timed, so that no stud is opposite an electrode at the zero point on the wave. A twelve stud rotor would have to run at 3000 RPM to give 600 sparks per second; while the same spark frequency could be obtained by running a 6 stud rotor at 6000 RPM. For a rotary on a 50 cycle system, the same reasoning applies. A spark frequency of 500 is desirable, and may be obtained by running a 10 stud rotor at 3000 RPM or one of 5 studs at 6000 RPM. In the case of the higher speed rotor of fewer studs, the quenching would of course be much improved, which is very desirable. Other combinations of speed and studs will suggest themselves. To be able to time the sparks properly, the stationary electrodes should be mounted on a yoke which may be turned through a few degrees about the shaft, and clamped at any desired position. It is adjusted till the spark gives the very

smoothest tone, and the radiation ammeter should show an increase at this point. (Note 4.)

Needless to say, perhaps, studs and electrodes should be flat and wide, and the gaps set at a very minimum, just sufficient to clear. Furthermore the edges of the studs and electrodes must be exactly parallel, or the sparks will occur at the closest point only and the advantage of the large cross section be lost. Inclosed rotary spark gaps are a luxury, but well worth while. Quenching is better and the

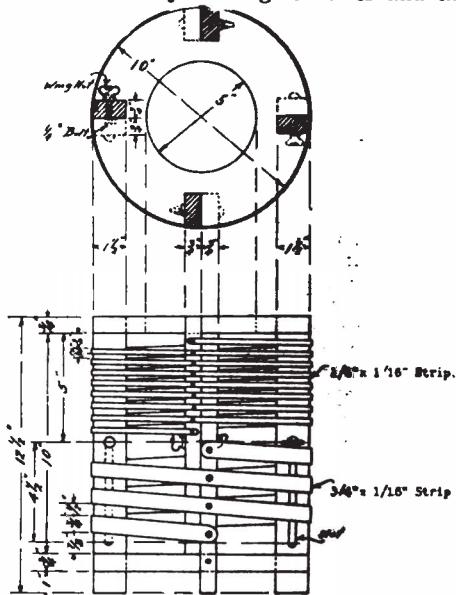


FIG. 5

objectionable noise and light from the spark is entirely overcome. There are so many medium priced rotary gaps on the market that it is hardly worth while to undertake building one, especially since the motor itself is the main item of cost, and would have to be purchased in any event.

The Oscillation Transformer

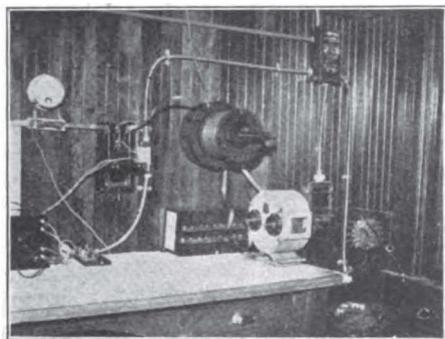
This is at least one instrument that can be built and operated by most any amateur. There are in use two general types, the pancake or spiral, and the helical. The latter is probably the better transformer, because it produces a uniform and undistorted magnetic field. The main points to

remember in designing an oscillation transformer are to use large conductors, spaced sufficiently on a good insulating material, in such a manner that the distance or coupling between the two coils is variable.

The drawing shown herewith (Fig. 5) illustrates a very simple yet efficient oscillation transformer, good for 1 KW or more. The frame may be made of 'most any sort of wood, if it is thoroughly dry. There is little or no need of using more than two or three turns in the primary for 200 meter work, while six or eight turns in the secondary will usually be found sufficient. Dead turns are not to be desired, and if any exist after the set has been tuned up, they had better be cut off. Only one of the uprights in each pair need be slotted for the sliding coupling. The bolt in the others may be fixed solidly by countersinking a nut in flush. The metal strip used may be either copper or brass, and fastened to the frames by round head, nickel plated wood screws.

The Radiation Meter

This may be a hot-wire ammeter or an instrument of the thermo-couple type, of 0 to 5 amperes scale. However, it is



ARRANGEMENT OF APPARATUS

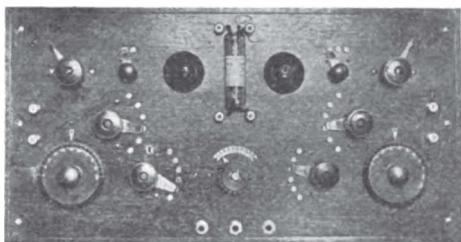
of hardly enough importance to justify much of an investment. Its chief value is in getting the highest indication when tuning the set up, and whether the reading represents actual amperes or not is a matter of small consequence. After that it is of very little use, and should be cut out of the circuit entirely or shunted with a single-pole single-throw knife switch.

The Key

Little need be said about this piece of equipment. Any easily adjusted smooth-working key, of 10 amperes capacity, is sufficient for a 1 KW installation; preferably one in which conducting strips are used to convey the current to the contacts, instead of depending upon the trunnions for that purpose. Fads in keys are rather to be lamented, as there is enough poor sending without them.

Arrangement of the Transmitter

Little need be said in this connection, as amateurs who pretend to be relayers in any sense of the word have a very good understanding of these pre-requisites. However, the accompanying photograph is presented as a good example of the compact arrangement of a transmitting set, which is necessary in order to have very short leads in the closed oscillatory circuit. All conductors of this circuit should be of comparatively large cross-section, to offer little resistance to the high frequency current. It will be noticed that

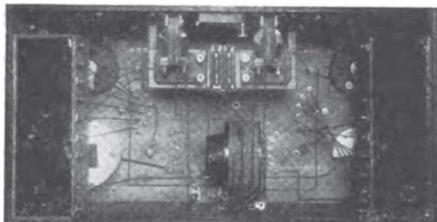


PANEL ARRANGEMENT OF REGENERATOR

the inclosed rotary is mounted with the pulley over the edge of the table, and the driving motor on the floor. This does away with excessive vibration, and gives more room on the table.

Tuning the Transmitter

For the accurate tuning of a set, a calibrated-by-standard wave meter is absolutely necessary. However, as this is an instrument that few amateurs possess, it is often necessary to resort to some approximate method. As most amateurs have some sort of receiving set, more or less sensitive, there is no reason why the receiving set itself should not be used as a wave meter. The amateur is perfectly familiar with tuning in 200 meter stations, and can adjust his circuits to the point where he gets some particularly sharp-tuned 200 meter station best. Then using his receiving set without changing any of the adjustments, as a wave meter, he may tune the transmitting set.



INTERIOR OF SHORT WAVE REGENERATOR

To tune the closed oscillatory circuit, the tuning coil or inductance of the receiving set should be brought into close

inductive relation to the primary of the oscillation transformer. The contacts of a small buzzer should be connected in place of the spark gap, in series with the condenser and primary. On operating the buzzer, this circuit will be excited by the spark at the contacts. The primary tap should then be varied on the oscillation transformer until the spark tunes in sharp at the 200 meter adjustment of the receiving set. In all probability one turn of inductance will be found sufficient, or possibly some fraction of a turn more or less.

The open circuit may be tuned independently of the closed circuit, by cutting the buzzer contacts in the ground lead, and with the tuning coil of the receiving set in close inductive relation to the secondary

meter, or to wind up an inductance and have it calibrated in connection with a variable condenser, borrowed from your receiving set for the time.

The Receiving Set

There are an infinite number of hook-up for receiving sets, and it would be folly to attempt to say which is the best. At any rate a short wave regenerative set, with two steps of amplification, is essential to an up-to-date reliable relay station. Whether the variometers or condensers are more effective is still very much a matter of opinion, and very wonderful work has been done on sets of both kinds.

The set described herein and shown in accompanying photographs and drawings has been giving splendid results on an in-

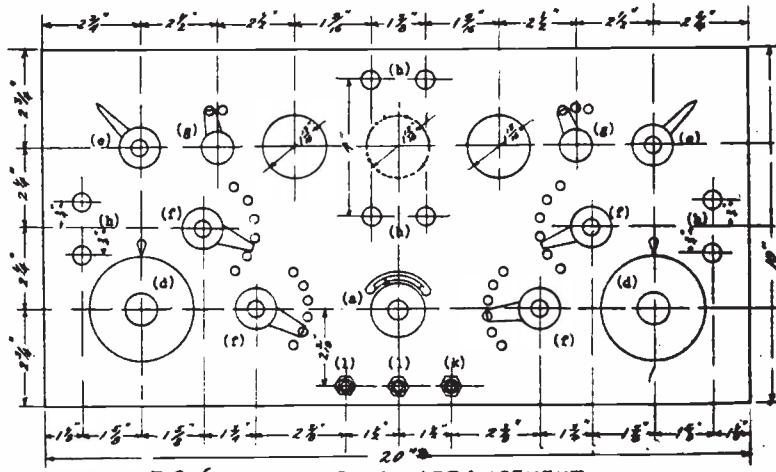


FIG 6 PANEL ARRANGEMENT

of the oscillation transformer and the aerial connected in its place at some point on the secondary. Then without changing the receiving set adjustments from the previous test, the buzzer should be operated and the secondary turns varied, until the spark tunes in sharp at 200 meters as before. Then on placing the primary and secondary in inductive relation, with comparatively loose coupling, and operating the set with the power on, a wave of very nearly 200 meters will be emitted.

Another method would be to simply use one turn in the primary and, operating the set, change the secondary turns, while comparatively closely coupled, until the apparent radiation was at a maximum. One trouble with this method is that the radiation might be so low, due to very little power being used, that a variation of several turns in the secondary might not have an appreciable effect on the indication, although the variation would alter the wave length considerably. The better idea would be to borrow a reliable wave

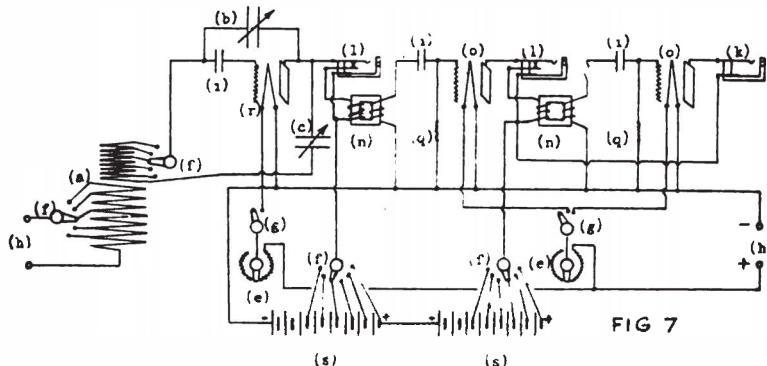
verted L indoor aerial of average height 15 feet from the ground. In fact, all efficient amateur stations within a thousand miles are heard. It is built up of standard parts bought from different dealers, as indicated in the list. The cabinet is built of mahogany, including the panel, and nicely finished, costing about \$5.50. The symmetrical arrangement of the parts gives the set a very pleasing appearance, and they had just as well be arranged that way as not. Since the tubular audions are no longer on the market, it is suggested that a third hole be put in as indicated by the dotted line, to accommodate a detector tube of the standard base type. The drawings and photos so clearly show the set, inside and out, that detail construction points hardly need be discussed. A full size drawing should be made up first and fastened to the panel, and all the center points transferred to the panel by punch marking. This saves scratching up the finish, as probably would occur in trying to lay out the arrangement (Fig. 6) directly on

the panel. Wiring up the set is the biggest job of all, and requires considerable patience, more than anything else. No. 14 bare copper wire was used in this set, and cut and bent to fit. It makes a very rigid job, and has a neat appearance. When using both amplifiers, the points on the filament switch are simply bridged by the lever arm, which is found to be entirely satisfactory. This set has a remarkable range of selectivity, and is recommended to all who are ambitious to build their own sets. It represents probably the best possible arrangement of the necessary apparatus, at the very minimum cost.

- (k) 1 No. 1421W. Federal Phone Jack.
- (l) 2 No. 1422W Federal Phone Jack.
- (m) 1 No. 1428W Federal Phone Plug.
- (n) 2 No. 226W Federal Amplifying Transformers.
- (o) 2 Marconi VT2 Amplifying Tubes.
- (p) 2 Marconi Tube Sockets.
- (q) 2 Marconi 2 Megohm Grid Leaks.
- (r) 1 Audiotron Double-Filament Detector Tube.
- (s) 2 Kennedy 45 Volt B-Batteries.

Comments

Note 4. As a non-synchronous motor cannot be expected to hold in synchronism



The location of the component parts of the set is indicated in the panel layout (Fig. 6) and in the circuit diagram (Fig. 7) by the letters used in the following list:

- (a) 1 Sears-Roebuck SCR-54 Variotuner.
- (b) 1 23-Plate Illinois Variable Condenser, Style No. 1.
- (c) 1 43-Plate Illinois Variable Condenser, Style No. 1.
- (d) 2 Sears-Roebuck Moulded Dials, No. 6A-9349.
- (e) 2 No. 81 Remler Rheostats.
- (f) 4 No. 82BP Remler Control Switches.
- (g) 2 No. 84BP Remler Control Switches.
- (h) 8 Murdock Binding Posts.
- (i) 3 No. 358 Murdock Fixed Condensers.
- (j) 1 Pair No. 55 Murdock 3000 ohm Phones.

any great length of time, the choice of speed described would not prevent electrodes coming into opposition at times when the voltage is too low to jump.

Such speeds "are generally high enough to work the condenser up to the power rating of the transformer", but we must point out that that does not mean greater range, in spite of increased antenna current, because it is the power in each wave train that makes the noise at the other end. For that reason we recommend that attention be given methods that put the greatest power in each discharge, such as the use of high voltages and a low spark note, preferably synchronous so as to discharge the condenser at or near peak voltage.—Editor.

Spark Reception on Honeycombs

By Charles Kinyon

IN the January QST I read with interest the article written by "A Novice" regarding the use of the Honeycomb coils, also the articles written by Mr. Groves in the January and previous numbers. I noticed "A Novice" requested that other amateurs of less ability than Mr. Groves give their experiences

with the H. C. coils and in accordance with this request I will set down my experience with them and hope the article will be of some value to the craft in general.

I do not claim that I have been able to get any exceptional results and in fact not as good results as Mr. Groves has reported and doubtless many other amateurs

July, 1921

Without in the least intimating that Mr. Kinyon's "grey matter is a little less grey", as "A Novice" put it, here is a more or less elementary exposition of tuning honeycombs which we know will be interesting to our readers. Mr. Kinyon confines himself pretty well to the reception of damped signals by the zero-beat method and altho most of us incline to the belief that the true field of the honeycombs is above 600 meters, Mr. Kinyon's article shows what can be accomplished with them in amateur work and, what is important, tells how to do it.—Editor.

have done better also, but I do believe that many amateurs are getting very little out of the H. C. coils in comparison to what could be gotten out of them by careful adjustment along more nearly correct lines. I have heard considerable criticism of the Honey-Comb coils from amateurs in this vicinity and I do not think it is justified by the action of the coils when properly handled. Of course the coils have their defects and in time will doubtless be improved upon but at present I do not know of any better receiving equipment for long waves or for a universal equipment to receive all waves from 150 meters to the highest around 20,000 to 25,000 meters, damped and undamped.

According to all the information I can get Salt Lake City is about the worst place in the world to get radio signals into and out of. It is surrounded on all sides by high mountains and in addition the soil is very sandy and dry a great part of the year. Before the war I had a loose coupler set in Kansas City and was getting pretty fair results with it but when I unpacked it here and set it up I could hardly get the Pacific Coast 600 meter stations on it and even after making several improvements in it results were greatly under what I thought they should be as compared with work in Kansas City. I then got the Honey-Comb coils and from the first got much better results with them than with the loose coupler.

In order that others may have some method of comparing their results with what I have been getting I will give some idea of the range I can receive from and if any one will remember that a station on the coasts or in the middle west should be able to receive from 1 1/2 times to 2 times the distance with similar equipment I believe they can readily determine if they are getting as good or better results.

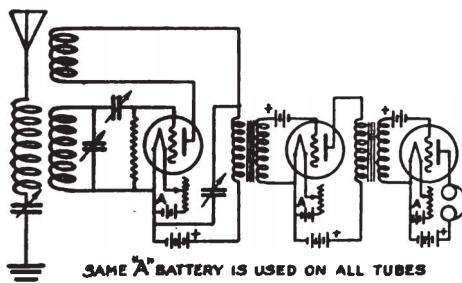
Amateur stations are received from the following points fairly regularly: Portland, Oregon, and south along the California coast to San Diego, Calif.; eastward to Roswell, N. M., and Douglas, Ariz., Anthony, Kans., Wichita, Topeka, Omaha, a station or two in Dakota, several stations in Montana. On commercial waves I can get coast stations on 600 meters with no aerial or ground. I frequently hear boats reporting their position 1,500 to 2,000 miles south and west of San Francisco. Undamped waves are received from Alaska, Hawaiian Islands and occasionally Guam and the Philippine Islands, Mexico

City, NBA Panama, eastern coast stations, NSS, WII, WSO, NDD, NAA and at times I have heard POZ, LCM, and MUU but these last are uncertain and are probably only received during favorable conditions. I have a two-step audio-frequency amplifier in service but find that one bulb will bring in any signals that can be read on the amplifiers provided there is no noise about the house to drown out the weak signals.

I am willing to admit that if anyone will be content with a wave length range of 200 to 600 meters or so, the regenerative set of the so-called Paragon type may be superior from the standpoint of quick adjustment, probably has a greater distance range also; however, as far as I have been able to personally compare the Honey-Comb coils with regenerative sets in this territory I seem to be able to hear amateurs as far away with the Honey-Comb coils as the other fellows do with the regenerative sets and also get a tone which I like better.

Most amateurs, I believe, are never satisfied with their sets regardless of what type, kind and amount of equipment they may have. This is probably due to three principal causes; first, the type and size of aerial is governed more by the room available in which to string it and by the supports it is possible to use than by the amateur's actual beliefs of what would be the best type and arrangement from an operating standpoint; next, the average amateur when starting to build his first set knows very little about what kind of apparatus is really best and must depend very largely on reading advertisements and generally buys at least some articles which he later finds to be greatly outclassed and later when he goes to construct a better set the third item, lack of money to buy what he then knows to be best, induces him to re-use certain parts of the old equipment which he hopes will answer the purpose but which he knows will not perform as well as other parts would do. My own set I know suffers to a greater or less extent from these causes. My aerial is not at all what I would consider ideal, either as to shape or location. The best arrangement I could get out of it seemed to be as follows: I have a pole 55 feet high set at one side of the house and the other end of the aerial is supported by a combination electric light and telephone pole which is about 30 feet high but the ground where the pole is set is

about 10 feet higher than the ground where the house pole is set. The aerial itself is of the inverted L type with the flat-top part consisting of 4 No. 14 copper wires spaced 2 feet apart about 60 feet long, with the free end about 35 feet above ground, and the end from which the lead-in comes off is about 50 feet from the ground. The lead-in consists of 4 No. 14 copper wires tied together and fanned out to meet the flat top portion. The ground is connected to the city water pipes and a pipe driven into the ground



but due to the sandy and dry condition of the ground this proved unsatisfactory for short wavelengths, long wavelengths coming in satisfactorily. This condition was eliminated by burying a single strand of No. 14 copper wire about 4 inches under ground and directly under the aerial. 200 meters then came in satisfactorily but of course more than this would be necessary to fit the aerial for efficient sending.

The receiving set consists of an assortment of H. C. coils from L-25 to L-1500, a Clapp-Eastham variable condenser of .0007 m. f. capacity in the aerial circuit, with a switch to change from series to parallel. (One of the DeForest vernier .0015 m. f. would be preferable and for larger aerials probably the loading condenser of .003 m. f. could be used to advantage.)

The secondary circuit uses a DeForest grid condenser, capacity unknown but probably close to .0005 m.f.; shunt condenser is a Murdock capacity nearly .001 m. f. but this condenser especially should be of the vernier type as it requires very accurate adjustment to obtain good results on short waves. I am using an old style DeForest tubular bulb purchased before the war as a detector and find it the best bulb I have tried although I have used the Marconi Class I and the Audiotron bulbs successfully. The tickler circuit besides the H. C. coil contains the "B" battery and a telephone jack arranged so that the telephone receivers may be plugged into the detector circuit when desired and when pulled out the jack contacts pick up the primary winding of the Fed-

eral amplifying transformer. At present I am using a variable condenser of about .00007 m. f. capacity around the "B" battery and the telephones or amplifying transformer windings but a condenser having a capacity of .004 or .005 m. f. would be much better. On account of the small condenser in use in this circuit I find it necessary to introduce a small loading coil in series with the H. C. coil in the tickler to enable me to get a satisfactory plate adjustment on the short waves. With a suitable plate condenser I think the circuit would be improved by leaving this loading coil out. I am using a grid leak made of lead pencil marks between binding posts on a piece of fiber. I prefer this leak to the Marconi on account of the ease with which the resistance may be varied to suit conditions.

The first step of the audio-frequency amplifiers uses a Marconi Class II tube connected as usual to the secondary of the transformer with a "C" battery of $1\frac{1}{2}$ volts connected negative side to the grid. No condenser or grid leak is necessary in this circuit. A potentiometer to vary this "C" battery voltage would probably increase the amplification but as yet I have not installed it. The plate circuit uses about 100 volts "B" battery and is hooked up through a telephone jack to enable the telephone receivers or primary of the second Federal transformer to be inserted at will.

The second step is hooked up like the first except that a W. E. Co. VT-2 tube is used and a "C" battery of between 8 and 9 volts. The same "B" battery is used on this step as on the first and is also run through a telephone jack to enable the telephone receivers to be used. I am using the Brandes Navy Type phones although I would prefer the Baldwins if available. The sketch shows the circuit used.

I have been using a method of adjusting, particularly on short waves (200 to 900 or 1000 meters,) which I have never seen explained in print and which seems to me to give good results from the standpoint of selectivity and loudness of signals, also retaining very nearly the natural tone of the spark stations although the detector tube is in full oscillation. When this adjustment is obtained the oscillations in the tube are exactly the same frequency as those in the aerial circuit or of the signal to be received (or if there is some difference in frequency it is so small that the beat notes which would be formed by this difference are of such a low frequency as to be inaudible.) For simplicity's sake and also because I know a great many of you will challenge the accuracy of the above statement I will refer to the adjustment as the location of a

(Continued on page 25)

July, 1921

Radio Market News Service

Beginning April 15, 1921, the radio market news service of the U. S. Bureau of Markets was expanded to include the sending of agricultural market reports by wireless from Washington, D. C., Bellefonte, Pa., St. Louis and Omaha, at stated periods each business day. This increased radio market news service is made possible by the co-operation of the U. S. Post Office Department which, through its Air Mail Radio Service, has offered to send certain agricultural reports to the Bureau of Markets at specified hours from its wireless stations at the cities named.

On December 15, 1920, the Bureau inaugurated an experimental wireless market news service at Washington for the purpose of determining the practicability of sending daily agricultural market reports to farmers by wireless, as previously announced in QST. Reports of prices and conditions of leading fruits and vegetables, live stock and meats, grain, hay and feed, at important national markets were prepared and at 5 p.m. each day were sent by wireless from the U. S. Bureau of Standards' Washington radio station to farmers and other agricultural interests within a 200-mile radius of Washington. The experiment proved successful and the offer of the Post Office Department to send similar reports from some of its wireless stations was gladly accepted. The sending of reports from Washington which had formerly been handled by the Bureau of Standards was transferred to the Post Office Department on April 5.

The schedule for sending reports is as follows: From Omaha a complete report of the Omaha live-stock market will be sent at 11:15 a.m. each day (Central standard time), and at 11:45 a.m. a complete report on the Kansas City live-stock market. At 2:15 p.m. a grain and potato report, giving prices and conditions at the Chicago, Minneapolis, Kansas City and Winnipeg grain markets, and similar information at the Chicago and other potato markets, will be dispatched. At 5 p.m. a daily "Radio Marketgram" will be sent, covering national market conditions on live stock, fruits and vegetables, grain, hay, feed and seed. The reports to be sent from St. Louis are a National Stock Yards live-stock market report at 11 a.m. (Central standard time), a Chicago live-stock market report at 11:30 a.m., a grain and potato report at 2 p.m., and the Radio Marketgram at 7 p.m. From the Washington and Bellefonte stations will be dispatched a Radio Marketgram giving a general daily summary of eastern market prices on live stock and meats, fruits and vegetables, grain, hay, feed and seed, at

5 p.m. and 7 p.m. respectively, (Eastern standard time). The Weather Reports from the local office of the U. S. Weather Bureau will be appended to the forenoon live-stock report. Any changes in the form or time of reports will be announced in advance by radio at the time of sending regular reports.

These reports are intended to be received by amateur radio operators within the territory covered by the 300-mile radius of each of the four wireless stations named. There are some 2,500 licensed wireless operators in the area covered, and the Bureau of Markets hopes that as many of these operators as can conveniently do so will receive the reports and see that they are placed in the hands of farmers and other agricultural interests as soon as possible after the information is received. The morning and early afternoon reports will be sufficiently brief to be transmitted in 10 or 15 minutes each, and the Radio Marketgram will require about 20 minutes. Each operator indicating a desire to receive and distribute the market reports will be supplied with blank forms so that it will be necessary for him simply to fill in (in longhand) the prices, and the brief comments on general market conditions. With one exception, the reports will be transmitted on a wave length of 800 meters at a rate of 15 words per minute. The Washington station will use an 1800 meter wave length. The reports will be opened by the general call signal to all stations (QST) and the call signals of the Post Office Department: WWX for Washington, WWQ for Bellefonte, KDEL for St. Louis and KDEF for Omaha.

Suggested methods of distributing the reports are: Furnish them at once to shippers' associations, county agents, States bureaus of markets, farm bureaus, and other agricultural organizations; deliver them to local newspapers for publication; post them on the bulletin board in the Post Office or elsewhere; and file them with the local telephone exchange so that farmers can get the information by asking the telephone operator for it. Suggestions for improvement of the service will be welcomed. It is desired that all A.R.R.L. members interested in receiving or planning to receive the reports by radio communicate with the U. S. Bureau of Markets.

SAVE YOUR MONEY!
CHICAGO CONVENTION
AUG. 30—SEPT. 3

A Cup For Summer Achievement

MR. Seymour Wemyss Smith of "The Hartford Courant", long a member of the A.R.R.L. and likewise of the Radio Club of Hartford and ardently interested in amateur activity, has presented the A.R.R.L. with the handsome loving cup shown in our illustration, to be awarded by the A.R.R.L. to the amateur performing the most outstanding feat in the interest of Citizen Radio, under rules to be drawn up by us.

Mr. S. Kruse has accepted our invitation to become the chairman of a committee to award the cup. He is now forming his crew, to consist of a well-known and representative amateur from each inspection district, he himself representing the Third. The tentative formation of the committee is as follows: Irving Vermilya, 1ZE; C. J. Goette, 2JU; S. Kruse (Chairman), 3ABI; E. H. Merritt, 4YA; J. M. Clayton, 5ZL; A. E. Bessey, 6ZK; Royal Mumford, 7ZJ; Rev. A. J. Manning, 8ZG; R. H. G. Mathews, 9ZN. It has been decided to make the award on November last of this year for the most outstanding accomplishment between July 1st and November 1st. The summer period was chosen purposely, because an achievement made then will be an accomplishment indeed.

The cup stands 13½ inches high, is the same in overall width, and with a bowl 9½ inches diameter. Across the face of it is engraved "National Trophy—American Radio Relay League—In Recognition of Outstanding Achievement in the Interest of Citizen Wireless". On the reverse will be engraved the name of the winner and the circumstances under which the award is made. It is a prize well worth having, for the honor that will go with its possession.

The readers of QST are requested to submit to the Chairman of the Committee, Mr. S. Kruse, 2637 Garfield St., N. W., Washington, D. C., any distinctly meritorious work in the advancement or interest of Amateur Radio that should come to their notice. Any type of work whatever will be considered, whether a feat of operating, construction, design, invention, organization, noteworthy publication, or what not. The achievement must be made between July 1st and November 1st, and all suggestions should be in by November 7th.

Who's going to get it? We'd be mighty proud to have it sitting in our static room, proof to the world that we did something noteworthy in the annals of Amateur Radio. The coming of the contest right in mid-summer means that you'll have to keep on

the job, fellows. Your neighbor will have the edge on you if you don't. We are an organization of Doers and it's going to be no easy matter for the judges to pick a winner, because we're all accustomed, anyway, to work for the advancement of Citizen Wireless. But somebody is going to do something distinctive—something "outstanding". Somebody is going to relay 1100 messages per month right thru summer, or is going to work Japan on a detector tube, or invent something, or put Citizen Wireless to some new use in the



service of the community. We do things that are conspicuous right along, but there's only one cup and the fellow whose accomplishment sticks up head and shoulders above the gang is going to get it, and with it the recognition of service to the game.

So don't dare to give up the set—stick right on the job this summer!

SPARK RECEPTION ON HONEYCOMBS

(Continued from page 23)

quiet spot between two noisy spots and leave the proof or discrediting of the above theory to some of you who have a more elaborate testing equipment than I have at my disposal. I presume that this method is practically the same thing that Mr. Groves described in QST some time ago but as I understood the article it applied principally to the longer waves and I believe that somehow he missed the corresponding results that could be obtained on the short waves.

(Continued on page 32)

First National A.R.R.L. Convention

THE First National A.R.R.L. Convention will be held in Chicago August 30th to September 3rd and will be the biggest combined radio show and general good time ever staged. The programs of the various meetings include the very best speakers from all over the country and it is believed that this program is so varied that it will be interesting to everyone. The Convention headquarters will be at the beautiful Edgewater Beach Hotel, situated on the shore of Lake Michigan. This hotel is of the very latest summer resort type and has as its attractions tennis courts, small golf links, swimming and bathing facilities, dancing, private bus service to the downtown district, and a hydroaeroplane taxi service. Registration will be done at this hotel and the offices of the Convention managers will be located there. The Banquet to be held on the final evening of the Convention will be held on the famous beach walk of the Edgewater Beach Hotel and speeches will be delivered from a gondola on the lake by means of loud speakers.

The general meetings, special meetings and manufacturers' exhibit and show will be staged at the Chicago Broadway Armory. This structure is over a block long and a half block wide and is beautifully decorated. The exhibits which will comprise booths furnished by radio manufacturers and dealers all over the country as well as exhibits of the latest Army and Navy equipment will line the walls of this enormous hall. Chair accommodations for over 2,000 are provided in the center of this hall which is provided with a speaker's platform equipped with modern sounding boards. All the big meetings and lectures will be held here, which is a decided advantage to both the Convention delegates and exhibitors as the meetings and exhibits are thus placed close together.

In connection with the meeting and exhibit hall is the well known Butterfly Room which is fitted up as a dance hall and which will be used for executive and traffic department meetings in the daytime. Dancing will be provided in the evening with music furnished by a special orchestra of radio men.

Refreshments will be served in the large lobby adjoining both the exhibit hall and the Butterfly Room.

These details serve to give a very meager idea of the scale on which this biggest of radio conventions is being staged. Every effort is being made to bring together the most notable collection of radio men ever gathered under one roof, and since "all

work and no play makes Jack a dull boy" special amusement is being provided by the various trips throughout the city as well as by the cabaret and banquet nights.

The cabaret night which will be held on the fourth evening of the convention will be devoted entirely to a general good time at which we will "take over" one of Chicago's best dinner and dancing places. Every attempt is being made to take good care of the wives and mothers who may accompany our delegates and special trips are being organized to Marshall Field's and several other of the large department stores, which should prove of interest to these fair visitors. For those who come without OW's, girls will be provided for the banquet. This may sound like an impossibility but we can guarantee at least 500 unattached young ladies who are willing to be talked to about radio.

Special rates are being arranged in connection with the various railroads whereby tickets will be certified at Chicago by the Central Division Manager which will allow of a considerable reduction on the return fare.

Preparations are being made to take care of an attendance of over 2,000 radio men and in addition an attendance of thousands of other interested Chicagoans is expected. Reservations for the Banquet and meetings, which will total \$5.00 per person, may be made with Mr. N. C. Bos, Reservation Manager, 118 N. La Salle St., Chicago, Ill. In addition to accepting reservations for attendance at the Convention, Mr. Bos will be very glad to supply inquirers with full information regarding hotel rates at the various Chicago hotels and will arrange hotel rooms in advance for any who wish such reservations made. Every effort is being made to get these reservations arranged early. The general tendency, however, is against early reservation because of fear that attendance may not be possible. In this connection it should be stated emphatically that any such reservations made now may be cancelled without question at any time up to and including the day before the Convention. Therefore please do not withhold your reservation because of any doubt as the possibility of your attendance.

At the manufacturers' exhibit, the spaces have been divided to allow booths approximately 14 feet square. The available space aside from that allowed for the meetings has been divided into 31 booths, 6 of which will probably be given over to Army and Navy displays and executive quarters. This leaves but 25 open to the first applicants. The Chief Show Director

advises that a number of unsolicited requests for space have already been received. Manufacturers and dealers desirous of obtaining space can obtain a chart of the booths, rates and contracts from Mr. N. E. Wunderlich, Show Director, First National A.R.R.L. Convention and Show, 4533 N. Sawyer Ave., Chicago, Ill. General information regarding the entire feature of the Convention, show, programs, or reservations can be obtained from the Central Division Manager, Mr. R. H. G. Mathews, 6433 Ravenswood Ave., Chicago, Ill.

A skeleton outline of the tentative program follows:

August 30th.

Day devoted to meeting arriving delegates, arranging reservations, etc.

7:30 p.m. Business and General Organization Meeting.

August 31st

| | |
|------------|--|
| 10:30 a.m. | Educational Lectures. |
| 1:30 p.m. | Central Division Organization Meeting. |
| 3:30 p.m. | General Business Meeting for discussion of interference control, time division, traffic regulations, observance of laws, legislative matters, etc. |
| 7:30 p.m. | Technical Meeting on spark apparatus. |

| | September 1st. |
|------------|--|
| 10:30 a.m. | Educational Lectures. |
| 1:30 p.m. | General Club Organization Meeting. |
| 3:30 p.m. | General A.R.R.L. Operating Department Meeting, to take action on matters discussed in general business meeting of preceding day. |
| 7:30 p.m. | Technical Meeting on C.W. apparatus. |
| | September 2nd. |
| 10:30 a.m. | Educational Lectures. |
| 1:00 p.m. | Indoor Baseball Game between A.R.R.L. Board of Direction and Chicago Executive Council. Each player will have his call letters printed in large letters on a white placard fastened to his back. |
| 3:00 p.m. | A.R.R.L. Board of Direction Meeting. |
| 8:00 p.m. | Cabaret—not a meeting but a get-together, free of speeches. |
| | September 3d. |
| 10:30 a.m. | Hamfest. All the DX men available will describe their stations, etc. |
| 2:00 p.m. | Stunt Party, with novel and interesting tests for which valuable prizes will be given. |
| 8:00 p.m. | Banquet and Dance at Edgewater Beach Hotel on the famous Beach Walk. |

A Sure-Fire C.W. Circuit

By E. W. Whittier, 1DH *

AFTER trying several C.W. circuits with poor or indifferent results, I happened to run across the hookup shown below, for which credit is due the General Electric Co. The beauty of this circuit is that anyone who can wire up a set correctly can get the maximum output of his tubes with almost no trouble at all. The constants given below have been found to be correct for two UV-202 tubes on several different grounds, aerials, etc.

This article deals mostly with the UV-202 tubes. Since they can be overloaded so easily and safely, we may as well get all we can out of them. The source of plate supply used is an Acme 200 watt C.W. transformer, the output being rectified by an electrolytic rectifier. The output voltage after rectification is between 550-600 V. This means that a high resistance grid leak must be used to keep the grid negative enough to prevent excessive plate current. If the tubes are run on normal plate voltage (350 V.) the grid leak may

be omitted. Using from 550 to 600 volts is liable to cause fireworks inside the stem or seal of the tube, and a safety gap connected from the grid of one of the tubes to the filament is recommended. This gap should be about .015 inch (1/64 inch).

The writer runs his two tubes on this high voltage and uses about 150 M.A. plate current. The power put into the antenna circuit is 30 watts under these conditions. The efficiency of the tubes at this overload is about 33%. The antenna current will vary with the conditions of resistance in the antenna and ground system. Using a 14 ohm antenna system 1.5 amperes can be obtained. With a good counterpoise the resistance may be made as low as 5 or 6 ohms, giving an antenna current of 2.2 to 2.5 amperes with the same plate voltage and current.

The circuit diagram and its accompanying legend show the constants of the various pieces of apparatus and exactly how to connect them up to get results.

The only meter that is absolutely needed is the antenna H.W.A. but it is highly

*Radio Engineer, Atlantic Radio Co.

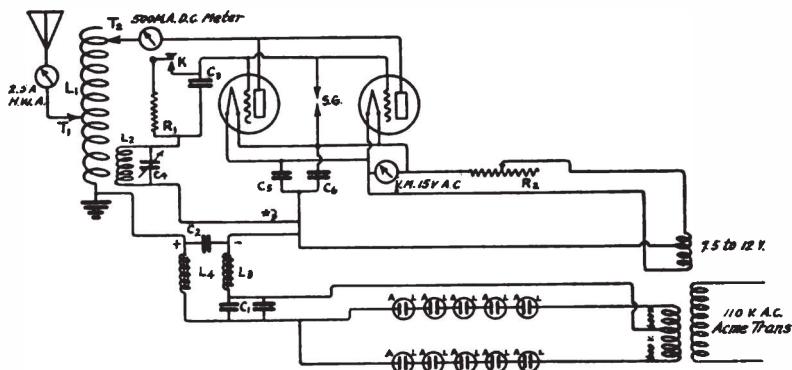
desirable to have a filament voltmeter and a plate milliammeter.

The only real critical adjustment on the whole set is the value of C_4 . If the value of this condenser is not right, the grids may be at such a low negative potential that the plate current may become very great. The value of C_4 is different for each change of T_1 .

In setting up this circuit, or any other for that matter, the use of as short connecting wires as can be used is always to be recommended. The condensers C_2 , C_3 ,

sq. in. per 100 M.A. is about right. When these plates are working properly there are little scintillating sparks running all over the immersed portion. The best way to make up the solution for these rectifiers is to dissolve as much 20 Mule Team Borax as possible in cold distilled water. Allow the surplus borax to settle and fill the tumblers containing the lead and aluminum strips with the clean liquid. As the solution evaporates add only distilled water.

It will be noticed that an A.C. voltmeter was used to tell the proper filament



L_1 —Antenna inductance 25 turns of large wire or edgewise wound copper ribbon about 5 to 6 inches in dia. Well insulated.

L_2 —Grid tickler coil 15 turns bell wire on 3 to 4 inch dia. tube and placed in bottom of L_1 . Wind in the opposite direction to L_1 .

L_3 , L_4 —1½ henry iron core chokes, 500 M.A. capacity. 150 M.A. will do.

C_1 , C_2 —21-AA Western Elec. Co. 1 mfd. condensers.

C_3 —.0005 to .005 mica or air condenser, fixed.

C_4 —.0005 to .001 air condenser (variable)

C_5 , C_6 —.001 fixed paper condensers.

R_1 —Grid leak resistance 10,000 to 15,000 ohms.

R_2 —Rheostat capable of carrying 4.7 amperes. (The rheostat may be done

away with if the voltage of the transformer is just 7.5 V. when the tubes are lighted. When modulating, the filaments need to be a trifle brighter than for telegraphy.

T_1 —Tap to vary wave length of antenna circuit.

T_2 —Tap to vary power input to plates of tubes (coupling).

V.M.—0-10 or 0-15 voltmeter.

S.G.—Safety gap.

K—Key.

*Secondary of modulation transformer may be inserted at this point. The secondary of this transformer must be shunted by a .001 condenser or short circuited when using straight C.W. The value of C_4 then will be different when modulating than when using C.W.

and C_6 should be right in the set and not near the transformer or rectifier. These are high frequency by-pass condensers and should be connected by short leads, and be near the oscillatory circuit.

In setting up the electrolytic rectifier, don't use large plates thinking you will get more voltage or current. If the plates are too large or too small the voltage and the completeness of rectification is affected. The author uses aluminum strips $\frac{1}{4}$ " wide and 3" long and $1/32$ " thick; these pass 200 M.A. easily. If the plates are wider they should not be immersed so far into the borax solution. A total area of $\frac{3}{8}$

brilliancy. This method gives several times as great filament life as the use of an ammeter for this purpose.

This same circuit may be used on UV-203 tubes (50 watt) with slight changes in the constants. The grid leak at 750 volts may be omitted. With 1000 V. on the plates of two UV-203 tubes the grid leak is about 250 ohms; for one tube twice that. The condensers on the filter circuit will have to be able to stand 2000 V. at least. Ten tumblers on each side of the 1500 V. secondary winding of the plate voltage transformer are needed.

The author has been using a small set

as described (two UV-202's) and has had no trouble working over 800 miles on straight C.W. With voice modulation about 100 miles is the limit when there is no QRM. I wish to thank those who have so kindly reported the signals from 1DH and stand willing to help those who may be in need of any dope on hooking up a C.W. Set.

(Editor's Note—Circuit students will recognize this hook-up as the favorite diagram of the English engineers in their war-time sets. It appears frequently in Stanley's "Valves and Valve Apparatus".

As to the results it gives, it is far and away the best short wave oscillator we have ever tried. Since the receipt of Mr.

Whittier's paper at the QST office we have tried this circuit at three different stations, one a phone station using two 50-watt tubes in a Colpitts circuit, one a 5-watt set using the Hartley circuit, and the third an experimental circuit using three E tubes. In every case surprising improvement resulted. These three cases are not enough from which to make a general rule but nevertheless we will state that the new circuit gave outputs that averaged more than twice the watts power given by the original circuits, accompanied by the ability to reduce wave length an average of 100 meters in each of the three sets. The 5-watt set used a UV-202 and with the new circuit, using 850 volts a.c. on the plate, 15 watts were put into an antenna of 500 mmfds. capacity on 190 meters! It works—try it.)

QRX For a New O.W.

By Irving Vermilya, IZE

"**S**QUEEK, scratch, pick, putter, pfoof, spiff awawk—" "What the hexx is this," thot old 1HAA, as he tuned around trying to get a line on its decrement. "Something new moved into this little old burg of Marion, I'll bet, or else that sixty cycle stuff is running loose up in some tree top."

All quiet, not a peep or scratch, and VN breathed easier. But we speak too soon, for suddenly the air was again rent asunder, worse than ever, with the darnedest scratching and sputtering and up-and-down shimmy tones ever heard. "Sure enough, that's a Ford spark coil or I'm a boob," said VN.

Mad clear thru, he threw the juice on his old stone-crusher and with the bug key gave a quick snappy "QRA?" and listened. Not a scratch to be heard. The usual 2's, 3's and 8's were pounding in but not a sound from the QRM'er. "Just as I thought," said Vermilya; "that bird is sitting there waiting for me to get busy with someone out in Ohio before he murders me with his coil." But after a long period of silence for both the big DX station and the new-born "friend," VN looked in the direction of his message hook and realized there was lots of work to be done. So he started in to clear the hook as quickly as possible.

No more was heard from the new-comer so the night progressed well for DX work. The next day, try as he might, Van could not forget that new noise. Marion is so far from civilization that one coil is a big matter, especially where hundreds of messages are handled each month and a good clear path is essential. Well did 1HAA realize that he already had his hands full

with the continual QRM he gets from the high power station not a mile away from his shack radiating four hundred and fifty amperes. Eventually he got to thinking



Miss Eunice Randall.

that perhaps he had imagined a lot of it, but was certain whoever or whatever it was had a pretty broad band of waves.

Next night as he sat in at his tuner, long before touching his key, sure enough that

was the same old boy at it again. "Scratch, scratch, scratch," oh and on it went. "Dog-gone it," said VN, "someone's either going to get a license now or pipe down or I'm going to find the reason why. I'll just take a listen to this and see if old Killjoy will hang himself if I give him plenty of rope." On went the scratch—"Sputt, stitich, futz, buut, fuerer, thup, wee, zipp." "Good

to realize that this little lady probably wanted an answer of some sort, so he put the switch down, and again very slowly: "I am married." The answer came back a-flying this time: that is, the reply was quick even tho the sending was not: "How we suffer, but my heart is not in my hand; I will see you tomorrow night just the same."

"OK have your own way."

Thus ended the conversation and no further scratching was heard. But upset! Say, VN was purely and simply licked. Here he was going to "make" someone get a license and the first thing he knew a little girl had come along and he had passed out like a little boy sent to bed without his supper. "Darn her anyway. Gee she's fresh, telling me she is going to see me tomorrow night. I'll be darned if she will. I'm going out to a dance tomorrow night and I'll lock this old coop up tighter than a drum."

Not daring to mention his experience on the air to a soul, next night VN went off to a dance in a neighboring town. Many of his friends were there; all seemed quiet and everthing was going along in fine shape; the music was good and so were the dancers. Now in these small country places strangers are easily spotted, and it wasn't long before Van noticed two very tall people enter the hall—a fellow and a girl, looking much like brother and sister. But as they stopped to speak to Brad Cleveland, an old friend of Van's, he decided they belonged there and that he had just never noticed them before. A little while later VN was sitting alongside of Brad and in the course of the conversation he asked Brad who that tall couple was that had come in a short while before. You could have knocked him over with a feather when he was told that their name was Randall and that the girl was in the wireless business somewhere up Boston way. "Holy smoke," that VN, "I'll bet my last nickel that that's the one I had on the air!" Here she came, making foot-prints over their way and up jumped Brad saying "Vermilya, I want you to meet Miss Eunice Randall. She is deeply interested in wireless and works up in the American Radio & Research Laboratories at Medford Hill-side." VN tried his best to say something but the best he could do was a sound that resembled "MO." "No," said Miss Randall, "you won't need your direction finder now; you can put it away. I have found you and met you as I promised I would do last night. I've heard about enough about 1HAA without knowing him, especially when you consider that my home is in Mattapoisett, only about five miles from your station. While I don't live there dur-



The Y.L. at 1XE.

night," that VN, what are we coming to?" Finally all died down again and once more Van put the juice on the old sink gap, and then just . . . — . . . and a listen. "That ought to do for bait," thought he. Much to his surprise he heard a very crippled call: "1 H AA 1 H AA ER."

"There now, for the love of mud, we do know that he wants to call himself 'ER'." So back he went after Mr. ER. He realized it would be useless to give this newcomer a show of speed for surely it would not be appreciated, so he spelled out as slowly as ever he sent, "Who is ER please."

A long silence, and then, soft and sweet this time, just the simple word "What?" So again: "Who are you please?" "There, that ought to fetch him," Van thought. And sure enough, like a long slow funeral procession came the following:

"This is a little girl in Mattapoisett and I will see you tomorrow night."

"Wow, said Vermilya to himself. "This is the little innocent chick I've been wanting to hang or kill or something. Wonder if she knows I'm married." A million other thoughts ran thru his mind but he began

ing the week, I manage to get down weekends once in a while. I am working up in the Amrad place as draftlady and now, to be truthful with you, I want to learn the code and theory of radio so I can be 'one of the boys'".

"Look here, Miss Randall, if you are in earnest and really want to learn the code and all about radio from one end to the other, I will help you all I can. But if you just want an adventure you're going to be plain Outta Luck. Now which is it?"

"I tell you I am really interested and if you had seen me shinnying up a tree putting my aerial in place you would believe me a lady of my word."

"Very well," said VN, "I'll give you a note to a good friend of mine who runs a radio school in Boston, where you can learn in a good thoro manner all the ins and outs of radio, as well as code. You're going to have a mighty hard struggle, I can warn you, and being a girl your trials will be many and hard, but I want you to know I admire your grit and nerve and I can see right now that you are going to succeed. When you come out, bring a first grade commercial license with you and then if you're not too busy let me know how you liked it all and whether you think that after getting that far and being thoroly bitten by the little radio bug you will ever waste any more time thinking of the things that most other girls think about. You're one in a hundred for the pick you are taking and I want to wish you success. But meanwhile please don't open up on that squeak box again until you can handle at least fifteen words

per minute. By that time you will be an honest dyed-in-the-wool O. W., and believe me if you make good I'll see that you have a station that will put Mattapoisett on the map."

"Gosh," that VN, "she isn't so bad after all. In fact I'll have to take my hat off to her. She has the proper spirit for a real honest to goodness shemale radio bug. Other districts have had the honor of boasting an O.W. long enough, by heck; we're going to have one of our own up here now."

So watch your step, boys, for already she is on the job at 1XE every night they have the radiophone concerts—yes, she's the assistant operator at 1XE. And on three other nights a week she's plugging away at code at a Boston school where reports say she is already doing better than some of the fellows that have been there six weeks longer than she. And it won't be long now before you'll hear another real DX station on the air and the operator is going to be Miss Eunice Randall.

As a word of warning, don't try to flirt with her, for she hasn't time and besides, as she has already asserted, she "does not carry her heart in her hand." Treat her as one of us, a sister operator. If you can lend her encouragement by all means do so as she's the jolliest girl you ever want to meet or talk with over the air. But don't expect to find a "little" girl, for Miss Randall is over six feet tall.

Three cheers for the new First District O.W.!

All Set to Perforate QRN!

A Midsummer Party to which Everyone is Invited

WE are off, and we are loaded for bear and lordhelpus if we don't knock Old Man Static full of holes in our static-puncturing contest on the night of July 19th. This was announced in June QST, page 21. Come on and unpack your receivers, you fellows who have closed up for the summer; dust 'em off and give our A.R.R.L. a lift. We need you, OM. We need everyone if we are to be successful in the undertaking. This is the first time such a contest has been attempted in mid-summer, and we want to prove that relaying can be done with C.W. thru QRN, and we are calling upon you men who can copy thru static. There will be a hole in static all right and C.W. will puncture some more holes—copy thru them. The scheme is to have pairs of transmitters broadcast messages as per the following schedule on

July 19th. Each pair of transmitters will consist of the most powerful C.W. and spark in each division of the A.R.R.L. Each transmitter will broadcast a different message at ten words per minute and each message will be sent twice.



It is a well known fact that it is rather hard to pick up the C.W. signals, so on July 18th each of the transmitters will QRL at exactly the same time and exactly the same wave as shown on the schedule. This will give all of you a chance to tune

July, 1921

for the different transmitters and make notes of the settings of your receiving equipment. In this way it will not be necessary for you to "hunt" for the transmitters on July 19th, because you can be reasonably sure of finding the stations on the same adjustments. There will be 38 transmitters, 18 C.W. and 20 spark, scattered all over the United States and Canada, and if you have any kind of receiver at all and can copy thru QRN, you ought to make some good records. (Undoubtedly there will be many stations heard over great distances where they have not been heard before. We will have authentic proof if new records are made and due credit will be given the receiving operator for his part in copying.) All transmitters have been instructed to start

messages travel in order to be received at your station. Therefore it will be necessary for you to note the distances of the transmitters from your station on each message. After all the transmitters have finished the broadcast, add the total mileage of the C.W. stations and the total mileage of the spark stations. Then add these two figures which will give you a grand total. Mail your copies to the American Radio Relay League, 1045 Main St., Hartford, Conn., so as to reach this office not later than July 26th.

If you are not interested in the contest, please have a heart and keep your transmitter silent during the transmitting period so the thousands of other amateurs can copy. We will have QRN, and we can but put holes in that, but please let us have your co-operation in a way that will reduce QRM to the very minimum, and

Schedule of Transmitters for the Static-Puncturing Contest, July 16th and 19th.
Eastern Standard Time, P.M.

| Division | C.W. | Wave | Time | Spark | Wave | Time |
|----------------|------|------|-------|-------|------|-------|
| Ontario | 9AL* | 250 | 8:46 | 3BP* | 200 | 8:50 |
| New England | 1AE | 275 | 8:54 | 1ZE | 250 | 8:58 |
| New England | 1TS | 275 | 9:02 | 1AW | 200 | 9:06 |
| Atlantic | 2ZL | 275 | 9:10 | 2JU | 200 | 9:14 |
| Atlantic | 3AAO | 280 | 9:18 | 3XF | 375 | 9:22 |
| Roanoke | 8ZW | 325 | 9:26 | 8SP | 200 | 9:30 |
| East Gulf | 4GL | 220 | 9:34 | 4XC | 375 | 9:38 |
| Delta | — | — | — | 5ZP | 250 | 9:42 |
| Delta | — | — | — | 5ZL | 300 | 9:46 |
| Midwest | 9HT | 200 | 9:50 | 9OE | 200 | 10:02 |
| Midwest | 9ZB | 375 | 10:06 | 9LC | 200 | 10:10 |
| Central | 8IB | 200 | 10:14 | 9ZN | 375 | 10:18 |
| Central | 8DE | 210 | 10:22 | 8ZL | 375 | 10:26 |
| Dakota | 9XI | 360 | 10:30 | 9ZX | 375 | 10:34 |
| West Gulf | 5ZA | 375 | 10:38 | 5ZX | 375 | 10:42 |
| West Gulf | 5ZW | 375 | 10:46 | 5ZC | 375 | 10:50 |
| Rocky Mountain | 6WV | 375 | 10:54 | 6JT | 200 | 10:58 |
| Pacific | 6ZX | 375 | 11:02 | 6OH | 200 | 11:06 |
| Pacific | 6EN | 200 | 11:10 | 6ZO | 375 | 11:14 |
| Northwestern | 7XF | 250 | 11:18 | 7DA | 200 | 11:22 |

*Canadian

promptly on schedule, and not to start 5 seconds before or 5 seconds after the scheduled time and not to overlap by even 1 second. The schedule is on Eastern Standard Time. Now your part will be to copy—copy any part or all of every message from every C.W. and spark station. You must have the signature of two people who witness the actual reception of the messages and these signatures must appear on the original copy that is sent to this office for verification. Remember that you will be given due credit for any part of any message that you copy, so do not feel discouraged if you do not get a perfect copy—send in what you do copy. While accuracy and completeness of copy will be considered in computing the percentages, the main feature in determining the winner is based on the grand total of air line miles over which distances the

accept our thanks for your efforts in asking others to do the same.

SPARK RECEPTION ON HONEYCOMBS

(Continued from page 25)

[Editor's Note—What Mr. Kinyon uses is "zero beat frequency." The tube is really in full oscillation but at the same frequency as the incoming signals, so that no beat note is produced. In such adjustment the full benefit of heterodyne amplification is received on spark signals and without distortion of the musical note. It is well worth the somewhat critical adjustment necessary to secure it.

In the concluding installment of this article, in our next issue, Mr. Kinyon will tell just how he adjusts his equipment for best results.]

EDITORIALS

de AMERICAN RADIO RELAY LEAGUE



What We Want in Radio Law

THE scheme of the two radio bills introduced in the House by Congressman White and in the Senate by Senator Kellogg at the instance of the Department of Commerce is to get away from outlining operating regulations in the law and instead provide a law that will establish an administrative organization and facilities for publishing regulations from time to time, so that the regulations can be changed as progress in the art demands without the necessity of framing a new law every few years. As we stated in these columns last month, our Board of Direction after a careful consideration of the case feels that the province of the amateur ought to be specified in the law. Some folks, we suppose, will think we are highly inconsistent in asking for what offhand seems to be a request for direct discrimination in our favor. But is it? We do not think so.

These bills would provide for the government of all classes of stations by regulations promulgated as occasion required, by the Secretary of Commerce. Now the present Secretary and the present Commissioner of Navigation and the present Chief Radio Inspector are all friendly towards the amateur and know his value, and we haven't any doubt that administration of such a law by them would be entirely satisfactory to us amateurs. But they won't be in office always, and we ask you to just imagine a Daniels as head of the department looking after us! We wouldn't be safe, and as now is the time to express ourselves for future years we are doing so. While we amateurs are well organized for looking after our interests in general, we are not financially equipped to wage a continual defensive against powerful commercial or political interests that might want to invade our little domain for some purpose of theirs. We feel very strongly that the only reason we have been unmolested in past years is that the law has very definitely said that there shall be amateurs and that their wave shall be up to 200 meters. As a class we are not prepared to combat big interests perpetually and our only safeguard is to get our future written into the law. And as we pointed out last month, commercial companies won't put good money into installations to use waves near the amateur's as long as there

is possibility that the latter may be changed to interfere with them; yet the intensive development of radio demands that use be made of all waves, so that definitely specifying ours in the law should stabilize the commercial use of nearby waves. An exception to this end in the case of the amateur would not be terribly inconsistent, since we are at about one end of the waves of value so that we could be put to one side and the use of all other waves left to regulation without disrupting the scheme.

And it's vital that no drastic change be made in our allocation. Our apparatus is extremely highly specialized and would be made virtual junk if we were suddenly given a wave length appreciably different from our present. And our investment in equipment runs up into many millions of dollars.

We have another thing in our favor in the very consideration of what wave lengths we should ask for. The Department of Commerce had a committee last year consisting of representatives from every radio interest in the country and they gave consideration to what wave length the amateur should have in new law. The old basis wouldn't do, for the navy want a wave under ours for chaser boats, and yet we couldn't be put up too high because the ship-to-shore telephone service wants waves around 300. They had many meetings but eventually a tenable basis was arrived at, with every interest agreeing that they would be satisfied if such waves were assigned the amateur. Broadly speaking they are 180 to 220 meters for spark, and 180 to 250 for C.W. If an unwise administration should assign waves other than the above to us amateurs as long as present conditions in the art maintain, they would certainly be stepping on the toes of one or more strong interests, yet the above wave lengths form a basis that has been mutually agreed to. And with the Navy below us and the A.T.&T. above us, both clamoring for more room, believe us we would like to see our wave length written into the law so that there would be no question about it.

These, then, are the reasons why we are asking our friends, the Department of Commerce, to amend their new bills to except the amateur and write his place into the law in black and white.

What We Are.

THE A.R.R.L. used to be just a little handful of ardent enthusiasts, but that was long ago and now we are a big national organization, recognized as the standard-bearers wherever amateur affairs are concerned. Recently we told of losing our goat to a chap we ran across who had never heard of our A.R.R.L., but altho such birds are rare it is not unusual for us to discover that apparently well-informed amateurs have no knowledge of what we are or why we exist. When they got into the game they heard of the A.R.R.L., liked what they saw of it and joined, largely perhaps because everybody else they knew belonged. As time passed they heard of our relay work and got a place in it, and they see and perhaps like some of the other things we do. But the Big Idea often never gets thru to them.

The A.R.R.L. is an organization of amateurs, and every official in it is likewise an amateur. From its very inception it has been non-commercial, its originators being amateurs with no axes to grind and clearly realizing that there could be no successful organization unless it be co-operative. The phase in which the non-radio public best knows us is as relayers, but we are much more than that. We are the amateurs and the writer of these poor lines is likewise an amateur. QST is our magazine and thru it we bind ourselves closer and accomplish things together, but QST is incidental to the League and simply does its best as the A.R.R.L.'s mouthpiece to further things "of, by and for the amateur."

Offhand we know no parallel to our organization. Always we have steered a careful course among the rocks of commercialism and personal ambition, and today we truly have a great big national self-governing institution which is a leader in amateur thought. We stand for observance of the law and for scientific progress. Our union makes possible many things of co-operative benefit: our relaying, our ability to speak as a solid body when dangerous legislation threatens, the many things of national breadth which we undertake. Almost every amateur of any prominence belongs to our League and so, as we are the amateurs and incapable of becoming a body to merely exploit the amateur, we are recognized as the leaders, the body politic in the amateur world.

From these things and based upon them there has come into existence a wonderful spirit—the A.R.R.L. spirit. There is a clean organization of the amateurs themselves, whose interests are those of its individual members, and with a feeling akin to amazement amateurs have realized this and come into our ranks. Look at our Operating Department, with almost four hundred officials serving without com-

pensation, grinding out letters, perfecting their network, inspired by the common cause and safe in the knowledge that they're not being "exploited"—realizing, in fact, that the A.R.R.L. is *they themselves*. Consider the official relay stations, the fading test recorders, the membership of our Board of Direction, the affiliation of some two hundred clubs—all of us imbued with the same wonderful spirit and working together in the advancement of a thing we all love, Amateur Radio. That's what it means to belong to the A.R.R.L.

This Word "Citizen"

YOU'VE seen it—we use it frequently in these columns. Some folks seem to object to it, mostly because there isn't anything the matter with the word "amateur" while "citizen" brings up to them visions of soviets, Citizen Bessey and Citizen Galyean and so on, red flags and parlor Bolshevism, etc.

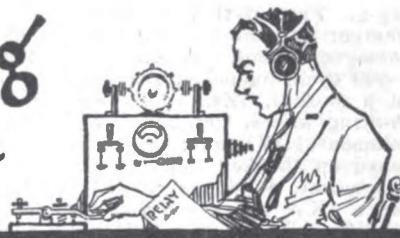
Now there's nothing the matter with the good old word "amateur." It correctly defines what we are, and implies a good clean sport. In sports it has always been unfortunate to lose one's amateur status, and likewise in these days the word rarely carries any stigma of inefficiency or clumsiness but generally quite the contrary. It means something definite and pleasing, and is the word under which we have our rights in the law.

On the other hand we are trying to get away from the idea that our radio is a plaything, and establish before the general public the fact that serious communication is being accomplished by private citizens. Do you realize that our radio provides about the only way by which an individual can communicate intelligence to another beyond the sound of his own voice without paying tribute to a government or a commercial interest? It's so, and it's a big thing and becoming increasingly important as new-comers enter the game. Simply to use a word implying that we love our sport and are skillful at it does not seem enough to us. When we speak of "Citizen Wireless" we convey a picture—no longer of little boys in short trousers playing with toys, no longer of eccentric dabblers, but of a vast field in which the private citizen of this country may enter and carry on useful communication. And when we stand up before a Congressional committee it's a good term too—just think exactly what it means!

So there're things to be said both pro and con and the subject is by no means a closed one. While we like the expression "Citizen Wireless" because it implies perhaps a more serious effort than the word "amateur", we're not abandoning the latter nor endeavoring to foist the former where it may be distasteful. Let's talk about it a little in QST—just what do we think about the matter?

The Operating Department

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



C.W. is fast supplanting the spark transmitter, and while this change is being made our message traffic is suffering. For the month of May a total of 6,699 messages is reported as against 10,532 for the month of April. A drop of about 37%, but as soon as a few more good C.W. stations come to the front our traffic will climb very rapidly.

The New England Division is honored for the third time in succession with the star station in traffic handling, and this month 1ZE (formerly 1HAA) must take second place to 1CK, who handles messages at a terrific speed and can be heard at 30 per 'most any night. F.B., Robinson.

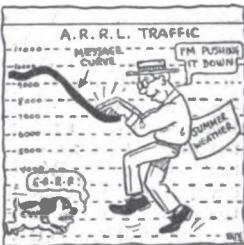
MR. P. F. ROBINSON, 1CK
Braintree, Mass.
412 Messages
New England Division

There is no use trying to dodge the issue. C.W. is here to stay and unless we are afflicted with a foggy brain, C.W. will be so far ahead of the spark that messages of unimportance will be left for that means of communication, while the messages of more importance will go via C.W., because they will get thru. And even when the "rock-crusher" at 9ZN is thrown into the discard, we will not be surprised, and all of you know what Matty thinks of a good spark. However, glance thru the Central Division report and note that communication is maintained with C.W. while the spark stations have given up in despair. On the other hand we point out to you the work being done by 2ZL, 4GL, 3AAO, and 1TS, all of which are C.W. stations. The spark set at 2ZL was junked so long ago that not even a punctured condenser remains. And 2ZL moves messages in groups of 5 and 10 almost every night regardless of QRN, providing of course that other stations are on the job. The only good reason that we can give for your not hearing the hundreds of C.W. stations is because you do not listen nor tune properly for them. Spare the key some night and just listen for C.W. stations. We will

venture a guess that you will be astonished at the goodly number you hear, and upon inquiry you will find most of them using less than 50 watts. And notice how the C.W. signals just cut right thru static.

Considerable activity in the Roanoke Division is the changing over of transmitters. The spark is going out while the C.W. is coming in. And that absence of signals from the Delta Division is caused by old man QRN. In other words they have no C.W. stations with which to carry on communication in the division. How about it, Jawn; when can we expect to hear your C.W. sigs?

Reports from the Pacific and Midwest Divisions are missing. The other reports follow:



NEW ENGLAND DIVISION

G. R. Entwistle, Mgr.

Conditions for DX work have been bad lately, due to QRN, aurora, etc. The spark stations seem to be affected more than C.W. Organization is one of the activities taking the most time at present. Especially is this true in Boston, where the newly formed Boston Executive Council is endeavoring to bring all classes of radio amateurs into a closely allied body.

The Boston Executive Council has secured the co-operation of the Army, Navy, A.R.R.L., Department of Commerce and commercial interests. The Council has adopted the Chicago Plan by revising it to the needs of Boston.

The Police Departments in Boston, Hartford and Lowell are co-operating with the amateurs in the transmission of reports of stolen automobiles and any other information through which the public may help them.

A.D.M. Robinson (1CK) reports a new radio station in Lowell, 1LZ, who we expect to help in a route through central New England. 1HAA has been comparatively quiet this month, handling only 304 mes-

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sages. Part of this slump was due to bad weather and the rest to lack of pep in his non-synchronous. 1HAA is now installing a 500 cycle quenched spark set to operate on a special, 1ZE. 1ZE will have three working waves, 200, 250, 375 meters. D.S. Johnson (1DY) must have a job. He is not heard on the key much lately. 1MAD of Pawtucket, R. I., is another comer. He has a 1KW spark set and promises to be a help to DX work. 1CF, 1UN and 1DH are making a lot of noise on C.W. 1XE and 1QR are working fine concerts nearly every evening.

D.S. McLean (1JQ) reports conditions between Springfield and Boston are improving only slightly. Southbridge does not seem able to get in communication with Springfield as yet due to a tremendous amount of QRM caused by high tension wires near that station. 1GY signals fade badly. Springfield finds it more satisfactory to work with Boston. 1WR comes through QSA and if not too much QRM can handle traffic through him. Recently 1XM and 1QR have been coming through QSA. In a short time we will have a station in operation on C.W. at Warren, Mass.

N. B. Judkins, 1PM, formerly of East Providence. This station will be half way between Springfield and Worcester, and there is no doubt but that traffic can be handled through in fine shape.

In regard to Albany: We find many stations en route to Albany—1KBO at Easthampton, Pittsfield Boys Club at Pittsfield, and other stations in between points,—so that by fall this route will be well organized.

By the next issue of QST we will be able to outline a route north and east of stations not more than 25 miles apart that will make it possible to handle traffic under all conditions. At the present time 1CCY, 1UAV and 1JQ are handling all Springfield traffic including police reports.

A.D.M. Castner (1UQ) of Portland, attended the banquet of the C.W. Club of Boston and reported C.W. increasing in his district.



ROANOKE DIVISION

W. T. Gravely, Mgr.

Reported by A. S. Clarke, Traffic Assistant.

C.W. is taking this division by storm. From all parts come reports of C.W. sets being built and when fall opens up practically everybody will have some sort of C.W. set. Remodelling of sets, addition

of new equipment and general preparation for better work next fall is the order of the day. Static has been so severe that the number of messages handled shows a decrease. C.W. seems to be the only thing that cuts through the terrific QRN.

The Division Manager is planning a complete re-organization of the division with several new appointments to be made.

D.S. Wohlford reports that 3BBE at Catawba has his transmitter in good shape and is working Roanoke regularly. A new station is reported in Lexington, Va., and one also at Salem. The Virginia Polytechnic Institute at Blacksburg will have three 1KW outfits.

A.D.S. Higgins will operate a set in Galax instead of Oldtown. A.D.S. Gundry at Stonega reports communication established with Bristol and is trying to connect up to 5DA. 3GO at Norfolk is undergoing a complete remodelling and when the season opens up, will have spark and high powered C.W. and phone, 3EN, city manager White of Norfolk, is putting in 15 watt C.W., also 3VV. 3ACT is handling his share of relay traffic, in spite of QRN, and is installing C.W. 3ACE, 3ACK and 3ACZ are reaching out but static has prevented much traffic being handled. The terrible QRN from NAM is being worked on but still remains the champion nuisance of the district.

The situation in Charlotte, N. C., remains about the same, with several C.W. sets in course of construction. A new 1KW set is in prospect at Asheville, N. C., also a C.W. set. 3BZ and 3AEV are both installing C.W. sets.

No report from D.S. Heck of West Virginia, but 8SP's spark is still heard so we know that traffic is being handled in that section.

No report received from Blair of Richmond. It is regrettable that of the 60 some stations in Richmond no one seems to be interested in DX relay work. They seem to be entirely contented to sit down and talk among themselves and call the neighbors in to listen to KDKA's music and news.

Although static will prevent the usual amount of relay work, there is no slackening of interest or laying down on the job in this division. Everybody is working and planning for the biggest season of all next fall and winter. So look out for the sparks and C.W. of the Roanoke Division when Old Man Static goes to sleep again.

Reported messages, 100.

EAST GULF DIVISION

E. H. Merritt, Mgr.

Practically all work reported this month has been accomplished by blasting thru QRN, as we have had a liberal supply on hand every night now for nearly two

months. There is a fine spirit being shown by the fellows still hammering away and actually getting thru where it appears to be impossible. The fact that everyone is rebuilding and getting ready for the fall season makes us believe that the East Gulf is going to show up some of the other divisions too. F.B., fellows.

4EG of Woodruff, S. C., reports that he has at last been able to reach out and connect a few DX stations. He says prospects for improvement in S. C. are good, stations in Greenville, Greenwood and Gaffney all trying to get started. This is the first real good news received about S. C. and it is about time we had a few good stations in the state.

D.S. McIlvaine reports that all Alabama stations were hard hit by storms during the month, practically every antenna in the state being blown down except at 5XA. Carrie, of Montgomery, had his antenna destroyed by lightning but other damage was not severe. 5JO in Birmingham has installed a radiophone and will have it ready next fall. The radio club in Mobile is progressing nicely. The chief operator at NGT is giving them instructive talks and assisting with their sets.

In Florida we are going to lose a couple of good men, 4AM and 4DL. 4DL will return next fall but 4AM is moving to Ohio. We are sorry to lose him from the East Gulf but know he will make a good man for the Central Division. 4AM was one of the first to help open the Florida route for traffic.

4ZN has been held up a long time trying to find a condenser that will hold up under his "coffin". He has moved his station to a better location.

Near Jacksonville, the Lybeck Ocean Harvester Co. has installed a radiophone and is experimenting with their fishing boat, using 350 meters. Anyone hearing "LOH" (temporary) on fone please write J. S. Chapman care of the company at Lybeck, Fla.

D.S. Benning of Georgia has little to report except that about half of Atlanta has been bitten by the C.W. bug. The Atlanta Radio Club has adopted the Chicago plan to control QRM. They are also getting all local stations down to 200 meters. 4AU, 4BT and 4XC recently made a week-end visit to 4BQ. They report that with his new apparatus and remodeled station 4BQ should be the best station in the south. 4BQ reports that a radio club has been formed in Cartersville, Ga.

4BK has installed a 1KW now, and has otherwise improved his set. 4DV in Columbus is still working on his set and has already connected with several DX stations. 4CU in Jackson, Ga., is heard occasionally. 4AG reports that QRN has held him almost helpless for two months. He is also improving his set and getting

ready for better weather. 4DT in La Grange, Ga., has busted loose with a good station and has taken a big hand in handling traffic this month. 4GL in Savannah is blasting thru QRN almost anytime with his C.W. Mr. Hill has about the best C.W. set in the Division but several others have promised to make him hustle to keep it the best. Let's hear more from C.W. men in the East Gulf.

Reported messages, 198. Busiest station, 4FD, 58.

CENTRAL DIVISION

R. H. G. Mathews, Mgr.

The severe static of April and May has reduced traffic work throughout the greater portion of the Division. This is especially true of those routes depending entirely on spark transmitters. Apparently the use of C.W. is a solution of consistent summer work and accordingly strenuous efforts are being made throughout the Division to form and put in operation such routes. The District of Eastern Ohio is especially active in this respect and we believe that satisfactorily and consistently operating routes will soon be in existence connecting Ohio with both the east and west by daylight with all parts of the country.

Mr. and Mrs. Chas. Candler, D.S. of the Miami Valley District of Ohio, report message work decreased considerably, due to the season and the fact that part of the stations were out of commission. 8ZL and 8FT were out of commission for all but a few days during the month. 8FT is now ready again, but 8ZL will be out for some time longer. Other stations in the district were considerably handicapped by having to find outlets for their traffic other than 8ZL and 8FT on whom they had largely depended.

Cincinnati seems to have fallen back into her old rut of keeping by herself rather than co-operate with the rest of the district. The personnel there never send in any report, either general or traffic.

Two newcomers from Dayton, 8AJB and 8AEE, sent in good reports this month and are to be commended for their good work. 8AWU and 8ANY are handling Xenia traffic in good shape, and a station is starting at London, O. 8AEY at Lebanon is beginning to work more regularly and comes in handy to link up with Cincinnati. Nothing more has been heard from Circleville or Chillicothe.

It is regretted that so many stations fail to send in reports. Not half of the stations do so and many of those that are left out do good work and are among the most active in handling traffic. These include the entire number in Cincinnati, 8AEY at Lebanon, 8HG and 8JB at Columbus, 8TN at Dayton and many others. I should like through the columns of QST

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to request that all stations in the Miami Valley District who are interested in or take part in relay work, get in touch with 8ZL and ask for appointments. Many of these stations could be used as alternates in routes already established and others could link up in new routes.

J. Warren Wright has been appointed City Manager of Springfield. He has recently received a special license and his station call has been changed from 8DC to 8ZAA.

All messages sent by 8IB and 8IV this month were transmitted on C.W. and buzzer modulated sets. A small portion of the work at 8ZL last month has also been done by radiophone.

Mr. K. A. Duerk, 8ZY, D.S., Toledo District of Ohio, reports that in this district most of the good DX relay stations are either closed down or, due to the poor relay weather, not operating very much. 8ZR has been heard only a few times. 8KP is temporarily out again, due to burned out transformer. All Detroit and Michigan traffic gets off in good shape, being sent through 8LV at Ann Arbor. Eastern Ohio traffic has not been going quite as promptly as in the last few months, because of the standbys, 8ZN and 8ZR, not being on as much as usual. We don't know the cause of this at 8ZR as they have a half dozen operators, unless it would be that QRN has them scared out. At 8ZN, Mr. Kauffman attends college at Pittsburgh, and Mr. Preston's work has kept him busy, so that he has not been able to devote as much time to operating as formerly. The north-eastern part of the district has not been developed like it should have been. There seems to be a lack of interest in real relaying. Accordingly, to stimulate development in that part of the District, Mr. James P. Turner, of 8AKM, 681 George St., Clyde, Ohio, has been appointed Assistant District Superintendent, having charge over the counties of Wood, Ottawa, Sandusky, Seneca, Huron, Erie, and Lorain. These counties are now out of 8ZN's jurisdiction. Mr. Turner is a wide-awake radio man, and has offered to do his best in getting that part of Ohio lined up. He states that he can cover that territory with his car, and see the operators personally. Upon Mr. Kauffman's recommendation Mr. Ulmer, of 8AJK, has been appointed C.M. of Bucyrus, Ohio.

Mr. J. A. Kolb, 9OX, D.S. of Kentucky,

reports that due to the heavy QRN very little work has been done. The number of amateur radio stations is rapidly increasing in this district. Formerly the amateurs were satisfied to work locally but after seeing the results achieved by 9OX, they speak only of DX.

9VZ, Covington, is having trouble with his aerial and condenser, hence his DX is curtailed; 9IO has a C.W. set going and is reaching out; 9UH, Newport, the star DX station of Kentucky, continues to do very good work; 9OX, Louisville, will dismantle and install at a new location.

Mr. Hutchinson, A.D.S. for Northern Indiana, advises of a very meagre report from Ft. Wayne, yet it would be supposed from the number of stations there that there should be much more reported.

No South Bend stations have been heard during the month. Are they all dead? It seems that from the number of aerials which the A.D.S. has seen there should be at least one active station in the city.

9ME is again on the air and comes in louder than ever. 9DF, Angola, is rebuilding his receiving set. 9DBQ, Stroh, is again back on the air. 9HR, Middlebury, Ind., has re-installed his transmitter, more than doubled

his radiation, and with a new short wave regenerative set and two-step amp. has things in fine shape. The A.D.S. is ready for the summer relay season. 9HR has been getting in to Chicago regularly. 9ALY, Goshen, Ind., has just installed a new and much higher aerial, and a new short wave set preparatory to jumping into the summer relay game. 9FS, Goshen, Ind., has installed a new short wave regenerative set and is all set for summer work. 9FS has been doing exceptional DX work, being on the job practically constantly, and proves a valuable station to the district. 9FG, Goshen, Ind., is on the job very little.

9AZX, at Jonesboro, Ind., has installed a 3 tube C.W. set and comes in very QSA at all points in the district. He will prove valuable in handling traffic to Indianapolis. 9AUC, at Albany, Ind., has offered his assistance in handling southern and western traffic. Prospects in the District are very bright for summer work and the A.D.S. will do all in his power to see that things get into good working order.

The station at Purdue University has been in operation regularly throughout

Howard H. Moore,
9FV, A.R.R.L. District Superintendent for Northern Indiana, passed from this life at his home in Elkhart on May 28th, after an illness of many months.

Mr. Moore was always one of the Central Division's best men and a strong A.R.R.L. booster. He made a good district out of Northern Indiana with almost nothing to work with, and his interest and loyalty to his work is attested by the fact that during his last two months he handled his district activities and made his reports from his sick bed.

Truly here was A.R.R.L. spirit, and in the passing of 9FV to a land where signals never fade we have lost a faithful friend and co-worker in the cause of Amateur Radio.

the past month.

9YB has been doing some pretty good work.

9UJ at Rensselaer, Ind., has some new equipment and is coming in pretty well. He will make a pretty good outlet to Hammond and Gary when he gets a little more experience in operating.

Mr. Burhop of the Wisconsin District states that many of his stations did not submit reports for April. 9TO of Antigo, who hasn't had very much success with his $\frac{1}{2}$, is expecting to put in a 1 KW United Wireless transformer.

The Fox River Valley bunch, Neenah, Menaha, Appleton, and Oshkosh, are expecting to organize an executive council and hold joint meetings. The Oshkosh Radio Club is starting the movement. M. C. Lapp, of the Ann Arbor Fleet, has put up a 1 KW station at his home at Plymouth. His call is 9DLX, and he has been extremely successful in DX work. 9ACM, of Sheboygan, has installed a 1 KW transmitter and added two steps to his regenerative receiver and is helping out great. 9DNL and 9DMU of Manitowoc with $\frac{1}{2}$ KW transmitters and regenerative receivers are in shape to help 9ZL.

Mr. C. E. Darr, D.S. of Michigan, reports: this state is rapidly falling in step with the others in becoming CW-ized. 8KM, 8BO, 8OJ, 8ADY, 8LV and 8ZZ all have C.W. sets that are doing good consistent work and are in close touch with the DX Ohio stations in daylight. A daylight route exists from Detroit to Grand Rapids. Detroit can now work Cleveland in daytime on 5 watts C.W., a thing that never could be done on spark even at night so we have reasons to feel elated over C.W. Traffic (DX) has fallen off somewhat but we are rather busy with interstate traffic.

The Cleveland Radio Association has formed traffic regulations which are being put into effect with excellent results. These regulations are as follows:

8:00 A.M. to 7:00 P.M. Free Air. If possible, confine testing to 6:00 to 7:00 P.M.
 7:00 P.M. to 10:00 P.M. Local work only, 50-mile radius. One-quarter kilowatt limit.
 10:00 P.M. to 11:30 P.M. Long Distance tryout. No. local work.
 11:30 P.M. to 8:00 A.M. Long Distance A.R.R.L. message work only. No Conversation.

Stations operating up to 11:30 P.M. will cease work at that time. Work only one long distance period.

Reported messages, 2444.

DELTA DIVISION
J. M. Clayton, Mgr.

Due to the few good nights for radio,

the amount of traffic handled thru the division for the month has been exceedingly small. From now on till September or October it's a case of relaying via Uncle Sam's relay whenever any stray messages come wandering thru.

5ZP has been forced to take a vacation on account of bum health, and is spending most of his time in bed right now. Where there's life there's hope, tho, and we all know that such a natively strong chap as ZP is, will pull thru in fine shape and we also know he will be back at the set as soon as he can.

Hutcheson, 5DA, D.S. of Tennessee, reports several new stations being installed in that state. There has just been a station completed at Chattanooga. Knoxville boasts of six DX stations now. Mr. M. M. Roddey of Cleveland, Tenn., is putting in a 100 watt C.W. station, and 5ER of Nashville threatens to do the same thing.

5ZAC, ex 5EA at Baton Rouge hasn't been heard from for several months. Evidently Barrow has decided to let QRN down him 'way too early in the year.

5ZAB, Pullen, of Houma, La., had a little aerial trouble when their main pole was blown down in a storm. They have decided to start rebuilding their station for next season.

5YH is still on the job, quite busy right now trying to get the howls out of a new three step short wave regenerative receiver. Captain Baldwin quits tearing off the tin-foil he has pasted on the back of the panel, as a capacity shield, every now and then to handle a lil traffic. However, there have been comparatively few nights this month in which it has been possible to even copy DX stations thru QRN.

No report received from Mississippi. We suppose that Prof. Kennon at 5YE has been too busy with school work.

DeBen, A.D.M., contributed a notable piece of work to the art of relaying when he discovered not only a RADIO station in Memphis, Tenn., but a whole nest full of hams in a radio club there. How he ever located 'em is beyond us. We have been longing for ONE real station in Memphis ever since the days of T. J. M. Daly of 5AK who used to be Thordarson's record-buster in the days of 825 miles on galena night after night.

5ZK is leaving Franklinton for the summer months as he is planing to take an auto trip up to Canada.

No report from Anthony of Shreveport.

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The last time we heard Willie on radio, he was giving the natives an exhibition of the whys and wherefores of radio at some County Fair at Shreveport. That was way late in the wee hours of morn so we guess Willie has been going to bed early ever after to make up for lost sleep.

5JD of Little Rock has been on the set very little this month, mostly due to QRN being too bad to do much good consistent work. Kinsolving is going to blossom out next season with a "sink" gap and all that. If this whole Delta Division ever opens up all at once next season the air will be full of nothing but sink gaps.

We have a new station at Thibodaux, La., 5YL, which looks like it will be a corker.

DAKOTA DIVISION Boyd Phelps, Mgr.

Relaying has dropped off considerably during the past month. OM Static is taking a whack at the ether and traffic has been reduced to almost nothing. In the month of May sun spots and Aurora Borealis played havoc with both wire and wireless. This discouraging stunt of nature has caused most of the best DX stations to be out, either for repairs or for their owners to catch up on sleep lost during the past season. Either excuse is somewhat justifiable but it is hard on relay traffic. This gives an excellent opportunity for the smaller stations to prove their worth. The ones that claim the big boys handle traffic right over their heads during the winter are now in a position to be of great help to relay traffic by filling in the large gaps that are now open in so many of the relay routes. There is a place for a good station in every town on the relay routes which are now largely on paper only.

To handle traffic successfully during the summer season all stations on the route should be within daylight range of each other and none of the jumps over forty miles. Last summer it was found that over certain areas the best time for working was at daybreak when the static was at a minimum. However, in other localities experiments seemed to indicate that at noon or at sunset was also a very good time to clear relay traffic. These experiments were not nearly exhaustive enough and it is one of the things to be accomplished this summer. With this in mind, stations are urged to test with each other at all times of day to determine the best hours of working in certain directions and to let the D.M. know their conclusions.

Northbound traffic if routed so as to reach Sioux Falls, S.D., can be easily handled north over a very good route to all of eastern North Dakota and as far north as Winnipeg, Manitoba, in Canada. The summer northern route is a very

successful fizzle when it comes to short jumps. The absence of stations of any description west of Ellendale, N. D., to the 7th district necessitates clearing on only the better nights but all stations plan on listening at least half an hour each night as quite often some very good nights turn up and messages may be cleared by the pound. The route from Wahpeton to Minneapolis would be working nicely if all the stations could work the stations next to them on the route. Stations are especially scarce outside of Duluth and Superior so that no route can come within a hundred miles of these cities. Mr. Bridges, 9YAC, has plenty of confidence in a C.W. set he hopes to have finished soon so perhaps we need have no fear of not getting msgs. to his part of the country.

Station owners in every town are urged to get in touch with their District Superintendents or Division Manager as there are many positions open on the routes that must be filled to make relaying all the year around a success.

Reported messages, 210.

NORTHWESTERN DIVISION R. T. Galyean, Acting Mgr.

Howard F. Mason, 7BK, newly appointed A.D.M. of Seattle, reports that 7IY and 7BK have been handling nearly all the Seattle traffic the past month. Traffic east goes thru 7FI with little trouble; and traffic south is sent thru 7CW, 7DA, or any number of 6th District stations. Summer conditions practically prevail but no trouble is experienced in working Portland stations, which roar in 'most every night. 6th District stations are heard consistently except those around Los Angeles and the southern part of California. 7MH of Olympia has been coming in good of late, and his station may be part of that daylight route to Portland which we are all looking forward to. North of Seattle, 7LS of Ferndale has been on the job regularly and has done his part well. With his help a day-light route from Seattle to Canada is now in operation. 5CP of Vancouver, B. C. seems to be taking traffic and reaching out in fine style.

In Tacoma, Miss Dow, District Supt., reports that, with the coming of summer, fading seems to be more noticeable. Portland stations are beginning to be more in evidence, 7DA being the most reliable



station handling traffic to the south. The most consistent station to the east is 7FI at Pullman, Washington who is in almost constant communication with stations both east and west of him. 7YA is the most reliable 375 meter station to the east.

H. E. Cutting, 7LY, A.D.M. of Bozeman, Mont., reports things in that end of the Division going as well as usual. There has been little slowing up due to QRN as yet, and signals seem to keep their normal strength. There are two northern routes to the east that can be depended upon at the present; one is thru 7CC to 7LY to 7ZO and the other thru 7YA to 7ZO or 7LY then to 7EX or 7ZG. From these stations to the south traffic is handled thru 6ZH or 6ZR.

At Portland, Old Man QRN has started his program of relentless interference, and the Sixth District stations have begun their summer fading program which retards the speed of traffic flowing in that direction. The northern stations in Tacoma, Seattle and Vancouver, B. C., are coming to life as far as the Portland District is concerned. These stations are seldom heard during the winter months, but with the coming of warm weather their signals seem to get through to Portland with but little QSS. This is one of the freaks of the Northwest.

The eastern stations in Idaho and Montana are coming in with their old reliability, the weather having little or no effect upon their signals. The Eugene, Oregon, stations are getting south at times, but are seldom heard here. 7CN at Marshfield has been heard during the month but has not been worked. Messages in that direction are QSR'd through the 6th District stations who seem to have less trouble in working him. Astoria and the lower Columbia River District seem to be dead at present as no stations are reported working out. The Upper Columbia River district seems to show life at times when 7ZH at Enterprise is on the job, but he seems to be taking a lot of sleep lately.

7ZJ at Vancouver has installed a 375 meter wave with which he steps out equally as successfully as with his old 200 meter wave. He has been heard this month by 9KL and 9YW. You'll hear him yet, Hiram!

In Portland 7ED, 7JW, 7GA, and 7DA on sparks and 7ZI on C.W. have been very successful in clearing traffic through this district. 7ZI has worked as far south as Los Angeles with his C.W. set in which he is using two 5 watt oscillators.

At last we have the long needed station at Corvallis, Oregon, where the Oregon Agricultural College is located. 7YJ, ex 7PV is coming through like a local station on his 375 meter wave. 7CW at Silverton, and 7BH at Salem, Oregon, are still holding their share of the air with the same old reliability and efficiency. Owing to lack of

organization in many parts of the North-western Division, complete reports have not reached the new management. The whole Division is undergoing a complete reorganization, a report of which will be forthcoming in the near future.

Reported messages, 720. Busiest station, 7BK, 112.

ONTARIO DIVISION K. Russell, Mgr.

May has been the best ever for the Ontario Division. In spite of extremely heavy static throughout almost the entire month a practical working relay chain through Southern Ontario has been initiated and by far the most messages ever handled in Ontario Division have been relayed this month. This has been in the main due to the fact that several new stations have been put in commission, and have vastly improved the chances for a really reliable working chain in the fall.

W. Carter reports from Windsor that messages are going thro' well tho' the QRN has been terrific lately. A new Radio Club has been formed in Windsor and vicinity which will endeavor to handle traffic in co-operation with the A.R.R.L. working under a modification of the Chicago plan.

In the Southern District there has been a change in the D.M., as Wes. Mitchell, 3BA, has had to abandon the position owing to press of business. Gowan of 3DS in Kitchener has taken over his work. This district has shown a startling improvement within the past six weeks, and there are now several good reliable stations which can be counted on for assistance in relaying messages south and west, notably, 3KS in Niagara Falls, Ontario, 3MO in Port Colborne, and 3LI in Welland. All these stations have been in touch with Toronto and other Ontario stations many times, and will furnish invaluable assistance in forwarding traffic from now on.

In the Toronto District there has also been some improvement and the new station erected by E. Rogers of 3BP has been of considerable value for relay work. Mr. Rogers has moved his station complete to New Market, Ontario, about 30 miles north of Toronto. This has enabled him to use a longer wave length, and has got him out of the local QRM so that his range is much more effective now. He has already succeeded in working 3DS in Kitchener, 3BA in Brantford, and 3KS in Niagara Falls. Traffic from this station has also been forwarded thro' a number of Buffalo stations. 3BP advises that during the past winter season his signals were copied at sea 1600 miles east of Newport News, and at 9OE in Wichita, Kansas. He reports having handled 24 messages in less than a

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week after getting set installed. In Toronto, 3GE has been maintaining a regular early morning schedule with 8CG in Niagara Falls, N. Y., and at present the most reliable means for getting traffic to Toronto and other Ontario points seems to be through the latter station, or 8FE or 8AHV.

In Eastern Ontario static and vacation time has cut down work to a very large extent, and no report has been forthcoming from that region this month.

Reported messages, 73.

ALASKAN DIVISION Roy Anderson, Mgr.

Thru the kindness of 7PO of Seattle, two more Alaskan amateurs have been brought to light. Those two are R. E. Pratovich, Bay View, Alaska, and L. C. Grove, of Kenai, Alaska. Letters have been sent these amateurs for particulars as regards their set.

Canadian 3HL advised that there were two amateurs in Prince Rupert and Canadian 4CB advised there were four. An attempt has been made to learn the power of these stations.

According to Mr. Maynard, these amateurs will only be allowed 50 meters wave length because they are on a route of navigation. The same probably holds true of all British Columbia coast stations. Those farther inland, however, are allowed from fifty to two hundred meters. There are about sixty licensed amateur stations in B. C. and with this number it will be, probably, possible to establish a relay route thru B. C., southward into the states, or, preferably, communication can be carried on with Seattle direct and the B. C. stations will have to be called upon only occasionally or else a route can be established eastward thru Canada.

Next month's report will probably contain more timely information as to these B. C. stations, as well as those in Alaska.

WEST GULF DIVISION Raymond L. White, Mgr.

Mr. Tilley, So. Tex. Dist. advises reports are rather meager on account of having hardly three nights to handle traffic during the month due to heavy QRN, but day-light work has been going on in his district with a rush and a surprising number of messages have been handled.

Austin is down to one station, 5ZU, so it falls to 5ZU to stand watch all hours of the day and regular schedules are maintained daily with 5XB, 5YI, 5YK, 5FA and 5KP and several others. Day-light work within 200 miles is comparatively easy.

The Texas University's station is nearing completion and will have a regular staff of operators who will stand watch each night from 7 to 11 p.m.

Mr. Sahm (5YK) at New Braunfels, Texas is making good.

A.D.S. Daniels, of Houston, reports conditions for reception and transmission for the past thirty days have been spasmodically good then bad, and most of the traffic moved into or out of Houston and vicinity has been done during day-light hours, with but few exceptions.

Earl Lester, 5NK, is our newest first class station and is doing some creditable work.



5ZW is doing some fine short distance work with his C. W. 5ZAA and 5CA are getting some interesting results with 110 A.C. on the plates of audiotrons and VT's.

D. S. Falconi, of the New Mexico District, states that atmospheric disturbances are slowly but surely isolating the southwest, though traffic has been going through. In an effort to make the handling of traffic during the summer possible, a C.W. set has been installed at 5ZA, and schedules are desired with other C.W. stations within easy range so that tests may be made. The power at 5ZA is 20 watts.

D.S. Dill of the Oklahoma District informs us that as far as League matters are concerned things look very well, but the chances of passing traffic through regularly do not look very encouraging. Traffic has been moving slowly at times, but impossible to work at all some evenings. Traffic can be handled with 5ZA on his C.W. set when his spark is unreadable through the static.

Several new stations have been found over the state this month.

Station 5RK of Norman, Oklahoma is now doing some good work, also 5JR at Enid is still working OK. 5CP of Oklahoma City is installing C.W.

H. P. Heafer, Dist. Supt., reports a complete reorganization plan in the Northern Texas Dist. Mr. John S. Dorsa, A.D.S., Dallas Territory, did not make a report. This is regrettable as there is some very good work being done in that Territory and no doubt has been reported by individuals. It is understood Dorsa has converted his aerial into a clothes line and his condenser tank into a wash tub; in short John is in the Laundry business now having purchased an interest in a local laundry. His report must have been lost in the wash. Huh?

In spite of the Laundry QRN, regular QRN and some O.W. QRM, there has been some relay work in the Dallas Territory and in Dallas proper some interesting de-

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monstrations of radio telephony, including radio dances, radio lectures and radio concerts, Mr. Bennett Emerson, 5ZG, furnishing the transmitting set.

Central Territory briefly reports by Mr. Guy Neel, 5XJ, a number of new stations among them being Mr. William Clark, 5ZAF, Waco. This station will prove very valuable as a relay station.

Western Territory, J. M. Martin, A.D.S., reports several new stations going up in vicinity of Amarillo but very little relay being done due to heavy static. A few messages are getting thru.

ATLANTIC DIVISION
Chas. H. Stewart, Mgr.

Report of Trunk Line Tests

On the nights of May 23, 24 and 26, trunk line tests were conducted over the northern and southern routes of the Northern Section of this division. They were none too successful, due to the unfortunate conditions that prevailed. In the first place the short notice given to stations along the lines caught a number of them unprepared and it just happened that quite a few were at the time undergoing repairs and changes. This particularly existed in the case of the most essential stations. Furthermore, many others were temporarily closed on the account of owners taking examinations at colleges, etc. In addition to this, to make matters worse and preventing large gaps to be covered, the atmospheric conditions throughout both New Jersey and New York were reported very bad on the first two nights. Fortunately weather conditions improved the last night and this was a great help.

All the fellows took keen interest in each test and showed their true spirit by co-operating heartily. Several of the Boiled Owls stayed right with the test until it was impossible to hear the faintest sign of a signal from any station on the route. FB, and thanks for the way in which you all responded. The story of the tests is given for the benefit of those who were not on the job and missed a lot of fun. A complete copy of all logs has not been turned in, therefore some credit may be missing where it is due.

New York to Philadelphia Test.

It was originally planned to route this message via the northern route through 3XM, Princeton, N. J., but at the last minute advice was received that because of examinations held on the above dates they would be unable to work. This station, being the only one which can consistently work Philadelphia and New York, in not operating made a change necessary and therefore the southern route was selected. This had to be abandoned immediately as it developed some of the re-

liable stations were temporarily out of commission. Furthermore, the local conditions prevented communication from Long Island points to Atlantic City, N. J. Knowing that transmission on the 23rd was impossible, 2JU handed a message to 2ZL addressed to 3ZS for broadcasting notifying him of test being called off. This message was received by 3NB at 10:30 p.m. (few words missed but were copied by 3AAN who furnished same), QRN bad, poor signals and extreme QSS on all N Y. City stations. Relayed this message to 3HJ, QSO good. 3HJ immediately relayed to 3ZS. Signals from 3ZS not audible at 3NB. At 10:58 3HJ handed reply to 3NB but it dropped dead there as the latter could not connect up with any 2nd district station. It was sent to 2GR the following evening and relayed from there to 2JU. May 24th: Signals of 3NB were coming in very good at 2JU and in view of this it was planned to try to work him direct which was done. Another message addressed to 3ZS was sent without breaks to 3NB at 11:08 p.m., who immediately relayed it to 3EH. 3EH started to give message to 3ZS but blew condenser and had to deliver message over the land telephone. May 26th: Message from 2JU to 3NB at 10:10 p.m. 3NB called 3HJ and started message at 10:16 but 3ZS who was standing by copied this message direct from 3NB. Reply sent from 3ZS to 3HJ at 10:20 who in turn sent it to 3NB at 10:24. 2JU standing by, copied message direct from 3HJ and gave final OK to 3NB at 10:25. Actual time consumed both ways 15 minutes. There was no slip in the handling of this message and credit is due all concerned. The time, which probably is no record must be considered very good.

New York to Albany.

May 26: This message together with one for Buffalo was sent by 2JU to 2GR at 10:38 p.m. 2GR had difficulty in raising stations between that point and Albany. Stations 2BB, 2DA, 2AR and 2BM could not be heard and delay existed on account of none of these stations answering 2GR. 2UA was on job and could have cleared 2GR but it would have done no material good as he would have had trouble working north. 2SZ, 2AWF and 2FG all copied message while being sent 2JU to 2GR but only 2SZ was able to get it complete, due to the others experiencing QSS and bad QRM. At 11 p.m. 2JU and 2SZ got in communication with each other and the latter OK'd for the msg. However, immediately upon copying message from 2JU to 2GR he relayed it to 2FG, which was at 10:42. For some unknown reason 2FG did not secure reply but the fact remains it reached Albany in 4 minutes.

New York to Buffalo.

On the nights of the 23rd and 24th very bad luck was experienced, due to the bad

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conditions. The first night message was given by 2JU to 2DI who in turn relayed it to 2UA. 2UA could not clear it further as he could not get in communication with anyone north of him. 2BB was on the job and copied message direct from 2JU but he also being unable to work any one north, message as far as the reports so far indicate dropped dead there. About the same conditions existed the following night but 2GR had been added and message was started through him with 2DI standing by. It is possible that one or more of the up-state stations had copied direct from 2JU but logs received up to the present writing do not show this. The final night was a little more successful. This time, although the message never reached Buffalo, it did get to Utica. 2JU started to 2GR who could do nothing on account of no stations working north to Albany. 2SZ had copied the message direct from 2JU as did 8HP. 2SZ not knowing that 8HP had copied it, called him several times but conditions between these points were bad and he could not connect. In the meantime 8HP was calling his head off, trying to raise stations west to Buffalo. He got hold of 8MDG, sent message twice but had to give it up as the latter station could not get it. Then he got in communication with 8FE, but on account of bad conditions he could not get it. The last attempt was made with 8AGK, when he sent message four times but it was utterly impossible to push it through and it had to drop there. 8HP certainly deserves thanks for his courage and patience in trying to get that message through. If we had better weather conditions, without question the Buffalo message would have been delivered and reply received and it is to be regretted that the outcome was so unfortunate.

Reports

It is noticed that the coming of summer with its QRN has caused a slackening of interest in relay affairs with a marked decrease in messages handled.

Mr. Lester Spangenberg, 2ZM, one of the few remaining old-timers in this Division, has been forced to resign as D.S. for northern New Jersey and may possibly have to withdraw from the game. This is sadly regretted, as 2ZM is a true amateur, a wonderful asset to our organization, and very well liked by all fellow amateurs. Mr. Ted Ostman, 2OM of Ridgewood, N. J., has been appointed as the new D.S. Ted has all the best wishes of his many friends and will prove his worth as a capable representative.

That stations in New Jersey may easily know who their D.S. is, the territory previously allotted the two Supts. has been changed in a few places, so that all stations whose call letters began with the number

3 will come under the jurisdiction of Mr. Marcus Frye, 3NB, Vineland, and those whose calls begin with the number 2 will come under Mr. Ostman, 2OM, Ridgewood.

We have lost one of our most efficient stations in the suspension of license of J. K. Hewitt, 2RK of Brooklyn. This suspension has caused considerable comment and agitation in this vicinity and it is to be regretted that such a thing should fall upon one of our best stations.

The Second District Council is forming regulations and traffic rules. Without question it will be something long wanted and we will not have to look forward to next season with the conditions of last season in mind. An invitation is extended all radio clubs in the Second District to join the council at once in order to be represented.

Benzee Bros., D.S. for Western N. Y., report only 391 msgs. handled, somewhat of a decrease. Numerous spark stations are being converted to C.W., and with the new C.W. stations traffic will be kept moving thru the summer. City Manager Haire (8GI) of Rochester has been forced to resign account entering the commercial game. 8FE is now using C.W. and has done very good work with four VT-2's. J. J. Young, 8HJ of Elmira, has been appointed City Manager of that city, and reports traffic moving very nicely there.

Carl E. Trube, D.S., Hudson Valley, reports that section of the N.Y.C.-Buffalo route from Yonkers to Hudson in splendid working order. 2DN, 2BK, 2BB, 2DA, 2AR and 2BM are handling traffic consistently. 2OA, 2HJ, 2UA and 2DK make a fine outlet for New England traffic, and all are handling heavy business. Complete record of traffic is not available, but 2BK handled 209, giving an idea of the volume. Plans are under way for a branch route towards Binghamton and all stations wishing to be appointed official relayers thereon should communicate with Mr. Trube.

F. H. Myers, D.S., Capitol Dist., reports a great deal of interest in the formation of his newly-created district, with everyone working hard on the New York to Buffalo route. 2SZ is back after repairs; 2FG temporarily closed. E. M. Williams of 2SZ has been appointed C.M. for Troy and the following official relay stations appointed: E. Wirsing, 2AWF, Albany; Geo. Benas, 8HP, Utica.

Dr. E. A. Cyriax, D.S. for New York City, reports that altho his district contains more stations than any other in the country, it has few DX stations and practically all outbound traffic must be relayed to a suburban DX station. Until local QRM is reduced local DX men will not be able to do their share. It is hoped that the Council regulations will overcome this handicap. 2CI and 2IF have been appointed official relay stations. Will others wishing appoint-

ments please communicate with Dr. Cyriax? 2DI handled 51 msgs.; 2CT closed down but expects to be on again shortly.

F. A. Maher, D.S., Brooklyn, advises that in the enforced absence of 2RK the traffic ordinarily handled by him is being absorbed very nicely by the other DX stations. 2WB is back after a long absence and proves a big help. The following are also doing their share: 2BO, 2ARY, 2MM, 2MB, 2PF, 2OW, 2DO, and 2RM.

Ted Ostman has just been appointed D.S. of Northern N. J. and so has not had sufficient time to become acquainted with his position. Traffic reports show a slight decrease as expected. 2AXB handled 25 messages during three weeks in May; 2AFP 68 for the month; 2BOC 80, and 2OM 248. 2VA not very active account college exams. 2UE is changing from spark to C.W. 2AJF is doing splendid work with his C.W. and we would like to see him handle more traffic.

Marcus Frye, Jr., D.S., Southern N. J., reports the same slowing up in movement of traffic as other sections. For the first time in history this district has been in direct communication with Baltimore, and considerable traffic has now been handled. Altho the distance is short it has always been very difficult to work this city, due to peculiar local conditions. 3FB is under repairs. A series of tests between 3NB and 3XF has been carried on in effort to establish daytime communication but results have not been very satisfactory to date. 3BA reports 14 msgs., 3AAN 20, 3EH 20 and 3NB 54.

H. S. Collins, D.S., Long Island, reports a much-needed efficient station in that of 2BML, Riverhead, L. I. Without question this station will be of great assistance in clearing traffic between N.Y.C. vicinity and New England. 2BGR and 2AJW are doing very good work with their C.W. sets and clearing lots of traffic. 2JU handled 123 msgs. during the last month. 2ZL and 2EL are doing excellent work and have cleared more traffic than many others, altho the exact number is unknown. (2ZL-2EL: Hw abt a report?—T.M.)

B. P. Williams, D.S., Western Penna., reports traffic fallen off due to summer weather and static. On Branch Line 2 between Monaca and Uniontown not much traffic is being handled, altho large volumes are moving from Monaca to Erie. Regular summer work is being pursued by 8WY, 8HA, 8HY, 8JQ and 8RU. 8ZD, 8DV, 8VQ, 8PN and 8MT will be off duty, overhauling and rebuilding. Our newest station, 8RU, will take the place of 8ZD in Pittsburgh for the summer. Western Penna. is decidedly hilly and stations located on high ground find QRN much more terrific than in other parts of the country, handicapping them by comparison with other localities where operators are sticking at it regard-

less of the warm weather. There are a number of good stations north of New Castle in this district whose applications for places on Line 2 Mr. Williams would like to have.

In Central Penna., D.S. H. M. Walleze reports QRN fast shortening the working range but traffic passing fairly well. The trunk line east from Milton is taking shape. A new station at Shamokin, 3AJZ, has opened up and should be able to work Reading, who has a schedule with Allentown, from where traffic passes easily to New York and some to Philadelphia. As yet no one has been located to substitute for 8XE this summer.

Slackening in traffic work is noticed in Eastern Penna. District, in the report of Supt. S. W. Place. Mr. Ehrhardt reports things dull in his territory, with few new stations. 3WX's new station is almost finished and will be regularly QSO Reading and York. Mr. Place's station has been granted a license to operate on 375 m., call 3ZV, and a C.W. set is now under construction, which will help in moving traffic.

Geo. L. Deichmann, 3HG, the recently appointed D.S. for Eastern Maryland, reports he has been unable to collect much data for his report this month. 3HG has been forced to abandon his morning schedule with 3ALN, Washington, because of examinations, but Baltimore C.W. stations, including 3ER, 3OU, 3AC, 3GZ and 3CT have arranged to keep up the connection. 3OU and 3AC have blossomed forth as regular DX stations and 3EQ, 3CT, 3EM, 3AJD and WJ have come to the rescue of summer traffic with C.W. stations that show some promise of putting the sparks on the shelf as long as static continues so annoying. 3EM has likewise abandoned the spark for C.W. Baltimore, Washington and Hagerstown at a joint club meeting have arranged for a regular daylight schedule connecting them. Conditions between Baltimore and Phila. are suffering badly for lack of perfect connection during the summer towards Phila. and Wilmington. It is suggested that the Phila. C.W. stations that are doing exceptional work should make tests with those in Baltimore with a view of perfecting a reliable schedule.

In the Dist. of Columbia, Francis Baer, D. S., the C.W. stations of 3AAO and 3ABI have blossomed forth as real DX workers. 3AAO is using two U tubes as oscillators with an antenna current of 3.5 amps. and has for nearly two weeks kept a reliable nightly schedule with 4GL in Savannah at 10:30, with 2BML at 9, and lately with 3ER in Baltimore at 9:30 on Mondays, Wednesdays and Fridays, all using straight C.W. 3ABI has a schedule with 1TS at 9:30 p.m. 3XF has made several unsuccess-

(Concluded on page 62)

Calls Heard

HEARD DURING MAY.
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 paper.

(2) Arrange alphabetically thru each district, from 1 to 9, with no break between districts, using commas to separate items and putting parentheses around calls of stations also worked—all as per the lists 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 by the 10th of the second month, for publication in the next following QST.

Heard at Sea by ex-9ZT from March 22 to April 7. At dock in New Orleans: 4CG, 4XC, 4YA, 5AF spk. & C.W., 5DA, 5EW, 5HO, 5IE, 5IF, 5JA, 5MY, 5NG, 5XA, 5XB, 5YH, 5ZA, 5ZR, 5ZX, 8AS, 8DZ, 8ML, 8ZL, 9CA, 9EL, 9GO, 9HI, 9KR, 9LQ, 9NQ, 9OE, 9OX, 9PS, 9UF, 9UT, 9XM, 9YA, 9ZB spk. & C.W., 9AAC, 9AAG, 9AFX, 9AIZ, 9ANV, 9AON, 9ARJ, 9ASN C.W., 9DSX, 9DGP, 9DIW, 200 miles southeast of South Pass (La.): 2RK, 4XC, 4YA, 5CA, 5EC, 5EG, 5IB, 5JD, 5LA, 5NC, 5XA, 5XB, 5YH, 5ZA, 5ZAA, 8DC, 8FK, 8SP, 8ARS, 9CA, 9EL, 8GJ, 9NQ, 9QO, 9WE, 9ZB C.W., 9AAC, 9AHO, 9AON, 9ARJ, XF-1 C.W. 350 miles southeast of South Pass: 1XM C.W., 1JAP, 3RK, 2ZL C.W., 4BP, 4DL, 4FD, 4AU, 5ZE, 5ZAB, 8DC, 9KK C.W., 8ZC, 9EL, 9MC, 9AOH, NBY C.W. 300 miles southeast of Key West: 4DL, 4FD, 5ZAB. 700 miles southeast of Key West, off Puerto Plata, Haiti: 1XM C.W., 4DL.

Heard Aboard KOGS, S. J. Mallory. Opr. Jan. 21 (60 miles south New York): 1IRJ, 2AGS, 2AOG, 2AUJ, 2BGR, 2EL, 2IT, 2TK, 3EN, 3FG, Jan. 22, (200 miles south New York): 1XT, 2DA, 2DN, 2EL, 2HN, 2OA, 2PD, 2ZM, 3ACM, 3BG, 3BV, 3EH, 3EJ, 3HG, 3HJ, 3ND, 3PU, 3UC, 3YV, 4BY, 8JS, 8XE, 8ZD, 8ZL, 9JN, 9ZN, 9ZQ, XF1 C.W. Jan. 23, (450 miles south New York): 1HAA, 2OA, 2RK, 3ND, 4BK, 4BY, 4FD, 8RP, 8XE, 8ZD, 9AWX, 9OX. Jan. 24, (700 miles south New York): 1IRJ, 2EL, 2NY, 2OA, 2RK, 2ZC, 3CC, 3DH, 8HJ, 8HX, 3KM, 3NR, 3VV, 4AG, 4BK, 4BY, 4CD, 5EA, 5YE, 8ACF, 8ARS, 8BO, 8HA, 8IK, 8MI, 8OI, 8SP, 8ZL, 8ZR, 9AEG, 9BY, 9EQ, 9FS, 9OK, 9UU, 9VZ, 9WE, 9YC, 9ZB, 9ZL, NSF C.W. Jan. 25, (off Miami): 2EL, 2OE, 2RK, 3EN, 3HJ, 3NB, 3NC, 4AT (daylite), 4BK, 4BY, 4CK, 5ER, 5JE, 5ZX, 8ANB, 8ZD, 8ZL, 9OX, 9ZB. Jan. 26, off Key West (QRN bad): 5LH, 5JE. Jan. 27, (200 miles west Key West QRN bad): 5LR. Jan. 28, (400 miles east Tampico): 5BR, 5HL, 5IS, 5KP, 5LR, 5XA, 5YH, 5ZK, 9AAC, 9AAG, 9AEG, 9AEY, 9AXJ, 9LR, 9MC, 9OE, 9YM, 9ZB. Jan. 29, (100 miles east Tampico): 5BC, 5LR, 5ZF, 9AAC, 9AEG, 9LR.

In port Tampico (Feb. 6th to Feb. 14th): 5DA, 5EJ, 6HL, 5HZ, 5JD, 5JE, 5LR, 5YH, 5ZC, 5ZG, 5ZT, 5ZU, 5ZW, 5ZX, 9LR, 9OE. Feb. 15, (100 miles northeast Tampico): 4XC, 5EW, 5FA, 6HL, 5HZ, 5IF, 5IS, 5JE, 5JX, 5KP, 5LM, 5LR, 5MF, 5XA, 5XB, 5YH, 5YM, 5ZA, 5ZF, 5ZG, 5ZK, 5ZP, 5ZR, 5ZU, 5ZX, 6IG, 9AEG, 9EL, 9FU, 9HI, 9HN, 9LR, 9MC, 9OE, 9SZ, 9WE, 9ZZ. Feb. 16 (250 miles southwest South Pass): 2RK, 4XC, 5HL, 5HN, 5HW, 5IS, 5JE, 5MF, 5YH, 5ZA, 5ZC, 5ZK, 8ADE, 8ZY, 9AAF, 9EL, 9EQ, 9HI, 9HN, 9LR, 9NQ, 9OE, 9TV, 9ZL. Feb. 17 (off Burwood, La.): 1IRJ, 4AG, 4FE, 4XC, 5DA, 5EJ, 5JD, 5JE, 5LR, 5MF, 5XA, 5YH, 5ZA, 5ZC, 8HG, 8IK, 8KK C.W., 8ZA, 8ZY, 9AIX, 9EL, 9EQ, 9ET, 9HI, 9LR, 9MC, 9WE, 9XM, 9ZB, 9ZJ, 9ZQ.

In port Gulfport, Miss. (Feb. 18 to 22nd): 2RK, 3GO, 4AG, 4AU, 4BK, 4BY, 4CG, 4FD, 4XC, 5BM, 5CL, 5DG (daylite), 5DI, 5DQ, 5EA, 5EK, 5ER, 5HL, 5HV, 5HW, 5IE, 5IS, 5JD, 5JE, 5JX, 5KP, 5LA, 5LR, 5MA, 5MF, 5OD, 5XA, 5XB, 5YE, 5YH, 5ZA, 5ZC, 5ZD, 5ZE, 5ZG, 5ZK, 5ZP, 5ZS, 5ZU, 5ZX, 8AKV, 8DC, 8KP, 8XE, 8XS, 8ZE, 8ZL fone and spk., 8ZY, 9ABD, 9AEG, 9AON, 9ASL, 9BW, 9BY, 9CS, 9EL, 9EQ, 9FU, 9HI, 9HN, 9JN, 9LA, 9LC, 9LR, 9MC, 9OE, 9QO, 9UF, 9UK, 9UU, 9WT, 9XM, 9ZB, 9ZL VMI.

Feb. 24, (80 miles south New Orleans): 2EL, 2RK, 3AHK, 8GO, 4BK, 4BY, 4CG, 4EK, 4XC, 5DQ, 5ER, 5HL, 5HS, 5HW, 5JE, 5LR, 5XA, 5XB, 5YE, 5YH, 5ZA, 5ZC, 5ZK, 5ZP, 5ZR, 5ZU, 8AFS, 8AGK, 8CH, 8HG, 8ID, 8XE, 8ZA, 8ZE, 8ZL, 8ZR, 8ZY, 9AKH, 9DC, 9DU, 9EL, 9EQ, 9FS, 9HN, 9LA, 9LQ, 9LR, 9MC, 9OE, 9UK, 9VZ, 9XM, 9ZN, 9ZQ, 9ZZ.

March 9, (50 miles south New Orleans): 4XC, 5DQ, 5H, 5HN, 5HP, 5HV, 5HW, 5IB, 5JD, 5JE, 5LA, 5XA, 5YH, 5ZP, 5ZX, 8ZY, 9BW, 9EL, 9HN, 9LR.

March 10, (150 miles southwest South Pass): 2RK, 3GO, 4XC, 5IF, 5XA, 5ZP, 5ZP, 7KX, 8KP, 8VJ, 8ZL, 8ZR, 8ZY, 9ANV, 9BW, 9DIW, 9EL, 9ET, 9FU, 9HN, 9GT, 9HI, 9JN, 9LF, 9LQ, 9LR, 9OX, 9VN, 9WE, 9XM, 9ZV.

March 12 to 21 (at Tampico) on two bulbs: 1IRJ, 2RK, 4XC, 5AO, 5DT, 5EW, 5FD, 5FL, 5HL, 5IB, 5IF, 5JA, 5JE, 5JI, 5LA, 5LR, 5MF, 5MX, 5MY, 5YH, 5ZA, 5ZAA, 5ZC, 5ZF, 5ZR, 5ZS, 5ZT, 5ZU, 6ER, 6IG, 6ON, 6ZR, 9AAC, 9AAW, 9AEG, 9DC, 9DIW, 9EL, 9FU, 9HI, 9HN, 9KO, 9LR, 9MA, 9MC, 9OE, 9OI, 9QO, 9YA, 9ZJ, 9ZY, 5GT fone.

April 11 to 20 (in Tampico, but on crystal): 5HL, 5XI, 5ZAA, 5XI, 8ZY, 9AEG, 9MC.

IMO, HARTFORD, CONN.—All C.W. 1BV, 1CBJ, (1FQ), (1NAQ), 1QN, 1TB, (1TS).

1QA1, (1UN), 1YM, 2ADL, 2AJF, (2AJW), 2BFZ, 2BML, 2CT, 2DA, 2BB, 2DN, 2HI, 2UD, 2ZL, 2XAC, 2XK, 2XX, 2AJ, 2AAE, 3AAO, 3BC, 4GL, 8DE, 8IV, 8NQ, 8RQ, NSF, NMW, XBI, XF1.

1FBH, STAMFORD, CONN.—All C.W. 1CK, 1FZ, 1BQH, 2DR, 2RB, 2UD, 2QR, 2XX, 2ZL, 2ZM, 2AJF, 2AKO, 2AWL, 2BDU, 2BML, 8RM, 8XK, 8ZW, NSF, XK1, XK4, KVKA.

IVAW, BRIDGEPORT, CONN. 1AW, 1CK, 1CM, 1CZ, 1CAS, 1CBJ C.W., 1DR, 1DY, 1DAL, 1FY, 1FBG I.C.W., 1GM, 1JT, 1LB, 1MK, 1NBA I.C.W. & fone, 1QN C.W., 1RV, 1SBZ, 1TS I.C.W., 1ZE, 2AEF, 2AFZ, 2AFT, 2AID, 2AJR, 2AJW C.W., 2ANJ, 2ARY, 2ASB, 2ASL, 2AWL fone & I.C.W., 2AXB, 2AYS, 2BK, 2BDU fone & I.C.W., 2BFF, 2BGR, 2BML C.W., 2BNF,

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2BNU, 2BQH fone, 2BRC I.C.W., 2CY, 2DI, 2DK, 2EL, 2FS I.C.W. & fone, 2GR, 2HJ, 2HBF, 2IF, 2IQ, 2JU, 2MJ, 2OM, 2OW, 2RB fone, 2RM, 2TK, 2UA, 2UK, 2VA, 2YM, 2ZC, 3AS, 3ACS, 3CC, 3DG, 3FB, 3HJ, 3HX, 3IW, 3OU, 3PU, 3WX, 3XM, 3ZO, 8AGK.

1IAA, SHARON, MASS. April—May.
2AF, 2AL, 2AWF, 2AX, 2AZ, 2BG, 2BH, 2BM C.W., 2BML, 2BRI, 2BQ, 2BQW fone, 2BZ, 2CC, 2DI, 2DR, 2DZ, 2EL, 2FD C.W., 2IL, 2OA, 2OM, 2QC, 2RE, 2RK, 2RW, 2SZ, 2UA, 2VV, 2WR, 2WU, 2XF C.W. & fone, 2XH C.W., 2XJ fone, 2XQ, 2XY, 3BZ, 3CC, 3EN, 3HJ, 3ND, 3OA, 3OU, 3PU, 3XM, 3AC, 3AD, 3AGK, 3AL, 3AMZ, 3AMM, 3ANO, 3ANT, 3AWX, 3BC, 3DA, 3DC 3DD, 3DR, 3DV, 3FE, 3HV, 3HR, 3IP, 3JW, C.W., 3JQ, 3MZ, 3QH, 3RU, 3RW, 3VQ, 3VV, 3XA, 3XE, 3YA, 3ZY, 3AAC, 3HR, 3HT, 3JN, 3KB, 3KF, 3ME, 3UH, 3XM, 3YB, 3ZN, 3ZL.

2DK, SCARSDALE, N. Y.
1BBL, 1BM, (1CBJ), C.W. & fone, 1CK, 1FBF, 1GBC, 1GM, 1HAA, 1HO, 1JAP, 1NBA fone, 1WR, 1ZE, (2AJW C.W.), 2AR, (2BGR), 2DA, (2EL), 2FG, 2OE, 3ACS, 3AHK, 3AVG, 3BG, 3CC, 3DV, 3SFR, 3GO, 3GU, 3HX, 3OU, 3PU, 3AOT, 3APB, 3DY, XF1 C.W.

2BKJ, GRANTWOOD, N. J.—June 1-6.
1ZE, 1DAL, 1GBC, 1CCY, 2SZ, 3BO, 3CC, 3CK, 3EH, 3EZ, 3GX, 3HG, 3HJ, 3IW, 3IZ, 3JR, 3NB, 3OU, 3PU, 3VV, 3XM, 3ZO, 3ALT, 3BO, 3DY, 3HR, 3PL, 3RQ, 3TK, 3TT, 3WY, 3XK, 3XU, 3ZA, 3AGK, 3AKA, 3ANT, 3AYN.

3ABP, YORK, PA.—April 20-May 21.
1AW, 1DH C. W., 1DT C. W., 1GBT C.W., 1NBA C.W., 1RD, 1TS, spk. & C.W., 1XB C.W., 1XG, 1XV, 1XX, 2AJF C.W., 2EL, 2HJ, 2MBL C.W., 2RK, 2XF, 2XQ spk. & fone, 2XX, 2ZL, 2ZM spk. & C.W. vy qsa, 3AAE, 3AAB, (33ADB), 3ACS, (3ACY), (3AGT), 3AIC, (3BAH), 3BAK, 3CC C.W., (3DB), 3EN, 3EQ, 3GO, 3KZ, 3LP, 3NB, 3NC, 3NY, 3PB, 3PU, 3SJ, (3WX), 3XF, 3XM, 3YE, 3YK, 3YV, 3ZA, (3ZO) spk. C.W. & fone, 3ZS, 4CX, 4GX, 4ME C.W., 4XB fone, 4XC, 5PA, 5KA, 5XB, 5AGK, 5HJ, 5HP, 5KM, 5P, 5VA, 5ZB, 5ZU, 5ZV, 5ZW, 5ZZ, 5ZAE, 5ZAF, 6GF, 7KX, 7YA, 8KP, 8YG C.W., 8ZG C.W., 9BW C.W., 9EL, 9FF, 9FK, 9FU, 9HN, 9HM, 9HN, 9HT, 9OR, 9OE, 9QU, 9WI, 9XM C.W., 9ZAC, 9ZN.

3AOV, STONEGA, VA.
(4AG), 4AL, 4BT, 4CK, (4DA), 5EK, 8AAS, 8AKS, 8AK, 8BM, 8BO, 8DI, 8EC, 8ID, 8LW, 8OJ, 9AAZ, 9AAC, 9ANV, 9AJT, 9APS, 9AZT, 9LQ, 9SH, 9UC, (9UH), 9UZ.

3ALR, WASHINGTON, D. C.
1AW, 1MAD, 2EL, 2JU, 2KL C.W., 2OM, 2RK, 2RM, 3BP, 3CC C.W. & spk., 3EH, 3EQ C.W., 3HJ, 3HJ, 3IC, 3NB, 3PU, 3XM, 4GL, 4YA, 5Z, 8AM, 8AIQ, 8HR, 8JM, 8PU, 8RQ C.W. & spk., 8XK C.W., 8XM, 8ZA, 8ZR, 9UH, 9UU, 9ZN, XF1.

3EZ, PORTSMOUTH, VA.—May 8-June 8.
1AW, 1BA, 1CZ, 1GM, 1JAP, 1ZE, (2ACD), (2AFJ), 2AHK, (2ARD), (2ARY), (2EL), 2ERN, 2GM, 2KL C.W., (2JU), 2OM, 2TS, 2UK, (2WB), 2XK C.W., 2XM, 3AD, 3AL, 3BG, 3BP, 3BZ C.W., 3CC, (3EH), 3EL, 3EQ, (3FB), 3FJ, 3HB, 3HG, (3HJ), (3HX), (3IW), 3IX, 3JX, (3KM), (3LP), (3NB), 3NX, (3OU), (3PU), (3QN), 3RQ, 3RX, 3UK, (3WX), (3XF), 3YK, (3YH), 3ZA, 3ZO, (4BY), (4GN), 3AEE, 3AFA, 3AGK, 3AGO, 2AJT, 3AMQ, 3ANW, 3BO, 3BK, 3CI C.W., 3DE C.W., 3DP, 3HJ C.W., 3HR, 3LX C.W., 3OI, (3RQ), 3TK, 3TT, (3TY), 3WA, 3WR C.W., 3WY, 3XA, 3XM C.W., 3XK fone, 3YN, 3ZG C.W., 9AAW, 9AGV, 9ANC, 9ANV, 9FS, 9ME, 9PC, 9UH.

5ZU, AUSTIN, TEXAS.
(4XC), 4GL C.W., 4YA, 5AG, 5EA, 5EF, (5EK), 5BR, (5CC), (5FA), (5FB), (5HE), 5HF, (5HL), 5HH, 5HB, 5IP, 5IF, 5IB, (5JE), 5JD, (5JS), 5KB, 5KV, 5LR, 5LM, 5LP, 5MF, (5MG), 5MX, (5NK), (5OR), 5RH, 5WI, (5XB), (5XI), (5YE), (5YH), 5YL, 5YM, (5YK), (5ZA spk. & C.W.), 5ZD, (5ZP), (5ZR), (5ZX), (5XAB), (5ZC), 5ZS, (5ZF), (5ZW), (5ZE), (5ZL), (5ZAA), (5ZAE), (5ZAF), (5ZZ), 6ZL, 8YN, 8ZZ, 8ZY, 9AEQ, 9AEG, 9AAC, 9AEY, 9AI, (9ALG), 9ARP, 9ANV, 9ANP, 9AR, 9ACJ, 9AUS, 9ANF, 9BW, 9DW, 9DL, (9EL), 9EQ, 9EK, (9HI), 9IY, (9JN), 9JA, 9JM, 9JC, 9KW, 9KV, (9LR), 9LA, 9LI, 9LQ, 9LC C.W., 9MC, (9OE), 9ON, 9PS, 9QO, 9SZ, 9TI, 9UH, (9WI), 9WW, 9XY, 9XAE, 9XM, 9XI, 9YM spk. & C.W., 9YI, 9YA, 9ZJ, 9ZL, 9ZN, 9ZQ, 9ZA, 9ZB, (9ZH), 9ZR, 9ZV, 9ZAB.

5FO, NORMAN, OKLA.
9OE, 5NK, 5LC, 5JL, 5ZK, 5OH, 5ZS, 5HQ, 5XJ, 5DE, 5NW, 5QA, 5HX, 5ZA, 5DW, 5LK, 5JR, 5HZ, 5AE, 5AR.

5YK, NEW BRAUNFELS, TEXAS.
4XB C.W., 5XD, (5XB spk. & C.W.), (5XI), 5YE, 5YH, (5YI), 5YL, (5ZA spk. C.W. & fone), 5ZC, 5ZD, 5ZE spk. & C.W., 5ZF, 5ZX, 5ZL, 5ZN, 5ZP, (5ZR), (5ZU), 5ZV, 5ZW, 5ZX, 5ZZ spk. & C.W., 5ZAA C.W., 5ZB, (5ZAB), (5ZAF), (5ZAG), 6ZZ, 9BY C.W. & fone, 9YI, 9ZC, 9ZU, 9ZJ, 9ZQ, ZA1, (ZD1), (ZK1), (ZM1), BW4 C.W., (AG5), AA6 C.W. Specials only, including army stations; others too numerous.

5KP, ELGIN, TEXAS.
2ZL, 4AG, 4YA, 5AG, 5BV, 5BM, 5CC, 5CL, 5DA, 5DB, 5DW, 5EF, 5EJ, 5EW, 5FL, 5HF, 5HV, 5IF, 5IS, 5JA, 5JS, 5KA, 5LK, 5LM, 5LR, 5MG, 5XA, 5XB, spk. and C.W., 5YE, 5YL, 5ZF, 5ZK, 5ZL, 5ZS, 5ZU, 5ZW, 5ZZ, 5ZAE, 5ZAF, 6GF, 7KX, 7YA, 8KP, 8YG C.W., 8ZG C.W., 9BW C.W., 9EL, 9FF, 9FK, 9FU, 9HN, 9HM, 9HN, 9HT, 9OR, 9OE, 9QU, 9WI, 9XM C.W., 9ZAC, 9ZN.

6ZT, SALT LAKE CITY.
5IF, 5ZA, 5ZZ, 6AE, 6AH, 6AK, 6AN, 6AW, 6BJ, 6BQ, 6BR, 6CO, 6CV, 6DH, 6DK, 6DP, 6EA, 6EB, 6EJ, 6EN, 6ER, 6FE, 6FH, 6FI, 6GY, 6HY, 6IC, 6IF, 6IG, 6JN, 6JR, 6JT, 6KA, 6KL, 6KM, 6KR, 6LC, 6MK, 6OH, 6PJ, 6PR, 6PY, 6QJ, 6QR, 6QY, 6RE, 6UM, 6VS, 6WV, 6XZ, 6ZE, 6ZH, 6ZK, 6ZN, 6ZO, 6ZR, 6ZS, 6ZU, 6ZY, 6ZY, 6ZZ, 6AAH, 6AAT, 6AAK, 6AAW, 6ACA, 6ACR, 6AFX, 6AFY, 6BAB, 6BAC, 6XAD, 7BH, 7BP, 7BR, 7BV, 7CC, 7CW, 7CU, 7DA, 7DS, 7EX, 7FL, 7QQ, 7IM, 7IN, 7JX, 7YA, 7YS, 7XB, 7ZB, 7ZD, 7ZG, 7ZJ, 7ZO, 7ZK, 8XK, 9EL, 9HT, 9LR, 9LW, 9OE, 9PS, 9YW, 9AFX, 9AMB, 8AVU.

6AUB, SAN DIEGO, CAL.
5ZA C.W. & spk., 6AE, 6AK, 6AQ, 6DP, 6ED, 6EN, 6ER, 6GE, 6HI, 6IF, 6IL, 6JM, 6KA, 6KM, 6LC, 6MK, 6OC, 6OH, 6OW, 6RN, 6SK, 6UM, 6ZA, 6ZH, 6ZK, 6ZN, 6ZR, 6ZU, 6ZX, 6ZZ, 6AAK, 6ABP, 6ACY, 6ADX, 6AIL, 6XAD C.W.

THACHER SCHOOL, OJAI, CAL.
6AAG, 6AAK, 6ACY, 6ADA, 6ADL, 6AGC, 6AGF, 6AGL, 6AHQ, 6AJE, 6AK, 6ALE, 6APH, 6AQ, 6ARG, 6BF, 6BG, 6DP, 6DS, 6EB, 6EC, 6EN, 6ER, 6EX, 6FH, 6FI, 6GP, 6IM, 6TY C.W., 6JN, 6KI, 6KM, 6KW, 6LW, 6NG, 6NY, 6OL, 6PO, 6PR, 6TF, 6ZK, 6ZN, 6ZU, 6ZX, 7CC.

7DA, PORTLAND, ORE.—April 15 to May 15.
(Canadian 5BA). (Canadian 5CJ). (6AH), 6AK, 6CH, (6CP), 6DD, (6DP), 6ED, 6EN, 6EP, (6EX), (6FH), 6GF, (6HC), (6HP), (6IC), (6KA), (6KL), (6LC), (6OC), (6OH), (6OW), 6PR, (6QR), 6SK, (6SR), 6TA, (6TC), 6TV, 6VM, (6WZ), (6ZB), (6ZU), 6ZX, 6AAP, 6AAU, (6AAW), 6ABM, (6ABX), 6ACA, 6ACI, 6ACM, (6ACR), 6AFN, 6AFY, (6AGF), 6AIT, (6AIW), (6ANK), (6APH), (6ZAA), (7AD), (7BA), (7BC), (7BH), (7BK), (7BQ), (7BV), 7CA, (7CE), 7CN, (7CW), 7EO, (7FI), (7FQ), (7ID), (7IY), (7KM).

July, 1921

7KQ. (7D), (7NL), (7NN), (7OF), 7PV, 7YS, (7YA), (7ZG), 7ZH, (7ZM).

7ZG, BEAR CREEK, MONT.—During April, 2RK, 2ZL, 3HK, 5IF, 5ZA, 6AEZ, 6JT, 6KA, 6LC, 6NQ, 6OT, 6VS, (6WV), 6ZA, 6ZB, 6ZH, 6ZU, 6ZZ, 7AD, 7BQ, 7CU, (7DA), (7DH), (7EX), (7FI), 7FL, 7FQ, 7GK, (7IM), (7JW), 7LN, (7LU), (7LY), 7MB, 7MC, 7MP, 7NN, 7NL, 1XB, (7XD), (7YA), 7YG, (7ZM), (7ZO), 9ABU, 9AEG, 9AEB, 9AFX, 9AGN, (9AIF), 9ALG, 9ALC, 9ALU, 9ANF, 9AOM, 9AQE, 9ARJ, 9ASF, 9ATN, 9ATO, 9AUO, 9AVZ, 9AWX, 9AXU, (9AYE), 9AWY, 9DAT, 9DHA, 9DKS, 9DMB, 9EE, 9ED, 9EQ, 9HI, 9HT, 9IY, (9JN), 9LW, 9MC, (9NR), (9OE), 9OO, 9PL, 9PN, 9PS, 9QO, 9RG, 9SZ, 9UE, (9WI), 9TI, 9XI, 9YY, (9XM), (9YW), 9ZAC, (9ZC), 9ZU. This is the biggest list for the past month and shows the good work done at 7ZG. This was all done on a home made set and a one step amplifier.

7BK, SEATTLE.—April 15-May 15. Canadian 5BA, 5CP, 6AK, 6CH, 6DD, (6DP), 6DY, 6EX, (6FH), (6HC), 6IY, 6KK, 6KL, 6KM, 6LC, (6OC), 6OH, 6OW, 6PR, (6QR), (6TC), 6TM, (6TV), 6VM, (6VX), 6WD, 6AA, 6AAW, 6ABM, 6ABX, (6ACR), 6ADH, 6AFV, (6AGF), 6AID, (6AJI), 6AJE, 6ALA, 6ANK, 6APH, 6ZA, 6ZH, 6ZN, 6ZR, 6ZU, 6ZX, 6ZAA, (7BH), 7BQ, 7BV, (7CU), (7CW), (7DA), (7ED), (7FI), 7FQ, 7GA, 7GP, 7HF, 7HN, 7IN, 7JN, (7JW), (7KB), 7KJ, (7LS), (7MH), 7MY, 7NL, (7NN), 7YA, 7YG, (7YS), 7ZG, 7ZI, (7ZJ), 7ZK, 7ZM.

8ANW, NILES, OHIO. 1AW, 1HAA, 1OE, 1RAY, 2RK, 2QR, 2ZL, 3XM, 4CC, 4CK, 5DA, (8AAV), 8ADJ, 8AO, (8AKJ), 8ALY, (8AEJ), 8AGZ, (8AMF), 8ANK, (8ARW), 8AXC, 8AWX, 8AYN, (8BDP), 8BK, 8BO, 8CD, 8CH, 8DE, (8GW), 8HA, (8HB), 8JM, 8JU, 8NQ, 8OI, 8PT, 8TT, 8XE, 8ZA, 8ZG, 8ZR, 8ZW, 8ZX, 9AAW, 9AL, 9DV, 9HN, 9LA, 9LQ, 9TI, 9WU, 9XM, 9ZJ, 9ZL, 9ZN, 9ZQ.

8AUG, CLEVELAND, O.—April 15-May 15. 1AW, 1XM, 2ANL, 2BK, 2DR, 2EL, 2FL, 2ZM, 2JU, 2OM, 2UK, 3AWV, 3CC, 3EL, 3EN, 3KM, 3NB, 3OU, 3PU, 3RW, 3WM, 3XF, 3XM, 4AG, 4BC, 5JD, 5ZL, 8AAV, 8ABG, 8AEZ, 8ACK, 8AGK, 8AGO, 8ANK, 8ARK, 8ATE, 8AWX, 8AA, 8AW, 8DE, 8EN, 8FE, 8KZ, 8QE, 8RQ, 8SP, 8TY, 8UL, 8WY, 8XE, 8YN, 8ZD, 8ZY, 9AAW, 9AWZ, 9JA, 9JN, 9JQ, (9LQ), 9ME, 9NW, 9PC, 9UK, 9UJ, 9UU, 9WM, 9WN, 9WO, 9ZN, NSF, WWW.

8AGZ, E. CLEVELAND, O.—C.W. Only. 1DH, 1QR, (1TS), 1XX, 2CC, 2XA, (2ZL), 2ZM, 2XQ, 2BML, (3CT), 3PU, 3AAE, 3AAO, 4GL, 4XB concert, 3BA, 8BO, 8CF, (8DE), 8GA, 8GE, 8HA, (8IB), 8II, (8IV), 8JJ, (8JM), 8JU, (8KM), 8IF, 8LV, (8OJ), (8PJ), (8QY), 8NI, 8RK, (8VS), 8XB concert, 8XX, 8XM, (8YG), 8ZL voice, (8ZG), (8ZN) voice, (8ZV), (8ZZ), 8ABO, 8ALN, 8AMM, 8ANK, 8ARU, (8ASM), 8AYO voice, (8TZV), 9XB, (9XI), (9XM concert), 9ZY, 9AZX.

8PU, ERIE, PA., April 21-May 21. 1AW, 1CK, 1TS, 1TY, 1XE, 1DAP, 1GBC, 1QR C.W., 1RAT, 2EL, 2HI C.W., 2JU, 2RK, 2UK, 2ZL C.W., 2BML C.W., 3BG, 3BR, 3CA, (3CC), 3DN, 3EN, 3HJ, 3HR, 3XM, 3AWV, 4AG, 4CK, 5DA, 8BO, 8CG, 8CP, 8DE C.W., 8DP, 8FE, 8FI, 8HG, (8HJ), (8KK), (8LM), 8LV, 8ML, 8MM, 8NB, 8NQ, 8NZ, 8OI, 8RM, 8RQ, 8SG, (8SP), 8TO, (8TY), 8UY, (8VH), 8WI, (8WY), 8WZ, 8XK, 8AAP, 8AAV, 8AAW, 8ABM, (8ACA), 8AFG, 8AGK, 8AGU, (8AH), 8AHG, 8AIA, (8AIS), 8AKV, 8AMZ, 8ANJ, (8AOT), 8APH, 8AQD, (8AQL), 8AQV, 8ARW, 2ASJ, 8ATW, 8AUB, 8AWX, (8AYM), 8UH, 9UU, 9ZJ, 9ZN, 9AAW, 9ABJ, 9ACM, 9ALS, 9DAX, Canadian 8AB, 3BP, 3DS, 3GI, 3GO, 3LI, 3MO.

8AOY, LANCASTER, N. Y. 1AW, 1CK, 1CZ, 1GBT, 1GM, 1HTF, 1NBA C.W., 1YR, 2BM C.W., 2EL, 2XA, 3AI, 3AVG, 3CC, 3HJ, 3NB, 3PU. Canadian 3BA, 3KS, 3LD, 3MO, 3BV.

8CG, 8DA, 8FE, 8FC, 8HA C.W., 8HJ, 8IL, 8KU, 8KZ, 8LB, 8MZ, 8PJ, 8SP, 8UF, 9WO, 8ZK, 5ADR, 8AGK, 8AHQ, 8AHS, 8AHV, 8AJR, 8AKX, 8AMB, 8AMM, 8AMZ, 8AMQ, 8ANJ, 8ANT, 8AOB, 8APB, 8APJ, 8ARW, 8AVD, 8AVE, 8AYT, 8BBK, 8BDH, 8BEU, 9FQ.

C. Gartlein and K. White, Florence Hall, Greencastle, Ind., April 1-May 8, Galena.

1XM, 5EK, 5FD, 5HL, 5IB, 5JD, 5YH, 5YS, 5ZD, 5ZL, 8CD, 9DZ, 8ML, 8YN, 8AGK, 8ARS, 9AV, 9EG, 9GW, 9HI, 9HN, 9HR, 9JA, 9JQ, 9KO, 9KP, 9KR, 9KX, 9LQ, 9MC (QSA), 9NH, 9NW, 9OB, 9OE, 9US, 9QO, 9SC, 9UJ, 9UK, 9UU (QSA), 9WE, 9YA, 9YB, 9YI, 9ZJ, 9ZN, 9ZS, 9AAV, 9AAW, 9ABL, 9ACN, 9AEG, 9AGR, 9AJK, 9ALV, 9AMK, 9ANV, 9ARJ, 9AWX, 5YR, 5YL, 5ZU, 5ZX, 8ASY, 8LU, 8TK, 9AFK, 9CF, 9VC, 9WC.

C. F. BURDICK, CASPER, WYOMING, April. 5HL, 5IB, 5IF, 5JD, 5JL, 5MX, 6ZA apk & C.W., 6AE, 6AEZ, 6AJX, 6DZ, 6JT, 6OT, 6VS, 6ZA, 6ZB, 6ZG, 6ZH, 6ZX, 6ZZ, 7DH, 7FL, 7LU, 7LY, 7MO, 7XD, 7ZG, 7ZM, 7ZO, 8ASB C.W., 9AAW, 9ACN, 9AEG, 9AEY, 9AG, C.W., 9AGL, 9AGN, 9AIF, 9ALG, 9ALO, 9ANF, 9ANV, 9ARJ, 9ASF, 9ATN, 9AUO, 9UU, 9AV, 9AVS, 9AWG, 9AXU, 9BT, 9EE, 9EL, 9FX, 9HI, 9HT, 9IF, 9JA, 9JN, 9JQ, 9KA, 9LLW, 9MC, 9NQ, 9OE, 9OO, 9PS, 9QO, 9SC, 9SZ, 9TI, 9UG, 9VE, 9WI, 9XAE, 9ZAC, 9ZAC..

Don't forget to send in your Calls Heard during the Summer months—they mean even more than in Winter.

MAY STATION REPORTS

4GN, Midville, Ga.

| Steadiest | Loudest |
|-------------|-------------|
| 1AW—1XF | 1AW—1XF—1BZ |
| 2RK—2EL | 2EL—2RK—2DM |
| 3EN—3GO—3YK | 3GO—3XM—3EN |
| 4XC—4CK—4BY | 4YA—4CK—4DT |
| 5YH—5ZS—5ER | 5XA—5YH—5DA |
| 8SP—8ZL—8YN | 8SP—8ZR—8YN |
| 9ZJ—9UK—9UH | 9MC—9UK—9YC |

4XC, Atlanta

| Steadiest | Loudest |
|--------------|--------------|
| 1AW—1XM | 1AW—1XM |
| 2RK—2EL—2SZ | 2EL—2RK—2SZ |
| 3GO—3HJ—3XF | 3DH—3GO—3HJ |
| 4FD—4GN—4BY | 4BY—4FD—4GN |
| 5ZL—5ZAB—5YH | 5ZAB—5YL—5DA |
| 8SP—8ARS—8ID | 8ARS—8ID—8SP |
| 9ZJ—9LQ—9UH | 9MC—9ZJ—9LQ |

4DT, La Grange, Ga.

| Steadiest | Loudest |
|-------------|-------------|
| 3VV | 3VV |
| 4GN—4FD—4AM | 4GN—4FD—4AM |
| 5YH—5DA | 5DA—5IB |
| 8SP—8CF | 8SP |
| 9AKC—9ME | 9AKC—9UU |

SHL, Oklahoma City, Okla.

| Steadiest | Loudest |
|--------------|--------------|
| 4XC—4YA—4AU | 4YA—4XC—4AU |
| 5ZK—5ZU—5ZAA | 5ZAA—5ZK—5ZU |
| 6ZZ | 6ZZ |
| 8ZY—8YQ—8ZN | 8YQ—8ZY—8ZN |
| 9QO—9AP—9MC | 9OE—9AEG—9QO |

5XA, Auburn, Ala.

| Steadiest | Loudest |
|-------------|-------------|
| None | 2EL—2ZM |
| 3GO—3HG | 3GO—3HG—3ND |
| 4GN—4FD—4YA | 4BY—4GL—4YA |
| 5EK—5FA—5YH | 5FA—5YH—5IB |
| 8VS—8OI—8BO | 8BO—8ZR—8ZA |
| 9OE—9ZB—9MC | 9MC—9YC—9FU |

(Concluded on page 62)

Who's Who in AMATEUR WIRELESS



MR. O. PSHAW

needs no introduction to our readers. He is a member of every radio club and operates many stations—when he can stay awake.

At club meetings he sits in the back row, says nothing, looks unhappy, and leaves without mixing with the gang. He always votes "aye" unless it is a rising vote which takes too much effort.

Mr. Pshaw will get his rotary gap finished about a week from some Sunday. In the meantime he uses a fixed gap. He will borrow the club's wave meter and ammeter to tune up when he gets the gap done but for the present gets along with any old antenna current.

Mr. Pshaw prefers to be called on full power as there is something wrong with his tuner. He has been wanting to repair

MR. JAY WATTBURNER

is familiar to all of us because of his theory of radio transmission. Mr. Wattburner discards clear tone, sharp tuning and clean sending as pure bunk, stating that the ether has a limited capacity, hence if signals are fed into it long enough some of them will finally drip out at 9ZN.

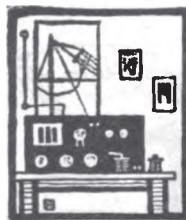
For years Mr. Wattburner's organization, the National Union of Tireless Senders, has attempted to saturate the ether in this way.

Their tests are disguised as calls for an imaginary station named "CQ." At present the N.U.T.S. have no station call, each man using his own call.

Why not assign them "ADF" and make each man use it?

it but doesn't seem to get the time.

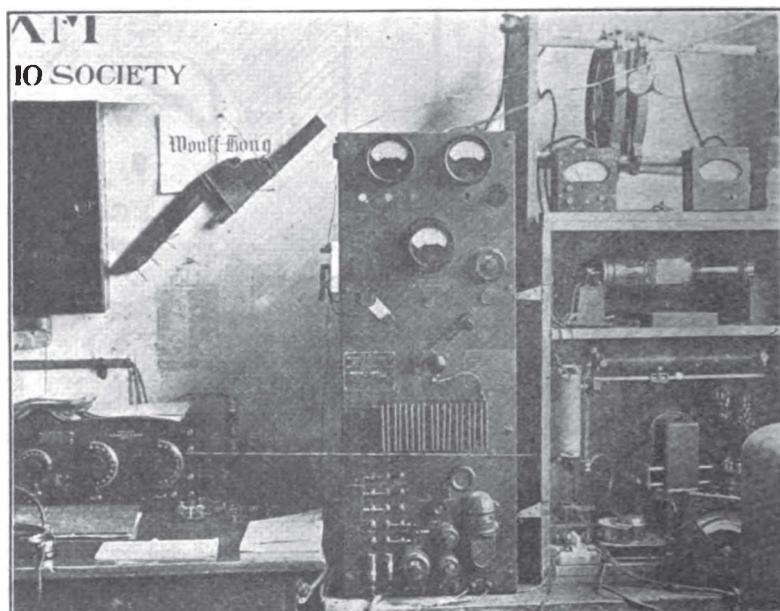
Some day someone will kill Mr. Pshaw, assuming that it is possible to kill a dead one.



Amateur Radio Stations



1XM, Cambridge, Mass.



Since 1XM, the station of the Massachusetts Institute of Technology Radio Society, Cambridge, Mass., is now being heard in six districts, some description of the station and the development work now going on may be of interest to fellow members of the A.R.R.L.

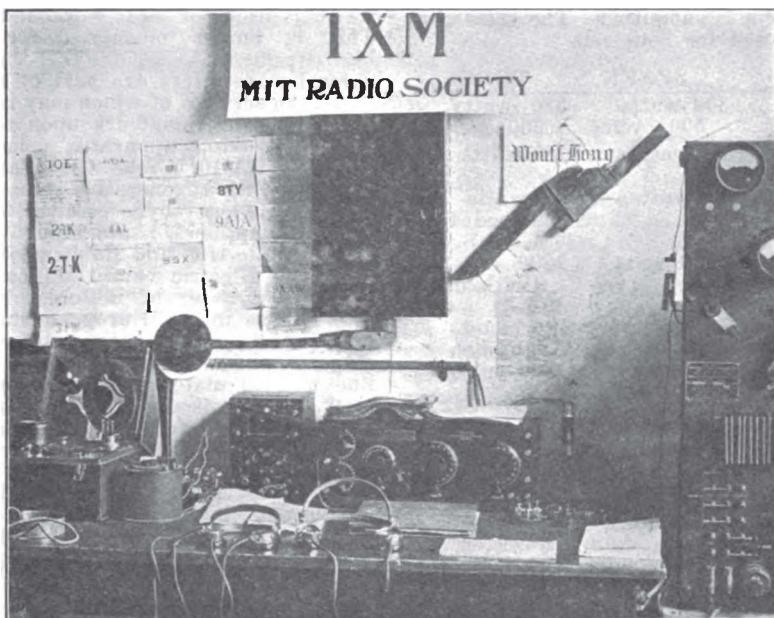
The M. I. T. Radio Society was started in 1913 in the old Tech buildings in Boston, with the call 1LC. Since the war the Society was reorganized, affiliated with the A.R.R.L., and a new station equipped in a location on Technology's Cambridge site, handy to the Institute's power house, the aerial being anchored to the top of the 200 foot chimney. The Society now has 175 members, fifty of them commercial operators who stand watches at the station with amateur operators as assistants. Men prominent in the radio field have been secured to speak at the monthly meetings and a banquet is held each year with invitations extended to all the radio amateurs in New England. The present officers

are: Henry R. Kurth of Combridge, Mass., president; Carole A. Clarke of New City, vice-president, in charge of station; Fullerton D. Webster of Everett, Mass., secretary; Alfred E. Shaw of Parkston, S. D., treasurer; Edmond Bruce of Washington, D. C., chairman, station committee. According to an agreement with Technology's department of Electrical Engineering, the M. I. T. Radio Society is now a part of that department's division of research. The arrangement is such that the undergraduates still retain complete control of the station, which is to be kept in operating condition for the courses in radio communication and engineering, while the department acts in an advisory capacity.

1XM's antenna system consists of an aerial rising at a 45 degree angle with the horizontal, and a counterpoise so designed as to place the anti-node directly in the transmitter inductances. The counterpoise is placed 25 feet above the earth to minimize the ground losses resulting from a

fairly conductive soil. The dimensions are as follows: length of aerial from transmitter, 105 feet, consisting of 4 wires spaced $2\frac{1}{2}$ feet; counterpoise, 6 wires spaced $6\frac{1}{2}$ feet. The leads are brought through panels of insulating material fastened in the window, and on which the

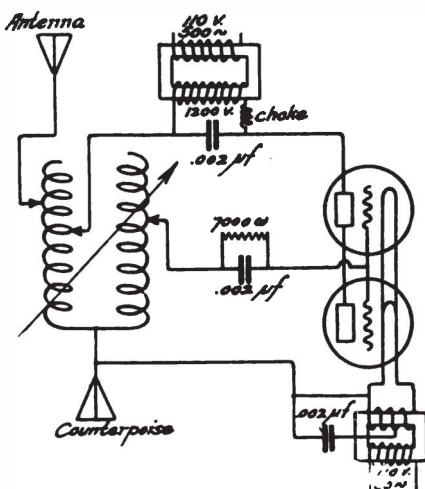
put to the tubes is 380 watts. Due to the limitations of the present 500 cycle generator it is necessary to run them far under their rated capacity. All three condensers are .002 mfd. capacity. A 7000 ohm grid leak is used with best success. A specially built Acme 500 cycle transformer furnishes



lightning switches are mounted. A system of antenna and counterpoise bus bars has been erected around the station so any of the sets may be connected by merely snapping test clips on the busses. Similarly a copper strip ground bus, used for receiving, runs under the operating tables. For "A" battery connections a distribution system is used so that the batteries may be kept near the motor generator and charging panel. Battery connections are made to a distributing panel from which numbered lines run to Fahnestock clips placed at convenient spots on the operating tables. The battery equipment consists of four 4-volt and two 10-volt Edison cells, and three 6-volt lead cells. Other power for operating is obtained from a 110/220 volt direct current line, a 220 volt 3 phase, and 110 volt single phase, 60 cycle a.c. mains, 110 volt D. C. motor generator supply, and a 500 cycle motor generator.

The circuit of the newest C.W. transmitter, now in use for DX work, is given herewith. 1200 volts, 500 cycles, is used on the plates of 2 Type F 250-watt General Electric Pliotrons, with a plate current of 0.25 amperes. The filaments draw 3.6 amperes each from a 60 cycle 30 volt filament lighting transformer. The total in-

the plate voltage. Signalling is accomplished by breaking the transformer input. The inductances are two pancake coils, each one foot in diameter, wound with $\frac{1}{2}$ " copper ribbon, and have 19 turns each. Thirteen turns are used in the antenna



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circuit, eight for the plate, and ten for the grid circuit, with two inches between the coils. All adjustments are extremely critical.

A comparison of the performance of the C.W. and the Wireless Specialty 200-watt 500-cycle quenched spark set operating under identical conditions on the same antenna system is submitted. The same generator is used for both sets.

| | SPARK | TUBES |
|---------------------------|--------------------------|---------------------------------------|
| Input | 300 watts, 500 cycles | 380 watts, 500 cycles |
| Output in Antenna | 93 watts | 186 watts |
| Transf. Core Loss | 21 watts | 78 watts (de- signed for 1 kw.) |
| Transf. Voltage | 8000 volts | 1200 volts (with drop) |
| Efficiency | 31% | 49% |
| Wave Length | 199 meters | 210 meters |
| Decrement | 0.09 | Negligible |
| Consistent Night Range | 250 miles | 1800 miles |

The constants of the antenna and counterpoise are as follows: capacity, 0.00054 mfd., total resistance, 10.5 ohms; natural period, 140 meters.

The contrast between the two sets is very marked in this data. However, the spark set is doing splendid work and oper-

ating very efficiently considering the input power.

In addition to the two transmitters just compared, the Society has a 1 kw. 60-cycle 3-phase Amrad quenched spark transmitter, giving the equivalent of a 180 cycle note; also a Signal Corps SCR-67 box type radiotelephone receiver and transmitter which is used for local work and concerts. This is buzzer modulated for handling local traffic. A Kolster decremeter and several wavemeters are part of the equipment, the services of which may be obtained by neighboring amateurs upon request.

The receiving apparatus consists of a Paragon RA-10, Grebe CR-2, and Clapp-Eastham ZRF regenerative receivers, Armstrong auto-heterodyne receiver, three two-stage amplifiers, numerous Brandes, Western Electric, and Baldwin phones, and Western Electric and Magnavox loud speakers. A set of deForest honeycomb coils brings in the European stations and a deForest jeweler's time set with two-stage amplifier is connected to a telephone line and regulates the Institute's master clock. A loop is used for direction finding.

1XM is open for traffic regularly from 9 p.m. to 6 a.m. Tuesday, Thursday, and Saturday. On other nights a watch is usually kept from 8 p.m. to midnight. A first grade commercial operator is in charge at all times. The division of time as

(Concluded on page 61)

5XA, Auburn, Ala.

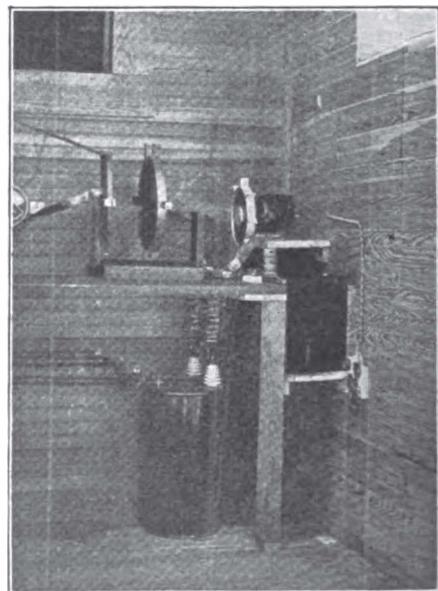
The noise-maker of the south, Alabama Polytechnic Institute, Auburn, Ala., is here portrayed.

5XA has a peach of a mast, 140 ft. high, of steel pipe, and two aerials, one a 4-wire stretching away for 550 ft. to a 120-ft. tank, and the other a 7-wire nearly vertical one, 130 ft. long, on which the short-wave work is done.

The receiving equipment consists of a Radio Apparatus Co. long wave set and a home-made regenerative for short-wave work, on which about everything is heard from 1AW to 5ZA. An SCR-55, used as an amplifier, can be thrown onto either receiving set. VT-1's are used thruout.

A college-made power panel is at the right-hand end of the operating bench, and to the right of it the transmitter is located. This consists of a 2 KW Packard transformer, Dubilier special condenser, Hyrad disc revolving 3600 r.p.m., and a pancake O.T. Since this photo was taken a new O.T. using 2-inch ribbon and mounted on hinges on the wall has replaced the one shown, incidentally shortening the closed-circuit leads also.

(Concluded on page 62)



Strays

Anouncement has been received of the marriage of Miss Mildred Josephine Finn to Mr. Ralph Howard Groves Mathews, 9ZN, A.R.R.L. Central Division Manager, on April 23d in Chicago. Our phone diagrams barely stood up under this news, but we are sure the whole amateur world joins with us in hearty expression of good wishes for a long and happy wedded life to Matty and his little lady.

1HAA is no more. Vermilya is now 1ZE, using 200, 250 and 375 meters.

Wouldn't it be wonderful if Kruse owned a lunchroom?

We print the following from the May issue of "Radio News", excerpted from a story by "G. Ridleak":

"...A friend of mine who also gives a weekly wireless concert confines himself to organ recitals. He plays these on a thing which believe is called the "QRT". This instrument, or whatever it is, is said to be the official organ of the Awful Racket Raisers League. From what I've seen, it sure takes a lot of wind to run an organ."

We wish we might also print the letters we have received from indignant A.R.R.L. men. But it really wouldn't do. We leave it to the amateurs of the country to form their own judgment.

In that "\$100 C.W. set", and others as well, it is advisable to use a separate transformer for heating the filaments. Then the filament voltage can be controlled by a rheo in the primary of the filament transformer if desirable and, as a big improvement, the key can be placed in the 110 v. circuit of the plate transformer.

Henry Klaus, 9AK, had a little accident recently, burning out all the tubes in his radiophone. Guess how many? Well, Henry figures that if it had been only four tubes or so it wouldn't have been half bad. The horrid truth seems to have been that there were thirteen of 'em in parallel and they simultaneously exhibited Dr. Goldsmith's "discouraging decisiveness" and went up the flue together! Oh mamma!

Paragraph 86, page 58 of the 1919 edition of the radio laws has been re-

pealed as of July 1. This was the paragraph that formerly gave authority to operate a station while awaiting receipt of a license.

The Somerville Radio Laboratory have added to their line of meters a model JX, 0-15 volt A.C. voltmeter, especially intended for the filaments of power tubes heated by A.C. The desirability of using voltmeter vs. ammeter is recognized but there have been no small scale A.C. voltmeters heretofore. The JX should completely fill this need.

9YA has a calibrated receiving set and will be glad to advise the correct wave length of anyone with whom they work.

The formation of a radio fraternity is announced at Coe College, Cedar Rapids, Iowa, with a chapter at Iowa City also. It is known as Alpha Delta Alpha. Information can be obtained from Paul A. Young, Radio Engineering Dept., Coe College.

On the night of April 19 last the C.W. signals of 8LF, W. K. Thomas, 17 Emerson Ave., Crafton, Pa., were copied by Jack Stevens, 6AOY, Avalon, Calif. Mr. Stevens reports the signals "normally loud—about the same as XF1 and 8XK". 8LF was using four Radiotron U.V.202's, putting 2.4 amps. in an antenna of about 8 ohms resistance, equivalent to an output of about 46 watts. Both participants in this C.W. record are to be congratulated.

On the night of May 14th when auroral disturbances had wire service completely tied up, 1AW undertook to get the Associated Press service from New York for "The Hartford Courant". It was realized that no station outside daylight range was likely to be heard and 1AW simply sat thru a long blank period until finally 2EL was heard. 2EL is Mr. H. H. Carman of Freeport, L. I., one of our best stations. 1AW succeeded in raising him and explained what was wanted and 2EL, after first being told by the New York officers of the A.P. that the wires were O.K., finally secured the news from them by telephone and passed it on to 1AW, where it was rushed to the newspaper office. Thus was

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another good job put over for Citizen Wireless and Mr. Carman has our thanks and congratulations on his persistency and success.

A decision of far-reaching importance has just been rendered by Judge J. M. Mayer in the United States District Court in a suit brought by Edwin H. Armstrong and the Westinghouse company against the deForest company. The suit was brought for alleged infringement of the well-known Armstrong circuit patents and the judge's decision broadly sustains the patent and holds it to have been infringed.

The Armstrong patents in question are the so-called "feedback" patents, covering almost any method by which part of the plate circuit energy may be returned to the grid circuit to reinforce the action, and apply to regenerative or oscillating receivers or tube transmitters, whether capacitive or inductive feedback. Mr. Armstrong, and the Westinghouse company by virtue of rights acquired from him, therefore are recognized as having the sole right to the use of the oscillating circuits employed today.

In his decision Judge Mayer paid great tribute to the imagination, clearness and accuracy of thought, perseverance and extraordinary ability of the inventor, incidentally dubbing him "Feedback Armstrong."

In the "Wouldn't it be wonderful—" column of this section in May QST a disparaging reference was made to the ability of the operator at WHE. There is but one operator at WHE, Mr. J. W. Harte, and we have convinced ourselves that he is a very good operator, rather than a poor one. Whereby, of course, a big injustice was done Mr. Harte and we take this means of offering our humble apologies.

On the value of radio frequency amplification: "The effect of amplification of the radio frequency currents is proportional to the square, while amplification of the audio frequency current gives an effect proportional to the first power. If a weak signal is amplified 20 times before it is applied to the detector tube the resulting audibility will be as great as would be obtained by applying the signal to the detector tube directly without amplification and then amplifying it 400 times.—"The Log" (Third Naval District).

No, Oswald, the airplanes don't drag a wire on the ground to make their earth connection—they use a counterpoise.

The Bite of the Wireless Bug

By Peter Deets

The wireless bug of which you've read

has bitten me, that's clear; no serum treatment yet devised can help me now I fear. At first I had a simple set, loose coupler and receivers, detector of galena stone, take note you unbelievers. It worked and each and every night, (the effect of the bug increasing), I'd try to understand the code. My efforts were unceasing.

Now and then I'd catch an "o", and "i's" I got with ease. The signals weren't so very good, just loud enough to tease. In order to increase them, I got a two stage set. The code and music now are great, it beats a "Vic" you bet.

Oh! when I think of all the time I've spent in crystal gazing, in search of useful spots thereon, in truth it is amazing; and some day in the years to come when I have learned the code and when I get my license I'll write another ode, and tell you all about the joys, as would old Epictetus, of how it feels to have a case of genuine "Wireless-itis."

They tell us there are a flock of operators on the U.S.S. Tennessee who believe it utterly impossible that amateurs with their limited power could be able to handle the Transcons as we know we did. In fact, it is intimated that the gentlemen believe our story is pure fiction. It would be if we had as much trouble making our sets reach out as the Tennessee does in trying to cover 200 miles with her 10 KW.

XG1 is the U.S. Army Balloon School at Lee Hall, Va., about 20 miles from Newport News. The CW set is an SCR-67, and the spark set an SCR-73.

From the LaCrosse, Wisc., Tribune:

"Citizen's Comfort Considered"

"Wireless Amateurs of England and America will endeavor to get in communication with each other on February first. The operations of the American amateurs are handicapped by Government restrictions. In order that the operation shall be conducted with as little annoyance to the outsiders as possible, a new garage has a sound proof room in which the horns are to be tested."

What the hexx!

David Sarnoff, commercial manager of the Radio Corporation of America since its organization, and for fifteen years connected with the Marconi interests, has been appointed general manager of the corporation; and E. P. Edwards, for a number of years assistant manager of the Lighting Division of the General Electric Co., has been appointed in charge of engineering, manufacturing and sales.

Our idea of nothing to do: Listening to somebody's radiophone concert.



THE A.R.R.L. has the pleasure of announcing the ratification of affiliation of the following additional societies, as of June 4, 1921:

Maryland Radio Assn., Baltimore, Md.
Southern Ontario Radio Assn., Windsor, Ont.

Wireless Assn. of Pennsylvania, Philadelphia, Pa.
Staunton Radio Club, Staunton, Ill.

Wireless Assn. of Ontario, Toronto, Ont.
Hill City Radio Club of the Summit Y.M.C.A., Summit, N. J.

Stoneham Radio Assn., Stoneham, Mass.
Premier Radio Club, Grantwood, N. J.

Manhattan Assn. of Radio Scouts, New York City

Radio Research Assn., New York City
Waco Hertzian Society, Waco, Tex.

Community Radio Club, White Plains, N. Y.
The Radio Assn. of Salem, Salem, Ore.

Collegeville Radio Club, Collegeville, Pa.
University of California Radio Club, Berkeley, Calif.

Radio Club of the Bronx, Bronx, N. Y. C.
Napa Amateur Radio Club, Napa, Calif.

Peninsula Radio Club of San Mateo, San Mateo, Calif.

The Mt. Sterling Radio Assn., Mt. Sterling, Ill.

Laconia Radio Club, Laconia, N. H.
Peoria Radio Club, Peoria, Ill.

The North Shore Radio Club, Chicago, Ill.
Triangle Radio Society, Rochester, N. Y.

Yonkers Radio Club, Yonkers, N. Y.
Radio Club of the Y.M.C.A. of the Oranges, Orange, N. J.

Tech Radio Club, Oakland, Calif.
The Maplewood High School Radio Club, Maplewood, Mo.

Y.M.C.A. Radio Club of Rome, Rome, N. Y.

Fordham Radio Club, Bronx, N. Y. C.
Ottawa Amateur Radio Assn., Ottawa, Ont.

Rubber City Radio Club, Akron, Ohio
Ft. Worth Radio Club, Ft. Worth, Tex.

Northwestern Indiana Radio Assn., Hammond, Ind.
Westfield Radio Assn., Westfield, Mass.

Brockton District Radio Club, Brockton, Mass.
Mystic Valley Radio Club, Malden, Mass.

The Ypsilanti Radio Assn., Ypsilanti, Mich.
The Limited Radio Assn., Chicago, Ill.

Radio Club of the Carnegie Inst. of Technology, Pittsburgh, Pa.

St. Paul Central High School Radio Club,
St. Paul, Minn.
University of Virginia Radio Club,

University, Va.
The Conneaut Radio Club, Conneaut, Ohio
Scenic Highway Radio Club, Clinton, Iowa
Fall River Amateur Radio Club,

Fall River, Mass.
Regina Amateur Radio Assn., Regina, Sask.

National Convention

At the First National A.R.R.L. Convention at Chicago Aug. 30—Sept. 3 important discussions of co-operative measures, club organization and activities, community work, etc., are scheduled. These will be of high interest to all forward-looking clubs and we suggest that as many societies as possible arrange to have at least one member attend the convention to partake in the discussions and secure ideas that will undoubtedly be worthy of local application. In other words, everything that clubs are interested in is going to be up for discussion at these meetings and it's going to be worth while to have a representative there to soak up ideas and report, if nothing else.

Here's Co-operation

The radio clubs at Washington, Baltimore and Hagerstown are having a series of get together—get acquainted meetings that already have eliminated all petty local differences and have done much to cement that locality into a smooth-working unit.

The first meeting was held at Washington on April 22d under the auspices of the Washington Radio Club, Mr. S. Kruse presiding in the absence of Mr. H. H. Lyon, president. About 125 were present.

A remarkably simple radio recorder was exhibited by Dr. E. A. Eckhardt, of the Sound Section of the Bureau of Standards. Using but two VT-1 (Western Electric J) tubes and an average amateur antenna this device recorded on paper, perfectly, the signals of YN, WII, and WSO through medium static.

Several men from each of the three cities told of the operating conditions and schedules followed in their own localities and how the stations in the other cities were heard. A great deal of very interesting information regarding the possibilities

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of regular relay routes between Baltimore, Hagerstown and Washington, which heretofore have not been in regular communication, was obtained.

After the formal meeting dinner was served at the Canton next door. Everyone ate all they could and enjoyed greatly talks by L. C. Young of NSF; S. Kruse of WWV; E. B. Duvall, A.R.R.L. A.D.M., of Baltimore; S. W. Piper, vice-president, and E. A. Green, secretary, of the Hagerstown club and several other prominent amateurs. The meeting was a great success.

The Washington and Hagerstown radio

happy mood snappy music was rendered by an Hawaiian orchestra which, to put it lightly, did do things up brown.

This meeting was one big success and accomplished this if nothing else: a friendly feeling and the assurance of co-operation by everyone present.

The third meeting of the series will be held soon.

The Radio Club of the Bronx

The Radio Club of the Bronx was organized in 1920. For a few months it struggled along on its charter membership



Washington—Baltimore—Hagerstown Meeting, May 17.

clubs, and representatives from clubs in Martinsburg, W. Va., and Waynesboro, Pa., were guests at a co-operative meeting and banquet given by the Maryland Radio Association, of Baltimore, at the Caswell Hotel at that city on May 17th.

The Baltimore meeting proved to be one of the most lively affairs held in the Third District since the Convention in Philadelphia last February. Addresses were made by Mr. L. C. Young of NSF, Mr. Henry Lyon, president of the Washington Radio Club, Mr. S. Kruse of the Bureau, R. E. Linthicum, V.P. of the Washington club, E. B. Duvall of the "Radio Condenser" staff, and E. R. Bateman, president of the local club.

The business of this meeting was devoted to suggestions for the arrangement of DX schedules for the summer months between these cities, both for daylight and evening working. At the close of the business meeting a banquet was served for the eighty-five present, and to keep the diners in a

unable to grow because of the lack of facilities. After merging with the R.R.C. to form one strong organization, we incidentally acquired a large meeting room and an operating room in the Bronx Y.M.H.A.

At present we can accommodate a much larger membership. To those who wish to join we extend every advantage associated with a strong and growing radio club. We cordially invite visitors and promise a pleasant and enjoyable evening to those interested enough to attend any of our meetings.

The club set at present is undergoing repairs but we hope in the near future to institute an operating schedule and become a link in the great chain of relay work that is being done in the Bronx.

The newly elected officers of the club are Sam Ellner, pres.; Nat Sauberman, secretary; and Michael Levine, treasurer. Kindly address all communications to the secretary—789 East 168rd St., Bronx, N.Y.C.

Radio Communications by the Amateurs

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



C.W. QRM

2637 Garfield St., N.W.,
Washington, D. C.

Editor, QST—

It has been brought home of late to those of us in the operating game that CW transmission has possibilities for creating interference that we had not anticipated. It is true that straight CW is very sharply tuned and that a comparatively large number of CW sets may be operated in close proximity without interference if the proper receiving apparatus is used. There are several variations from this ideal condition when CW is put into operation. In the first place, very few of us transmit CW. We modulate intentionally with buzzer, voice, or by an alternating plate power source, or unintentionally by commutator hums or electrolytic rectifier noises. All of these things, especially voice modulation broaden the wave and cause it to depart rather widely from the ideal sharp tuning. Some of this interference can be avoided by carefully filtering out commutator noises and using pure CW in place of commutator or otherwise modulated CW. The telephone is inherently broad tuning, and for that reason, to me an obnoxious perversion of the CW set.

There is another type of interference which is due to oscillating receiving sets which are used in CW work. Each of these sets, if operated autodyne, is a moderately good transmitter capable of creating considerable local interference, especially when several operators are listening to the same sending station and hence are radiating unintentionally on about the same wave length. We have found it quite possible to send for a mile or so by using the receiving set as a CW transmitter. It follows that we can create considerable interference over at least the same range. This nuisance has already become a practical operating difficulty in Washington and if the much announced conversion of amateurs' transmitters to CW should become a fact, we are likely to be operating under difficulties that will make our late spark interference seem tame by comparison.

Will not someone suggest a type of receiving set which when used for CW reception will not radiate and yet can be handled with sufficient ease so that a CW set may be followed through its wave

length variations? The same operating difficulty has led to the use of the separate heterodyne in Europe. It would seem most unfortunate that we should complicate our sets in a similar manner.

Sincerely,
S. Kruse.

RECEIVER CIRCUIT DESIGN

104 West 49th St.,
New York City.

Editor, QST—

Have read with interest Mr. Hatry's letter on page 58 of the May QST in which he presents a simpler regenerative circuit than any of those given by the writer in the March QST.

For about nine months, just after the ban was lifted, the writer experimented with nothing other than single-tuned receivers, and tried about every circuit that came to hand that looked anywhere near feasible, and some that could well be used as monuments to the deviser's imagination. Over twelve receivers were actually assembled and built employing some different form of tuning or regeneration, while there is no complete record of number or circuits that were tried. However, after getting one out of the lot that seemed the best, it was given a careful test against a loose-coupled variometer set, with discouraging results.

Mr. Hatry's circuit was tried among others, and despite a trial of different inductances, condensers, etc., it was found that to cover the range Mr. Hatry attributes to it, all four adjustments had to be carefully juggled, while to work from about 180 to 300 meters, the antenna inductance had to be varied, as well as the capacities, while the plate inductance was left at a fixed value. This left three adjustments, and when compared with the three in Figs. 1 or 2, as given by the writer, the single-tuned set showed a woeful lack of selectivity, and was extremely critical in adjustment for phone reception.

The antenna used in this test was a very short single-wire of low capacity, and it was noticed that good selectivity was only obtained, as Mr. Hatry states, when the antenna series condenser was set at very low values, in the writer's case from about 50 mmf. to 250 mmf.

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However, for constructional cost, Mr. Harty's set has it all over the writer's, and works very well where there is less QRM than in and around New York.

A very good single tuned set may be constructed with only one condenser, using the tickler circuit. In this case the condenser is used in the ground lead, regeneration being obtained by a tapped tickler tightly coupled to the antenna inductance. The antenna inductance should be tapped every ten turns, and the tickler every three after about 20 turns, with enough wire used to cover the desired range of wave lengths. This set has the advantage of no moving coils, and only one condenser, and operates very nicely, even on phones.

Capacity tuning of the plate circuit is not entirely satisfactory for several reasons; one of which is that the condenser alone does not always permit a zero regeneration adjustment. Take for instance a case where for a given station a large inductance is used in the plate circuit, with a correspondingly small shunt capacity. If we then try to shift to a weaker station on approximately the same wave, the condenser, even at zero, may not be low enough for best regeneration. This means that the inductance must be reduced, the condenser reset, and the antenna condenser probably reset, and yet if we try to shift the regeneration by the shunt condenser alone, it is probable that good results will not be obtained. However, this trouble is not confined to single-tuned sets alone, and should be considered when designing any type of tuned plate set.

The writer hopes Mr. Harty will not be offended by this comment, as he probably realizes the faults of single-tuned sets as well as anyone else, and knows that they cannot be compared to sets designed as carefully, only with inductive coupling.

With best regards, I am,
Yours very truly,
McMurdo Silver.

UNRELIABLE STATIONS

Marion, Mass.

Editor, QST—

Just a word about "Spasmodic hams". We have them all around me. For instance, where are all the hams and official relay stations in Fall River and Rhode Island the last many weeks? Also Martha's Vineyard, and several other nearby places?

I have messages on hand for all these birds. In their succession, they will come on the job every night for two or three weeks, when there is nothing on the hook for them, causing all kinds of careful tuning to work around them. Then when messages arrive, they are off the job for a month at a clip and the messages must be mailed.

This is no fading or poor radio weather

for they are all well within range when on the job. No monthly reports have ever been received from any relay station as long as I have been D.S. for So. Mass., and what I turn in is gathered by observation only.

How come such stations exist at this late day of advanced Citizen Radio? What are we going to do about it? Shall we consider them dead and never forward them a message whether they are on or not, or shall we just forget it and put them down on our list as "inactive spasmodic radio stations" with which radio communicaton is unreliable?

Very truly yours,
1ZE.

GOOD WORK ON CRYSTALS

1619 Grand Ave.,
Connersville, Ind.

Editor, QST—

I write to tell you about a crystal detector set which has done very good work in recent months.

The set was installed in February and consists of a balanced type galena detector, five hand-wound honeycomb coils, a shunt and a series variable condenser, two pairs of phones, and a fixed condenser. The aerial is a single wire 125 ft. long, 35 ft. average height, within a few feet of the branches of four trees. The ground is three water pipes connected together and then joined to the set by a wire 30 ft. long. The set was intended to receive time signals but amateurs and commercials were also heard. For amateurs, two single-layer H.C. coils in series with the series condenser were used, while a 12-layer coil and shunt condenser were used for Arlington. After a little practice in adjusting the detector very good signals were received and as we became more skilled our range rapidly extended until we heard NAB, NAE, NAR, NAS, NAT, WNU, NGL, WLC and others. Of the amateurs we have heard from the 1st, 3d, 4th, 5th, 8th and 9th districts, including 1XM, 3DH, 3YE, 4AL, 4XC, 5MF, 5BM, 5HL, 5HV, 5HY, 5IB, 5YH, 5JD, 5ZD, 5ZL, 5ZX, 5ZU, 8WC, 8ZW, 9ABU, 9AEG, 9GW, 9YI, 9YB, 9LO, and 9ZC.

Some freaks have been experienced, the most notable being the reception of signals from 9ABU, Carrington, N. D. He was heard sending CQ's and a letter to him brought the reply that he was sending at the time heard but using only 60 watts on a Ford coil and about $\frac{1}{4}$ amp. in the aerial. But freaks are exceptional, as stations like 5HL, 5YH and 9AEG have been heard clearly nearly every night.

From this it is obvious that exceedingly good work can be done on a crystal. The only essentials are fairly good crystals,

patience in adjustment, and careful listening.

I would be glad to hear from other amateurs who are doing good work with this kind of a detector.

Yours truly,
Carl W. Gartlein, 9DQD.

LOSSES IN "A.C." C.W.

Mass. Inst. of Tech.,
Cambridge, Mass.

Editor, QST—

The popular tendency of late in A.C. vacuum tube transmitters is to avoid the usual rectifiers by the use of the so-called self-rectification systems of using a separate oscillator for each half cycle.

I have taken careful measurements of the characteristics of this system and am disappointed in the large losses occurring in the tube not in immediate operation.

I would like to point out the following concerning the transformers utilizing the secondary centre tap for connection to the filament junction and grid bias:

At a given instant, the centre tap is negative in respect to one outer terminal. At the same instant it is positive in respect to the opposite outer terminal. It necessarily follows that this centre tap is neutral in respect to both terminals. This means that the tube note developing oscillating energy has a negative charge on the plate and a POSITIVE grid charge. This results in surprisingly large losses of oscillating energy by passage of current from this grid to the filament. Fortunately, the phase relation is so disturbed that the transformer input decreases and the losses are not as great as one would at first suppose. Nevertheless, the input-output ratio of such a system has discouraged its use at the station of the M.I.T. Radio Society.

Our available time for experiment is extremely limited and I would appreciate together, I am sure, with many other experimenters any information on this topic published in the pages of QST.

Sincerely,
Edmond Bruce.

OUTTA SPIRITS

Richmond, Virginia,

Dear Eddy:—

Say, OM, where do they get that stuff Ouija is all wrong? I owe my life to that bird for several reasons which I am going to set forth in this horrible example of narration.

To begin with, my spark had never been heard outside of the city limits, even though it was a full grown 1 KW with a radiation of 1.4 amps. using the best ground I could get. Hooked myself onto the city

water mains, buried wires, strip, etc. I could not make a soul hear me even though I used up about \$17.43 worth of juice per month and the Power Co. sent up to test my meter voluntarily for "high bill". Well I had almost given up in despair, cussed those birds who said they sent thousands of miles on 1KW, laffed loudly at those who said they got 8 amps on 1 KW, etc., as the greatest flicker I could get was 1.4 on a big meter.

I dropped around to a girl's house one night recently and the gang were there playing Ouija Board. Now, I am very very skeptical regarding talking with spirits, especially this time of the year as my stock is about all out now. But they harangued me to ask the thing a question, swearing it would answer. So as radio was prominent in my mind and the girls operating the thing didn't know anything about radio, I thought here is a chance to QRT Ouija in our locality. So I asked it would a ground or counterpoise aid me in furthering my distance. It answered 'counterpoise'. So I began to sit up and take notice. Then I fired another, asking how long, and it told me and after a fifteen minute session with it, it had given me complete description of the counterpoise, how to insulate it, how far off ground to put it, the number of wires, etc. Then I asked what radiation should I look for and it said five amperes. Then I asked it to give me the call letters of several friends and it just naturally faded the Government call book out entirely. So I say this Ouija bird must be T.O.M. himself. After getting all the dope I went home and slept on it. The more I thought abt it the more convincing his argument was, and I didn't have my hands on the board at all. Just a couple Janes working it.

The next day was Saturday and as I took a half-day off I bought the stuff for the counterpoise and went home and put it up. After getting it up and disconnecting the ground, I pressed the key and the hot-wire meter took a healthy flicker and went over to about 5 and I took my hat off then. The gang in town reported me very much more QSA and I went home and ate supper and the first night I listened in after I put the counterpoise up I worked 3BZ, a distance of 150 miles, who reported me QSA. This was the first time I had ever worked out of town on the set and the "Combination" was found. Have since received several letters and cards reporting my spark QSA in nearby cities and I hope to get further by adding more wires to the counterpoise. Now don't think I am in the same class with the fellow who reports he was arrested for being crazy—talking in a radiophone and the neighbors sent a cop over because he mumbled to himself (seemingly) all the nite.

July, 1921

If I am heard any more it's due to that confounded Ouija and let me say a word right here in its behalf.

"IF YOU WANT DISTANCE AND ADVICE, GET A OUIJA BOARD".

It has Dr. Radio, Zenneck, T.O.M., M. B. West and all the other dopesters beat a mile; although I am firm believer in all of the above, I am for the Ouija without exceptions. I accept the nomination.

Now you can either believe that or not but T.O.M. has good food for thought in one of his "rotten" arguments by naming it "Rotten Ouija Dope."

Got to go now, spilled enough for this time. Take it or leave it, the counterpoise is there to stay. If Hertz's spirit told me to stick up the counterpoise, I thank him, for it sure did prove a revelation to me.

CUL and lets hear what the gang has to say abt this.

73's

C. D. Blair, 3ZL.

TRANSMITTING ON VT-1's.

92 East Franbes Ave.,
Columbus, Ohio.

Dear Mr. Warner:

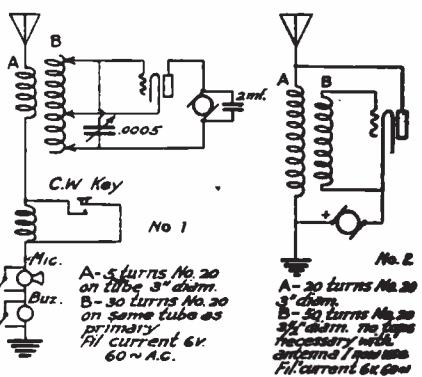
In regard to my low powered C.W. set you recently inquired about. It used only a VT-1 receiving tube that I was fortunate enough to get a hold of and surely proved itself a wonder.

I received letters from Mr. Furrow, 8FT, of Troy, Ohio, and Mr. Endley of Mansfield, Ohio, 8ZR, both saying my CW signals came in fine. Stations up to ten miles reported my buzzer modulated and voice readable at quite a distance from the phones, one station even reported buzzer and voice readable over the entire floor of his house. The distance to Troy and Mansfield is between 60 and 65 miles, the straight CW sigs only being readable there. What seems the most remarkable part of it, is that all the work was accomplished with an antenna only 20 ft. high, a single wire from the back porch to a nearby telephone pole about 60 ft. long. There were numerous large buildings very close which do not help matters any.

I used an old 500 volt motor, which gave about 500 volts when driven as a generator at normal speed, although voltages as high as 600 have been obtained without undue overload. 500 volts is about as high a voltage as the VT1 bulbs will stand without blueing over and excessive heating. When working at exactly 400 volts and with a filament current of 1.2 amp. I got a radiation of 400 milamps. I generally work the voltage at 375 volts as I believe the tube will have a longer life.

I am enclosing two circuits with con-

stants which I have used with equal success with the VT-1. Circuit No. 2 seems to work better with the Marconi bulbs and not require a very critical adjustment of turns, ten turns in the primary does not affect radiation in the least. It seems very queer but is an actual fact. Am able to put about 350 milamps in the aerial with one Marconi bulb. 400 volts on plate.



I used 110 V. AC supply stepped down with a toy transformer to light the filaments.

The above work was all accomplished during the daytime. Have worked with 8FT—62 miles at 1 P.M. and 8ZR heard my sigs at 5 P.M. so you see I must have had quite a little range at night.

Sincerely yours,
Robert C. Higgy, 8IB.

ARTISTIC REPORT POSTCARDS

711 W. 23d St.
Austin, Tex.

Editor, QST—

It is the general practice among amateurs to let others know how their signals are "coming in" and this is often done by means of postal cards.



FIGURE • 1

Some amateurs have cards printed, but this involves too much expense for the average "radio shark".

A very serviceable card stamp may be made by cutting the call letters out of some material such as an old inner tube, and then gluing them to a block of wood. The letters of course must be reversed as in Fig. 1. After the glue has dried all of the letters may be made the same thickness by rubbing the stamp block on a piece of fine sandpaper. An ordinary stamp pad will serve to ink the stamp.

Yours sincerely,
Geo. E. Endress, 5JA.

PAGE MR. GROVES.

Mercer, Pa.,

Editor, QST:

"A Novice" certainly raises an interesting point when he asks in the January QST why we do not hear more from the amateurs on the performance of the honeycomb coils. We are all interested in the fine work Mr. A. L. Groves has done, but we would like to know whether any one else has had his success with these coils. I have read Mr. Groves' articles attentively, and he has been kind enough to write me several letters in an endeavor to get me into the straight and narrow path, but up to date I have not been able even to approximate his performance. While giving Mr. Groves full credit for his wide experience and undoubted skill, I am inclined to think there is something very favorable in his location. There seems to be regions that attract radio waves that have passed over other territory with seeming contempt. Every radio situation is to a great extent a law unto itself. An aerial and an equipment that will give a certain result in one place will not duplicate that result in another in all cases. It looks as if the tuning of honeycomb coils for long distance reception were almost an art by itself; but it is one well worth pursuing, for success in spite of difficulties is a reward worth having.

Mr. Novice's experience has been astonishing. He tells us that his coils perspired profusely and that the water literally dropped from them. Now, I have labored some with these coils, and I can testify that in my case it was the operator that did the sweating. I fear that Mr. Novice's locality is very wet and needs the attention of the prohibition enforcement officers.

But testimony is what is wanted, so I shall proceed to detail my experience with the honeycombs. Aerial 116 feet long and 62 feet high; 6 copper cables spaced 26 inches apart. Last February I got two coils of 1200 turns each and one of 750 turns. These I mounted on a straight rod. I used one audiotron and Holtzer-Cabot

receivers. As to results: I heard the Atlantic coast stations, Mexico City and sometimes San Diego, Calif. Of the stations on the other side I heard POZ many times, YN once and MUU two or three times; all nicely readable. As spring advanced I had frequent engagements with King Static, and was finally routed and driven from the field. This winter I got the coils out again, and purchased a number of others. The latter were mounted on plugs. I also mounted my original three on plugs so all could be used on one of the hinged mountings. Now the strange part of the story is that although I am using the same aerial, the same tube, the same 'phones and the same coils (and more) that I used before, I do not hear any European stations at all. Why is it thus? I do not know.

I have been after the CW stations exclusively and have used the tickler circuit. I have no duplicate coils except the two 1200's. It is with these two, using the 750 for a tickler, that I have had my best results. Perhaps if I had more duplicates, I should have better success. NPL XDA and the Canal Zone are as far as I have penetrated this season. I get NPL by using two 1200's with a 750 as a tickler, and the secondary condenser (.001) set at 54. I can hear WSO almost any way, without primary and aerial connection. But the signals come from the aerial just the same. I can place one hand on the aerial binding post, and, by using the other hand as a primary, get greatly increased signals from WSO. It is probable that a 23-plate condenser in shunt to the secondary would work better than a 43-plate, as it would allow greater freedom of movement in making adjustments.

From the above it will be seen that neither my success nor my activities have been great. I intend, however, to get more ammunition and continue my campaign against Europe, hoping for a set of coils that will enable me to hear the ex-Kaiser groan as he confesses his sins.

S. F. McCartney.

CORRECTION

Thru our error the advertisements of Radio Testing Station in May and June QST quoted their aerial wire "per 100 ft., 58c; per 100 ft., \$5.50." The figure of \$5.50 is the price for 1000 ft.

1XM, CAMBRIDGE, MASS.

(Concluded from page 52)

agreed upon by the Greater Boston Executive Council, on which the Society is represented, will be strictly followed.

During the month of April 1XM handled 171 messages, worked forty stations outside of the first district, and has copied 124 DX stations. 5ZA, 4YA, and 4BY

July, 1921

have been copied and the last mentioned also worked. 2DN, 2BK, and 20W have been easily worked after daylight.

The Society is indebted to the Acme Apparatus Co., Atlantic Radio Co., Radio Equipment Co., Clapp-Eastham, W. J. Murdock Co., General Radio Co., and American Radio and Research Corp., for their co-operation.

Communications should be addressed to the M. I. T. Radio Society, Box 160, Massachusetts Institute of Technology, Cambridge 39, Mass., or telephoned direct to the station.

OPERATING DEPARTMENT (Concluded from page 45)

ful attempts to arrange schedules with Hagerstown stations; they are unable to receive Washington regularly account bad induction. During the recent aurora disturbance, many nights passed without Washington stations hearing any but Baltimore stations. This is phenomenal, as the signals were strong and steady, whereas normally night communication between these cities is almost out of the question.

It is hoped that the good work of the numerous DX men in the District of Columbia will continue thruout the summer, and there is every indication to this effect. The use of straight C.W. is showing itself very effective in maintaining communication under adverse state conditions, the chief difficulty being inability to raise stations other than those with whom schedules are pre-arranged.

Reported messages, 1519.

5XA, AUBURN, ALA.

(Concluded from page 52)

5XA is under the direction of Mr. V. C. McIlvaine, Laboratory Instructor, Box 12, Auburn, to whom correspondence

MAY STATION REPORTS

(Concluded from page 48)

5ZU, Austin, Tex.

| Steadiest | Loudest |
|--------------|--------------|
| 4XC—4GL—4YA | 4XC—4GL |
| 5XB—5YK—5ZA | 5XB—5YK—5ZA |
| 6ZZ | 6ZZ |
| 8ZZ—8SYN—8ZY | 8ZZ—8ZY—8YN |
| 9AEG—9LR—9EL | 9EL—9AEG—9OE |

7DA, Portland, Ore.

| Steadiest | Loudest |
|-------------------|-------------------|
| Can. 5BA—Can. 5CJ | Can. 5BA—Can. 5CJ |
| 6ZU—6AH—6KA | 6ZR—6ZU—6AH |
| 7YA—7BK—7FI | 7YA—7FI—7BK |

7ZM, Moscow, Idaho

| Steadiest | Loudest |
|--------------|---------------|
| None | 5ZA |
| 6ZR—6ZX—6AGF | 6ZR—6AH—5OC |
| 7YA—7CU—7ZJ | 7YA—7YS—7CU |
| 9AGN—9LW | 9AGN—9LW—9AEG |

9YB, Purdue University, Lafayette, Ind.

| Steadiest | Loudest |
|-------------|-------------|
| None | 3KM—3YE—3YA |
| None | 4YA—4AG |
| 5EK—5YH—5DA | 5DA—5YH—5EK |
| 8ZR—8CF—8SP | 8YN—8ZR—8ZW |
| 9LQ—9ZJ—9FS | 9ZJ—9LQ—9OE |

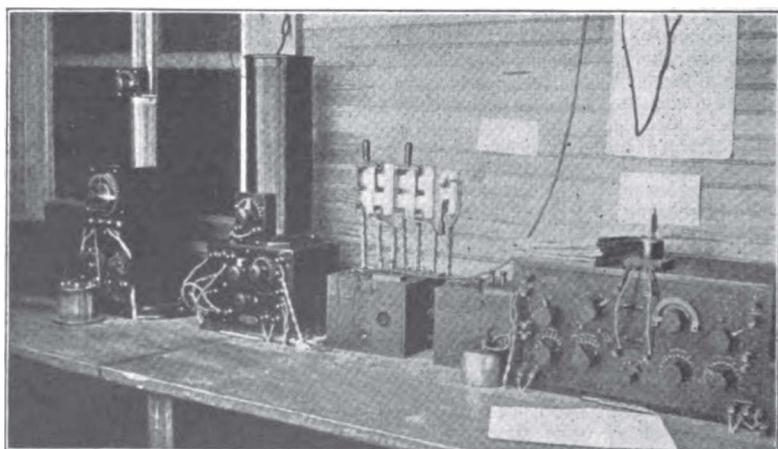
Remarks: Very few stations coming through from First, Second, Third, Fourth and Fifth districts. Reception has been unusually poor during latter part of month.

A newcomer, 5EK, in the Fifth District has been heard a number of times and seems to be the most consistent of the stations in that district but not as loud as some of the others.

8ZR seems to be holding out in the Eighth District but most of the other good stations mentioned in past reports seem to have dropped off the earth. A new special 8YN comes in very loudly.

In the 9th District, 9LQ now gets credit for being the most consistent station. Since 9ZJ has gone down to 200 meters his signals although loud have a tendency to swing more. 9FS has been working consistently during the past month.

should be addressed. Mr. McIlvaine advises us that 900 watts is the greatest power 5XA uses, at which input 4.5 amperes antenna current was attained on 270 meters with the coupling shown.



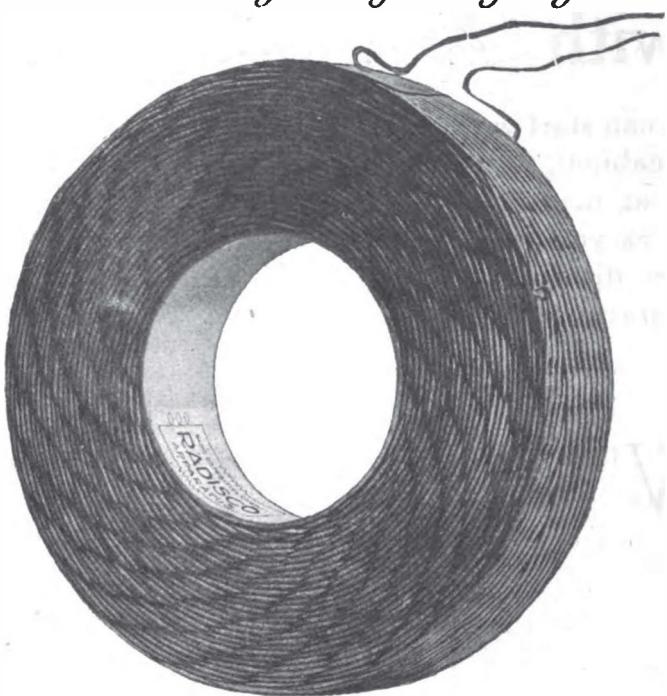


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BOSTON, MASS.
Atlantic Radio Co.
88 Broad St.
BROOKLYN, N. Y.
Kelly & Phillips,
812 Flatbush Ave.
CHICAGO, ILL.
Chicago Radio Lab.
1316 Carmen Ave.
EUREKA, ILL.
Klaus Radio Co.
Branch, Peoria, Ill.
KANSAS CITY, MO.
McCreary Radio Supply
4th and Delaware Sts.
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ABC sectional UNITS were purposely designed to work together and to save you money when you want to add to your set. The first cabinet is the Radio Receiver, a completely equipped crystal detector station. And altho this Unit is highly efficient and complete in itself, here is the important part of the *ABC* system: Whenever you want to increase your range, you simply

hook the next cabinet (the *ABC* Combined VT Detector and One-Step Amplifier), directly onto the receiver and proceed. It takes about as long to do it as to say it, and you haven't discarded a nickel's worth of equipment. There's no tinkering, no adjusting to be done. Your new set works perfectly from the start. The Units are designed for each other, and the standardized methods of production makes it certain that every new combination of Units, as you go along, will make a smooth-working efficient outfit.

IN PLACE of the *ABC* Combined VT Detector and One-Step Amplifier UNIT, you may add on these Units separately. But we strongly recommend the Combination Unit because it gives you (with the proper coils) sufficient range and sensitivity to pick up any known type of sending station, code or phone, on any known wave length.

OTHER CABINETS of the series are the *ABC* Two-Step Amplifier UNIT and the *ABC* "CLEARION", a loud speaker that hooks right on to any previous combination of Units without any additional batteries or extra equipment.

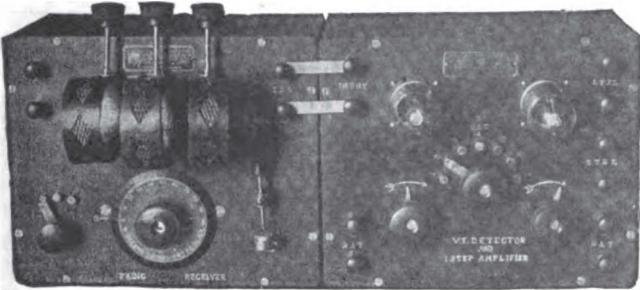


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crystal detector, a switch for varying the wave length range, etc. The panel is a special impregnated fibre, highly polished, and carefully fitted to the handsome Kodak-finish cabinet. The price is \$24.50.

FOR THOSE who want it, there is also provided the ABC Completion Package to go with this Unit. The Completion Package contains phones, aerial, insulators, ground clamp; in fact all the equipment needed to set a complete working station in two hours. This package is an unusually good buy at \$7.50.



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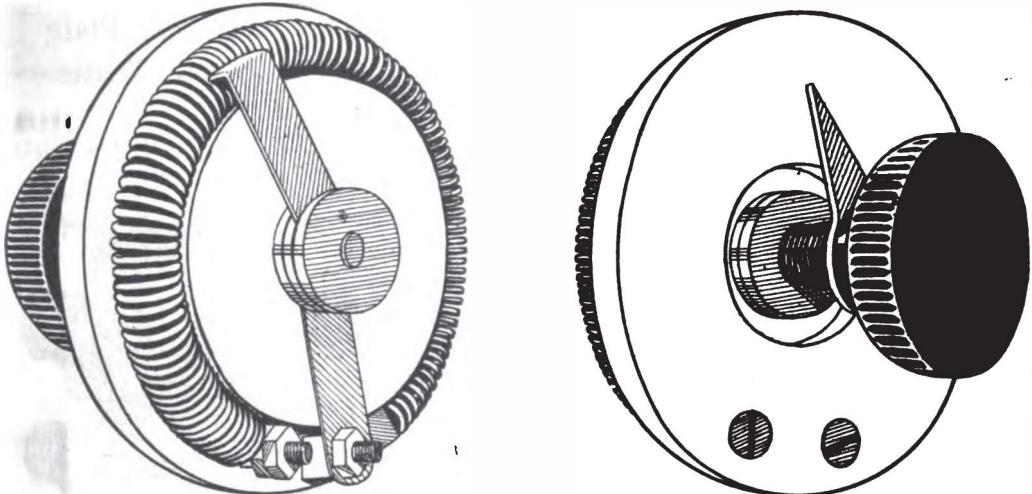
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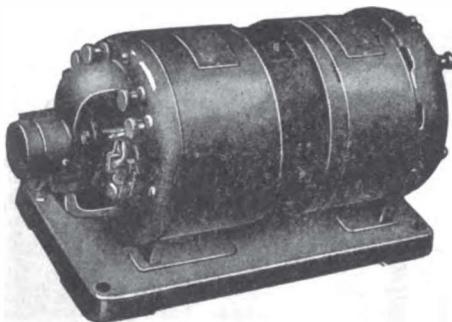
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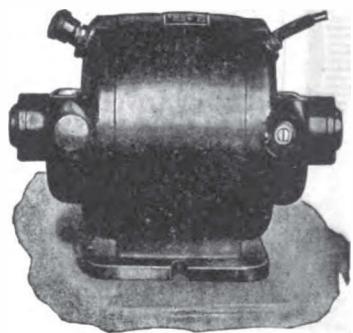
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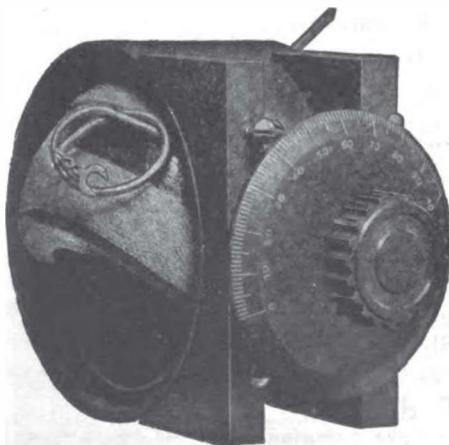
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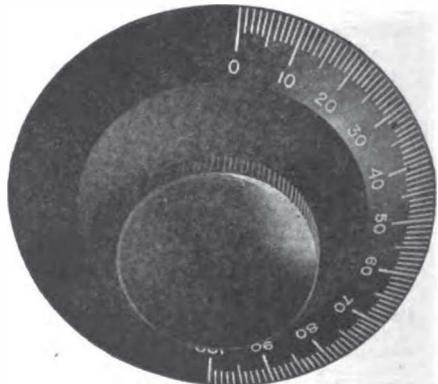
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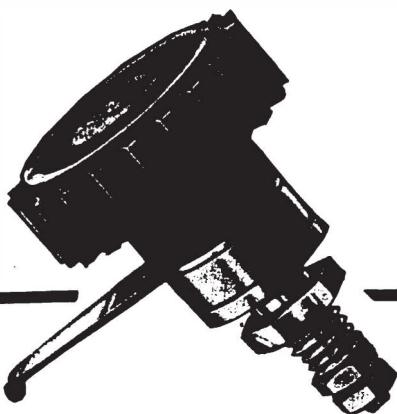
THE DIAL

This 3" knob and dial is our own product heavy brass dial black oxidized finish, composition knob 1 1/8" diameter. Supplied for 1/8" shaft only. This dial cannot chip or warp and will run true. Its beauty is in keeping with the best products of the instrument maker. Price dial and knob #F800H complete.. \$0.75

Complete catalogs sent for 6c stamps
Patronize your local dealer: If he won't supply our material your order will receive immediate factory attention.

CLAPP-EASTHAM CO., 114 Main St., Cambridge, Mass.
Headquarters for Radiotron Tubes. All types in stock.

**CORWIN'S
Improved
SWITCH
LEVER**



PRICE:—

**90 cents,
Postage,
5 cents.**

A switch lever may be just a small item, but it pays to get a smooth running, well made switch like the one pictured above. This new Corwin switch is a handsome accessory that will add to the appearance as well as the efficiency of your set. The knurled knob is a special composition,—identical with the knobs used on the standard #67 Corwin Dial. The brass shaft is moulded right into the knob, so that it can never come loose. Blade, bushings, etc., are nickel-plated brass. Contact radius, $1\frac{1}{4}$ ". Send your order today. Satisfaction guaranteed.

**NEW RADISCO
VARIO-COUPLER**

This is the coupler that caused such a sensation when it was announced two months ago. Sales have been tremendous, but we, never-the-less, have a generous supply on hand, ready for immediate shipment. "Accurate to the .002 part of an inch!" Moulded base, Formica tube, all metal parts brass. Price \$7.50 postpaid.

**CORWIN'S 1921
CATALOGUE—10c.**

If you haven't already sent for your copy, don't lose another day. You will certainly want these 32 pages, listing all Corwin and Radisco instruments. You will find in this catalogue a good instrument for every part of your station at a price that won't "take the joy out of life". One dime and your name brings the catalogue by return mail.

A few specials from our catalogue,---ready to ship at once

New Patent Plug \$2.00
Postpaid.

FIRCO VOCALLOUD

The ideal loud speaker. Requires no batteries, no adjustments, no extra equipment whatever.

Station type, \$25.00
(in mahogany cabinet)
Laboratory type 23.00

UNIVERSAL-COIL MOUNTING PLUGS

Anyone can easily make smooth-running mountings with these plugs. No bending, no filling, they are made to fit exactly, in the first place. Suitable for Radisco and all hand wound coils. A few minutes work with these plugs will save you dollars that can be put into better apparatus. Price 80 cents, postpaid.

GRID CONDENSERS

Radisco, postage 3c 35c
"B" BATTERIES

Radisco No. 1 (2 lbs.) \$1.50
Radisco No. 5 (5 lbs.) 2.65
Eveready Storage Battery
prices on application

ROTARY SWITCHES
Clapp-Eastham No. 19 \$1.00
Clapp-Eastham No. 19A35
Our Own No. 140
Our Own No. 255
Postage05

CORWIN DIALS
No 66, 3" \$0.75
No. 67, 3" with knob 1.30
No. 68, 3 $\frac{1}{2}$ " 1.00
No. 69, 3 $\frac{1}{2}$ " with knob 1.70
Postpaid

RECEIVERS
Murdock No. 55, 2000 ohm \$4.50
Murdock No. 55, 3000 ohm 5.50
Brander Superior 7.00
Baldwin C 16.50
Baldwin E, improved 20.00
Brownlie new 12.00
Shipping weight, 2 pounds.

VARIOMETERS
Radisco No. 1 \$7.00
Radisco No. 1D 8.50

All orders for apparatus not listed as postpaid must be accompanied by postage charges.

A. H. CORWIN & CO.
Dept. D4.4 W. Park St., Newark, N.J.

Remember Corwin's reputation for shipping mail orders promptly and in perfect condition.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

FORMICA

Sheets, Rods, Tubes

Made From Anhydrous
Redmanol Resins

Insist on getting the best insulating material
in your equipment and apparatus.
FORMICA is approved by the Bureau of
Engineering, U. S. Navy, and is used by the leading
manufacturers of radio apparatus.

**Highest Insulation Resistance
Lowest Power Losses**

Splendid Appearance

Excellent Machining Qualities

*The following dealers can supply you
with FORMICA sheets, tubes and
rods.*

Manhattan Electrical Supply Co.,
17 Park Place, New York, N. Y.

Clapp-Eastham Company,
139 Main St., Cambridge, Massachusetts.

The Radio Electric Company,
3807 Fifth Ave., Pittsburgh, Pa.

Pennsylvania Wireless Mfg. Co.,
507 Florence Ave., New Castle, Pa.

Radioelectric Company,
919 Huron Road, Cleveland, Ohio.

The Wireless Manufacturing Co.,
Canton, Ohio

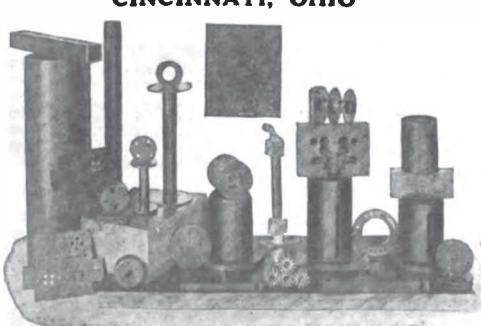
The Precision Equipment Co.,
2437 Gilbert Ave., Cincinnati, Ohio

Detroit Electric Company,
434 Shelby Street, Detroit, Michigan

The Wireless Shop,
511 West Washington St.,
Los Angeles, California

Leo J. Meyberg Company,
428 Market St., San Francisco, Cal.

The Formica Insulation Co.
CINCINNATI, OHIO



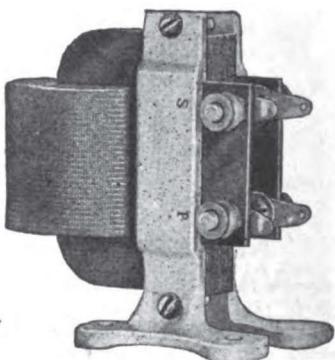
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AUDIO

FREQUENCY

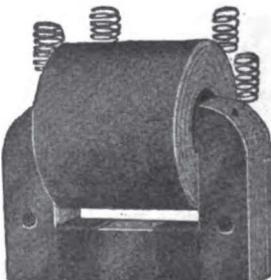
Amplifying Transformers

HIGHEST QUALITY
MOST EFFICIENT



\$5.00

NOTE THE NEW (ONE PIECE)
PUNCHED LAMINATIONS



UNMOUNTED

\$4.00

SEMI-MOUNTED \$4.50

—DEALERS WANTED—

Shipments Made From Stock Prepaid.

Note Change of Address

All American Elec. Mfrs.

1516 NORTH LOREL AVE.,
CHICAGO, ILL.



Announcing the

VOCALOUD

Laboratory Type

(*Mounted without cabinet
on metal base.*)

Complete with 6" cord, \$23.00
Sound chamber alone, \$12.00
Sound chamber, with base, \$15
Vocaloud reproducer with 6"
cord, \$8.00

Station Type

(*Complete as shown in
large photo*)

\$25.00

At Last -

The Ideal Loud-Speaker for \$25.

Hook a Firco Vocaloud right on to your receiving apparatus, and get your signals QSA—all over your house! No batteries, no adjustments, no extra equipment needed whatever! Just hook your Vocaloud in and listen!

Vocaloud reproduces wireless telephone perfectly, as well as code. Its reproducing elements are the same as a high-priced phonograph.

The reproducer itself employs the famous Baldwin *amplifying* mechanism. The sound chamber is designed and shaped like a *human ear*,—the most perfect sound amplifier known. These *exclusive features* are not duplicated in any other loud speaker at any price. Yet the price of a complete "station type" Vocaloud, (shown above) in an exquisite solid mahogany cabinet is only \$25.00.

*Examine a Vocaloud at your radio dealer's. If he
should lack a supply, write for leaflet direct to*

John Firth & Company, Inc., 18 Broadway, N. Y.

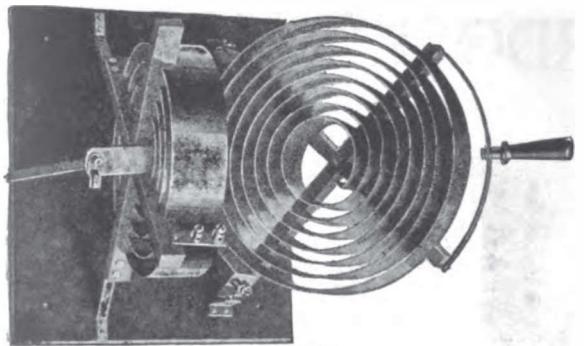


FIRCO RADIO
EQUIPMENT
"Pioneers—since 1901"

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

67

DO YOU KNOW?



DX-52 PRICE \$25.00

That the current put into your oscillation transformer often exceeds the 2000 ampere mark? That if your O. T. is not wound with sufficiently large ribbon this current will be lost due to the resistance of the small ribbon? Our DX-52 oscillation transformer is built to take care of this enormous current, being wound with 2 3/4" phosphor bronze ribbon, 4 turns on the primary and 8 turns on the secondary.

Aside from that it has bakelite insulation thruout thus insuring you against possible leakage due to poor insulation.

Another feature is that the coupling is adjustable while transmitting or testing allowing you to keep an eye on the radiation meter.

Large 1 1/2" wide clips are furnished free with this instrument DX-52 Price \$25. This is the O. T. used by 8ZR in their trans-continental transmission to 6EJ, 3AK and 7ZJ.

Don't forget our DX-51 Spark Gap and C.W. power motor advertized in the March issue of Q S T. Price \$30.00.

Write for our latest bulletin.

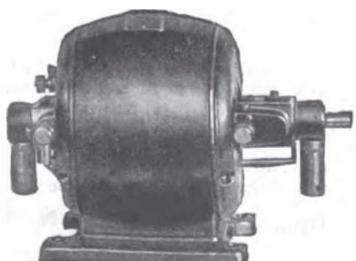
THE AMERICAN RADIO SALES & SERVICE CO.
GREAT AMERICAN BUILDING **MANSFIELD, OHIO**

Testing Station 8ZR

A 6 Volt Battery Will Operate A C.W. Transmitter

when used with a

RAY-DI-CO "DYNAMOTOR".



Ray-Di-Co "DYNAMOTOR" operates on 6 volts delivering 400 volts for space current. "DYNAMOTOR" entirely enclosed—fool-proof—portable—can be placed on automobile, motor boat or used for portable work or in station.

Capacity 15 watts — Net weight 18 lbs.

Price \$52.35 F. O. B. Chicago.

Usual Ray-Di-Co standard of construction prevails.

RAY-DI-CO

(Ray-Di-Co)

2653D N. Clark St.,

Radio 9AG

Chicago, Ill.

H. H. BUCKWALTER, 713 LINCOLN ST., DENVER, COLO.

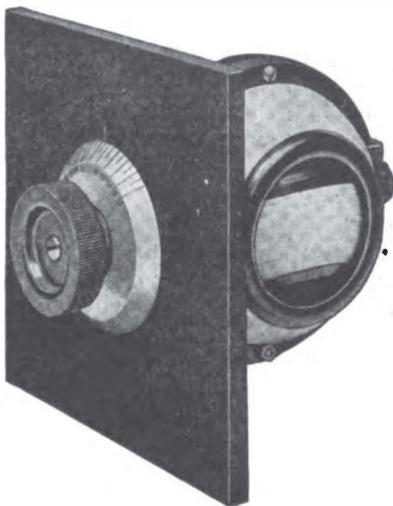
Representative

Colorado, Wyoming, Utah, Nebraska, Western Kansas, Northern New Mexico,
Deadwood and Lead, S. Dak.

"Meet us at First National Radio Convention Chicago Aug. 30-Sept. 3."

THE LATEST "MURDOCK" VARIOMETER

NO.
345
"MURDOCK"
VARIOMETER
\$7.50



THE PRICE
IS
UNUSUALLY
LOW

THE QUALITY
IS
REMARKABLY
HIGH

WINDING FORMS ARE "MURDOCK" MOULDED

OTHER "MURDOCK" RADIO INSTRUMENTS

REAL RADIO RECEIVERS

| |
|--|
| No. 55 Double head receivers, complete with head band and cord:— |
| 2000 ohm \$4.50 |
| 3000 ohm 5.50 |

VARIABLE CONDENSERS

| | |
|------------------------------|--------|
| No. 366, 43 Plates, .001 MFD | \$4.75 |
| No. 367, 43 Plates, .001 MFD | 4.50 |

VARIABLE CONDENSERS

| |
|--|
| Panel Type |
| No. 3661, 43 Plate, .001 MFD with knob and extension handle \$4.25 |
| No. 3662, 43 Plate, .001 MFD with knob, dial and extension handle 5.00 |
| No. 3681, 23 Plate, .0005 MFD with knob and extension handle 3.50 |
| No. 3682, 23 Plate, .005 MFD with knob, dial and extension handle 4.25 |

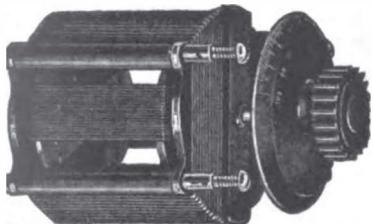
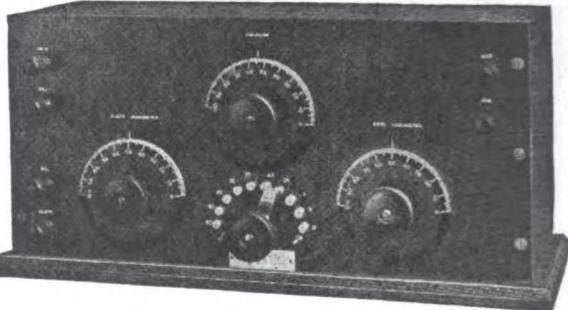
BUY THEM FROM YOUR DEALER

Bulletin No. 20 Sent Anywhere on Request

WM. J. MURDOCK CO.
65 CARTER ST., CHELSEA, 50, MASS.
509 Mission St., San Francisco, Cal.

The ESCO Regenerative Receiver-- Improved

The original ESCO REGENERATIVE RECEIVER is described in previous issues of this magazine. It has been improved upon. The new set as illustrated above is contained in a smaller cabinet than originally so that now the set is easily portable. All of its former excellent operating features are but enhanced in the new outfit. The wave length range is 150 to 600 meters so that amateurs and the majority of the commercial stations may be heard. Our new circular describes the set in full. Write for it. Price F.O.B. Columbus, Ohio or Philadelphia, Pa. is \$50.00. Shipping eight 11 lbs.



ESCO variometers and vario-couplers as shown alongside are sold separately for the convenience of those amateurs who prefer to build their own equipment. The instruments are absolutely guaranteed to be satisfactory. Prices are as follows:

ESCO variometer with dial, \$0.50 ESCO vario-coupler with dial, \$1.00
ESCO variometer without dial, \$0.50 ESCO vario-coupler without dial, \$0.00

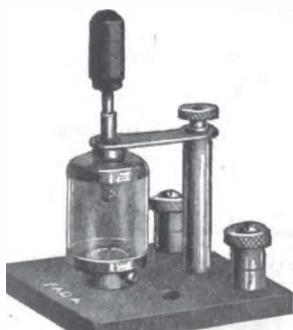
PLUGS AND JACKS

The cut illustrates a plug and jack which have been on the market for only a short time but in that time have acquired a wonderful reputation. With their use many practical connections can be effected. Phone and amplifier connections are quickly made in multi-stage circuit. The upper and lower contacts complete a single circuit thru the phones when the removal of the plug automatically connects the amplifying transformer. Jack and plug are nickel-plated and very attractive in appearance. Plug only, \$0.75; Jack only, \$0.85; Plug and Jack complete, \$1.50. Shipping weight 4 ounces.

Send 15c for our complete literature of Radio supplies. This amount will be refunded on your first purchase of \$1.50 or over. High printing costs make free distribution impossible.

The Electrical Specialty Co.

Dept. L., 48-50 So. Front St., Columbus, Ohio.
Dept. L., 20 N. 9th St., Philadelphia, Pa.



—YOUR INTERESTS

are just as valuable to me as are my own. That's one reason why the price of the FADA crystal detector (complete with Super-sensitive Galena Crystal) has been reduced from \$3.00. The other reason is because the demand is so large that for the first time automatic screw machines make the parts in very large quantities.

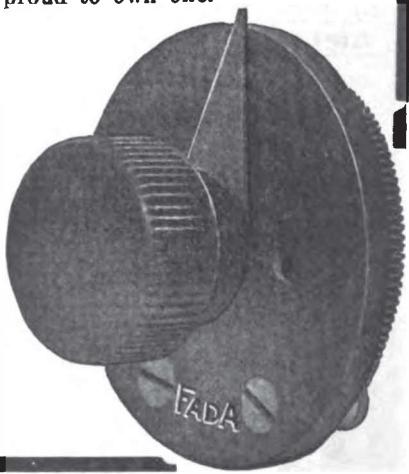
FADA detectors are used by thousands of amateurs to-day. Many receive radiophone concerts, etc. with this detector and their simple receivers. You'll be proud to own one.

CRYSTAL DETECTORS now \$2.50 each.

**FADA panel-mounting RHEOSTAT
\$1.25 each.**

Another mighty good buy is the new FADA panel-mounting rheostat. The base is made of an asbestos-synthetic material, Thermopax, which resists heat up to 600° F. The resistance is 6 ohms and it will carry 1½ amperes. All exposed metal parts polished nickel including screws for mounting. The best rheostat that you can obtain and it costs less than others. Ask your dealers for FADA products.

FRANK A. D. ANDREA
MANUFACTURER OF FADA RADIO APPARATUS
1882-B JEROME AVE., NEW YORK





The New Westinghouse Radio Receiver

A single-circuit tuner; a supersensitive crystal detector; a fixed condenser; and a set of head telephones, all in one case.

Just the outfit to take on camping trips or automobile tours to keep in touch with your home town.

Weighs only 5 lbs. Wave-length range 190 to 500 meters. Send for Folder 4465.

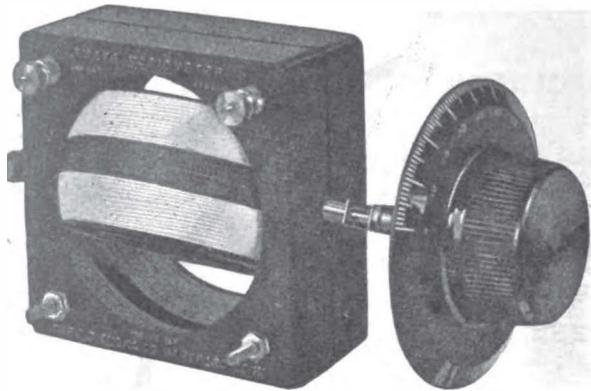
PRICE 25.00

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
PITTSBURGH, PA.

Westinghouse

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

71



TUSKA Moulded Variometer

MECHANICALLY AND
ELECTRICALLY PEERLESS

TYPE 200. PRICE \$7.25

SEE THEM AT YOUR DEALER'S

INDUCTANCE

| OTHERS | MINIMUM | MAXIMUM | MINIMUM | MAXIMUM |
|---------------|---------------|---------------|---------------|--------------|
| No. 1. | 70.3 m.h. | 940 m.h. | 8.4 mmf. | 44.1 mmf. |
| No. 2* | 75 " | 440 " | 22.8 " | 60. " |
| TUSKA® | 70.0 " | 1560 " | 14.0 " | 55. " |

*Coil wound on OUTSIDE of moulded form. Notice the large distributive capacity for range.

*Think how EXTREMELY low the DISTRIBUTIVE CAPACITY is in the TUSKA VARIOMETER compared with the EXCEPTIONALLY WIDE range.

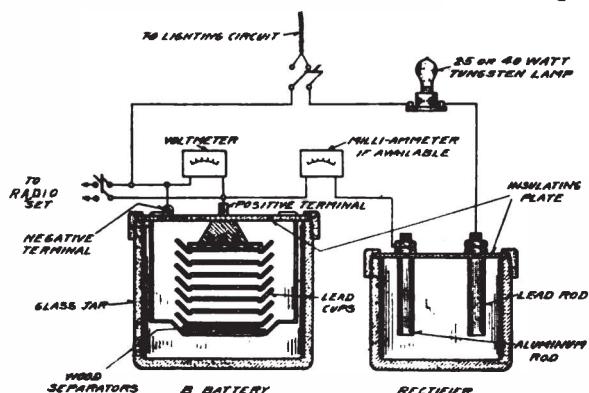
Send 5c for C.W. and Variometer Booklets

THE C. D. TUSKA CO.,

HARTFORD, CONN.

The McTighe Storage "B" Battery

Patents Pending.



be assembled easily and quickly by following the complete instructions which accompany each set of parts. Descriptive leaflet will be sent on request.

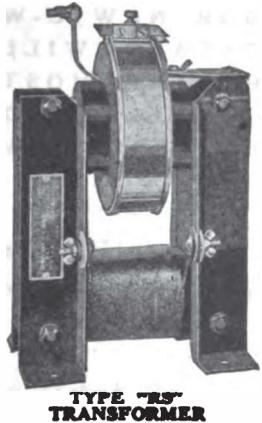
PRICE LIST

| | |
|---|--------|
| Set of parts for 12 cell battery without jar..... | \$2.50 |
| Lead aluminum rectifier parts without jar..... | 1.00 |
| Flint glass jar for battery, 4 x 4 inches..... | 1.00 |
| Flint glass jar for rectifier, 3 x 3 inches..... | .75 |

Postpaid.

McTIGHE BATTERY CO., Wilkinsburg, Pa.

Important Reductions in Prices of Thordarson Apparatus



TYPE "RS"
TRANSFORMER

Type "RS" Transformers

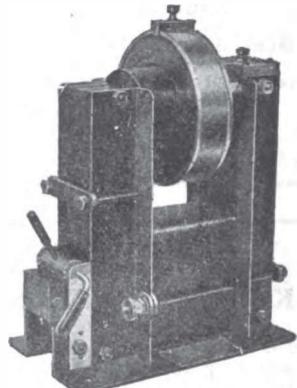
A non-resonant transformer with a lower secondary potential designed to give you the highest possible power factor.

| | |
|------------------------|---------|
| 1 KVA 15000 VOLTS..... | \$30.00 |
| ½ KVA 10000 VOLTS..... | 20.00 |
| ¼ KVA 8000 VOLTS..... | 15.00 |

Type "R" Transformers

The famous resonant transformer affording the highest practical voltages.

| | |
|------------------------|---------|
| 1 KVA 25000 VOLTS..... | \$40.00 |
| ¾ KVA 10000 VOLTS..... | 28.00 |
| ½ KVA 10000 VOLTS..... | 22.00 |



TYPE "R"
TRANSFORMER

Other Thordarson Equipment

| | |
|--------------------------------------|---------|
| POWER CONDENSER (.0018-.009 MF)..... | \$25.00 |
| OSCILLATION TRANSFORMER | 10.00 |
| R8 ROTOR (8 TOOTH)..... | 5.00 |
| R16 ROTOR (16 TOOTH)..... | 5.00 |
| R12 ROTOR (12 TOOTH)..... | 3.00 |

(Specify diameter of motor shaft when ordering rotors.)

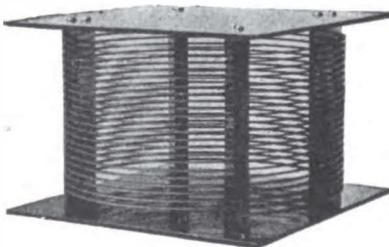
A POSTAL BRINGS OUR CIRCULAR TO YOU.

Thordarson Electric Manufacturing Co.
517 S. JEFFERSON ST., CHICAGO, ILL.

C-W C-W C-W C-W C-W C-W C-W C-W

Prepare for the bad radio season by installing your CW outfit now. It will carry thru summer static and is ideal for relay work.

OUR C-W CATALOG
WILL BE READY
ABOUT MARCH 15th.
SEND FOR YOUR
COPY NOW.



OUR NEW C-W
CATALOG WILL
BE THE MOST
COMPLETE AND
BIGGEST — CW
ONLY.

CW Inductance No. CW-100 shown above, mounted on Formica exclusively—25 turns edgewise copper strip $3/16 \times .050"$ complete with connection clips, \$10.00.

Send 15 cents for catalog, which amount may be deducted from first order of One Dollar or more.

"8ZV" WIRELESS MANUFACTURING CO. "8ZV"
CANTON, OHIO

"Chi-Rad" BULLETIN BOARD

Knocked Down Variometer Parts.

Read our ad in last month's QST and order your set today. Complete set of parts for two Variometers and Vario-Coupler for only \$10.00. And remember all windings are in place—you have nothing to do but put on the end bearings and connect stator windings together. Guaranteed to be the best value on the market and to give perfect satisfaction when assembled or money refunded. Immediate Delivery—better send us your order right now.

The Big A.R.R.L. Convention.

This will be the biggest Radio affair of the year and every Radio-Man should be here during the entire five days, August 30, 31 and Sept. 1, 2 and 3, 1921. Make our store your headquarters, we will gladly show you the latest in apparatus, direct you about the city or put you in touch with other Chicago Amateurs without obligation of any kind. Material and space for letter writing provided free of charge.

Plan on this Convention, make your reservations to the proper authorities AND be sure to visit our booth at the Show—we'll have several surprises for you.

A Word About Stock.

We are Chicago and Middle West distributors for all the old reliable makes of Radio Apparatus. We aim to carry the largest and most complete stock in this section of the country and therefore can make Immediate Delivery of almost any desired piece of apparatus. If you are located in the Middle West send us your orders and have the instruments in two to four days. Better yet, if possible drop around and see our display of new apparatus which arrives weekly. All DeForest Interpanel Sets, Midget Radio Phones, etc., in stock. See the new Firth Loud Speaker at only \$23.00.

Blue Print of 4 new C.W. Circuits for 15c. Bulletins of new apparatus free upon request.

CHICAGO RADIO APPARATUS CO., INC.

C. C. KLENTZ

508 S. DEARBORN ST.

Phone Harrison 1716.
(ROOM 210)

L. L. LYNN.

CHICAGO, ILL.

**MAIL ORDER
"SERVICE"**



Reg. U.S. Trade Mark.

**WE SHIP SAME
DAY ORDER IS
RECEIVED**

Our large stock of all reliable makes of Radio apparatus enables us to make immediate Shipment of your orders.

ANTENNA SWITCHES

| | |
|-------------------------------|--------|
| Murdock, 3 pounds..... | \$4.50 |
| Clapp-Eastham, 10 pounds..... | 12.50 |

AERIAL WIRE

| | |
|---------------------|--------|
| 7x22 tinned copper | |
| 100 feet 2 lbs..... | \$1.25 |
| 200 feet 4 lbs..... | 2.40 |
| 500 feet 8 lbs..... | 6.00 |

AMPLIFYING TRANSFORMERS

| | |
|-----------------------|--------|
| A.R. Co. (1 lb.)..... | \$5.00 |
| Federal (1lb)..... | 7.50 |

"B" BATTERIES

| | |
|------------------------------|--------|
| Radiosco No. 1 (2 lbs.)..... | \$1.50 |
| Radiosco No. 5 (5 lbs.)..... | 2.65 |

Eveready Storage Battery
prices on application

CONDENSERS TRANSMITTING. (Dubilier)

| | |
|--|---------|
| No. D-100 250 W. 10,000 V. .007 MF..... | \$19.00 |
| No. D-101 500 W. 14,000 V. .007 MF..... | 30.00 |
| No. D-102 1000 W. 21,000 V. .007 MF..... | 45.00 |

CONDENSERS (Low voltage)

| | |
|---|--------|
| Western Electric 1MF 500 Volts..... | \$1.50 |
| Western Electric 2MF 500 Volts..... | 2.25 |
| No. 21AA Western Elec. 1000 Volts A.C. 2.50 | |
| No. 577 Dubilier .002 1000 V. | 2.00 |

CONTACT POINTS

| | |
|------------------------------|------|
| CP No. 1, Brass, dozen..... | .25c |
| CP No. 4, Brass, dozen..... | .25c |
| CP No. 5, Nickel Plated..... | .45c |

Postpaid

CORWIN DIALS

| | |
|----------------------------|------|
| No. 66, 3"..... | .90 |
| No. 67, 3" with knob..... | 1.30 |
| No. 68, 3½"..... | 1.00 |
| No. 69, 3¾" with knob..... | 1.75 |

Postpaid

GRID CONDENSERS

| | |
|---------------------------|------|
| Radiosco, Postage 3c..... | .35c |
|---------------------------|------|

GROUND OUTFIT

| | |
|--|--------|
| Consists of SPDT 500 AMP Switch, 25 feet No. 4 wire, clamp and cleats prepaid..... | \$7.00 |
|--|--------|

JACKS AND PLUGS

| | |
|-----------------------------|--------|
| Federal Closed Circuit..... | \$0.25 |
| Federal Open Circuit..... | .70 |
| Federal Double Circuit..... | 1.00 |
| Federal Plug..... | 2.00 |

Postpaid

LOOSE COUPLERS

| | |
|---------------------------|---------|
| Clapp-Eastham Radion..... | \$14.00 |
| Murdock 344..... | 9.00 |

6 pounds.

OSCILLATION TRANSFORMERS

| | |
|--------------------------|---------|
| Radiosco No. 5..... | \$15.00 |
| Via Express collect only | |

ROTARY SWITCHES

| | |
|----------------------------|--------|
| Clapp-Eastham No. 19..... | \$1.00 |
| Clapp-Eastham No. 19A..... | .35 |
| Corwin No. 1..... | .40 |
| Corwin No. 2..... | .55 |

Postage

.....

REGENERATIVE RECEIVERS

| | |
|--|---------|
| No. CR-1 Grebe 175-650 Meters..... | \$60.00 |
| No. CR-2 Grebe 175-650 Meters..... | 45.00 |
| No. CR-3 Grebe "Relay Special" 175-650 Meters..... | 65.00 |
| No. CR-3A Grebe With tube control, 175-375 Meters..... | 45.50 |
| No. CR-5 Grebe's "Super-Special" 175- 3,000 meters, tube control, self-con- tained. Complete receiving set. Just out..... | 80.00 |

RECEIVERS

| | |
|-------------------------------|--------|
| Murdock No. 55, 2000 ohm..... | \$4.50 |
| Murdock No. 55, 2000 ohm..... | 5.50 |
| Brands Superior..... | 7.00 |
| Baldwin C..... | 16.50 |
| Baldwin E, improved..... | 20.00 |
| Brownie new..... | 12.00 |

Shipping weight, 2 pounds

RADIO CRAFTS PRODUCTS

| | |
|----------------------------|---------|
| Detector..... | \$15.00 |
| Two step Amplifier..... | 50.00 |
| Detector and one step..... | 45.00 |
| Detector and two step..... | 70.00 |

Postage Paid

| | |
|--------------------------------------|---------|
| Ragen. Receiver, 150-600 M..... | \$60.00 |
| Ragen. Receiver, long wave type..... | 145.00 |

TUSKA C.W. APPARATUS

| | |
|-----------------------|--------|
| 181 Coll (2 lbs)..... | \$7.50 |
| 182 Coll (2 lbs)..... | 10.00 |
| 183 Coll (3 lbs)..... | 12.50 |
| 170 Filt (3 lbs)..... | 15.00 |

VACUUM TUBES

| | |
|--------------------------------------|--------|
| No. UV-200 Radiotron, detector..... | \$5.00 |
| No. UV-201 Radiotron, amplifier..... | 6.50 |
| UV 202 Radiotron, 5W. power..... | 8.00 |
| UV 203 Radiotron, 20W. power..... | 30.00 |
| UV 204 Radiotron 250W. power..... | 110.00 |

VARIABLE CONDENSERS

| | |
|--------------------------------|--------|
| A.R.CO. .001..... | \$6.25 |
| A.R.CO. .0005..... | 5.00 |
| With No. 67 Dial add..... | 1.00 |
| Murdock 366..... | 4.75 |
| Murdock 367..... | 4.75 |
| Murdock 368..... | 3.75 |
| Clapp-Eastham 800..... | 7.50 |
| Clapp-Eastham 800A..... | 9.50 |
| Clapp-Eastham 800B..... | 11.50 |
| Complete with dial..... | |
| Shipping Weight One Pound..... | |

VARIOMETERS

| | |
|----------------------|--------|
| Radiosco No. 1..... | \$7.00 |
| Radiosco No. 1D..... | 8.50 |

3 pounds

VARIO-COUPLER

| | |
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| Radiosco No. 3..... | \$7.50 |
| Radiosco No. 3D..... | 8.50 |

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Note New Address

1533 Pine St., Philadelphia

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22½ VOLT

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BATTERY

4⅞" x 5⅛" x 8"

"THE LARGEST "B"—KNOWN"

Behind all this RUGGED CONSTRUCTION—What? The two 19 strand heavy service terminals connect to 15 cells, each 4" long and 1½" in diameter made up into a 12 pound unit that is "CHOCK FULL" of 6400 milliamperes hours of energy.

PRICE \$4.00 F.O.B. our N. Y. or Add P.P. Shipping Write For
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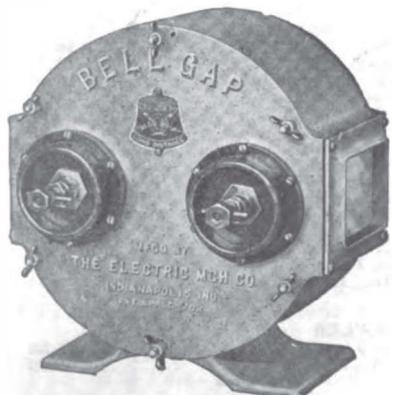


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Electrical Supremacy Through Mechanical Perfection Is the Secret of

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Of what value is an electrically correct gap if its bearings are continually wearing out? The Bell Gap Is Built to a Machinist's Ideal as Well as That of the Radio Experimenter's.

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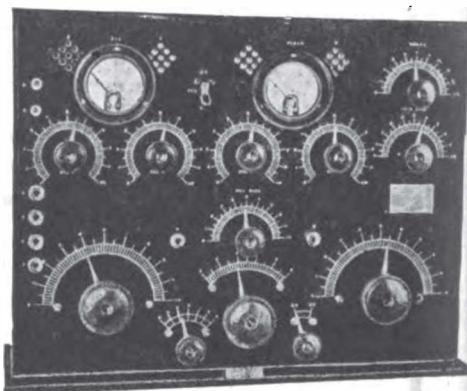
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O I N

The prices below represent our contribution toward the reduction of the "High Cost of Radio"

| Instrument | Old Price | New Price |
|----------------------|-----------|-----------|
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| Amplifigon AGN-1 | 75.00 | 64.00 |
| Amplifigon AGN-2 | 105.00 | 89.25 |
| Amplifigon AGN-3 | 135.00 | 115.00 |
| Hyrad Disc | 12.00 | 10.50 |
| Hyrad Non-Syn. Gap | 65.00 | 49.00 |
| Hyrad Syn. Gap | 125.00 | 105.00 |
| Jeweler's Time Rec. | 75.00 | 69.50 |
| Multiceiver MC-3 | 265.00 | 236.00 |
| Altaceiver CW-3 | 300.00 | 254.00 |
| C. R. L. Regenerette | 12.75 | 12.75 |
| One-Step Amp. AM-1 | 33.50 | 28.50 |
| Two-Step Amp. AM-2 | 65.00 | 55.00 |
| Detector AD | 20.00 | 17.00 |
| Detector ADP | 30.00 | 25.00 |



Z-NITH MULTICEIVER—MC-3

G The most complete, efficient and flexible receiver ever designed. Described in detail in our Catalog F-21. Write for it.

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NEW CATALOG F-21 JUST OUT GIVES COMPLETE LIST OF PRICES

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50,000 ft. Aerial Wire just received, 85ft.
to the lb. pure copper #14 @ 45c. per lb.
Brass Rod, $\frac{1}{4}$ " sq. @ 12c. per ft.
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best for code practice \$2.49.
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Loading Inductance \$2.25.
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600 Meter Loose Coupler \$5.90.

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Amplifier \$6.40
Variable Grid Leaks,—necessary to use with
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Fixed Grid Cond. 33c.
Porcelain Rheostats for Panel \$1.00; for table,
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Nov. date "B" Batteries 50c.
New Type Eveready "B" Battery, large, tapped
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J J N Variometers \$4.00
J J N Variocouplers 4.50

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Mail all orders direct to 602 W. 145th St., N. Y. C., Dept. Q.



TRESCO TEN \$ TUNERS

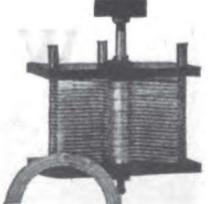
When you think of tuners say TRESCO. One for every
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CIRCULAR FREE.

Knocked-Down Condensers

Assemble them and save money.

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| 11 Plate..... | \$1.80 |
| 21 Plate..... | 2.25 |
| 41 Plate..... | 3.20 Add P. P. |



If you want us to assemble them for you add \$1.00, plus
P.P., to above prices. Shipping weight 2 lbs.

10c brings a wonderful catalog of 16 pages. 100 testimonials and freak hook ups
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SIX Stages of audio fre-
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See John Firth & Co.'s August
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| Unmounted Amplifying Trans- | |
| formers | \$3.45 |
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| Honeycomb or Duolateral Coils | |
| 20% Discount | |
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| D-101 Dustproof Galena De- | |
| tectors | \$2.15 |
| Variable Grid Leaks—G-100 .. | .55 |
| Hard Rubber 180° Dials with- | |
| out Knob | .45 |
| Hand Key—1K.W. Silver Con- | |
| tacts | 2.95 |
| Amrad Panel Rheostats..... | 1.45 |

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|--------------------------------|---------|
| K20—Enclosed Rotary Gaps | |
| 20a—with Motor | \$25.00 |
| 20b—Pulley Drive | 20.00 |
| K1—Open Rotary Gap with | |
| motor | 16.00 |
| K2—16 pt. Sawtooth rotor | 4.50 |
| K3—10pt. Wide tooth rotor .. | 4.50 |
| K6—"Cootie" Double Action | |
| Key | 4.50 |
| K8—"Big Midget" Audion Cab- | |
| inet | 12.50 |
| K7b—Honeycomb Tuner and | |
| two condensers | 29.50 |
| K4e—Audion Detector Cabi- | |
| net | 25.00 |

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| DeForest Condensers—All Styles for immediate | |
| Shipment | |
| #366 Murdock .001 in case | \$4.75 |
| #366 Murdock .001 Interior | 4.25 |
| #366 Murdock .0005 in case | 4.00 |
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| #3682 Murdock .001 Panel Mount | 5.00 |
| #K10 Chelsea Panel Mount with Dial | 4.75 |
| Perfection Knock Down Condensers | |
| 11 Plate \$1.80, 21 Plate \$2.25, 41 Plate \$3.20 | |

TELEPHONES

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|------------------------------|---------|
| Baldwin Type E | \$20.00 |
| Baldwin Type F | 21.00 |
| Baldwin Type C | 16.50 |
| Brandes Navy Type | 14.00 |
| Brownlie Adjustable | 12.50 |
| Liberty 2200 Ohms | 12.50 |
| Trans-Atlantic Brandes | 12.00 |
| Brandes Superior | 8.00 |
| Murdock #55—3000 Ohms | 8.50 |
| Murdock #55—2000 Ohms | 4.50 |
| Brown adjustable | 17.00 |

VACUUM VALVES

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|----------------------------------|--------|
| UV 200 Radiotron Detector | \$5.00 |
| UV 201 Radiotron Amplifier | 6.50 |
| UV 202 5 Watt Transmitter | 8.00 |
| UV 203 50 Watt Transmitter | 30.00 |
| C300 Audiotron Detector | 5.00 |
| ER Detector Tube | 6.00 |
| APVT Amplifier | 7.00 |
| APTT 5 Watt Transmitter | 7.50 |

TRANSFORMERS

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| Acme 250 Watt semi mounted | \$13.00 |
| Acme 250 Watt fully mounted | 16.00 |
| Acme 500 Watt semi mounted | 18.00 |
| Acme 500 Watt fully mounted | 22.00 |
| Acme 1000 Watt semi mounted | 28.00 |
| Acme 1000 Watt fully mounted | 33.00 |
| Thordarson Type R-1/4 KVA | 22.00 |
| 1500 Volt Acme Power Transformer | 25.00 |
| Thordarson Type RS-1/4 KVA | 18.00 |
| 200 Watt C.W. Power Transformer | 20.00 |
| Same semi mounted | 16.00 |
| 50 Watt C.W. Power Transformer | 15.00 |
| Same semi mounted | 12.00 |
| Unmounted Modulation Transformers | 4.50 |
| Mounted Amplifying Transformers | 5.00 |

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|-----------------------------------|--------|
| Clapp-Eastham Variometers | \$5.75 |
| Clapp-Eastham Varilocuplers | 7.50 |
| Amrad Variometers | 14.50 |
| Amrad Varilocuplers | 17.50 |
| Murdock Variometers | 7.50 |
| Murdock Varilocuplers | 8.50 |
| Grebe Regenerative CR-3 | 55.00 |
| De Luxe Regenerative DX-1 | 35.00 |
| (All Bakelite Variometers) | |

METERS

| | |
|---|--------|
| Model H Flush Mount Radio Frequency Meters | |
| 0-1, 0-3, 0-5, 0-10 | \$7.50 |
| Midget Flush Mount Milliammeters 0-100, ... | |
| ..0-200 | 8.00 |
| #471 0-5 Ammeters | 5.50 |
| #471 0-200 Milliammeters | 5.50 |

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Our laboratory and workshops are adequately equipped to satisfy your most exacting requirements in the construction or assembly of special receivers, spark and C.W. Transmitters, or radio telephone sets. Specifications and estimates will be furnished without charge

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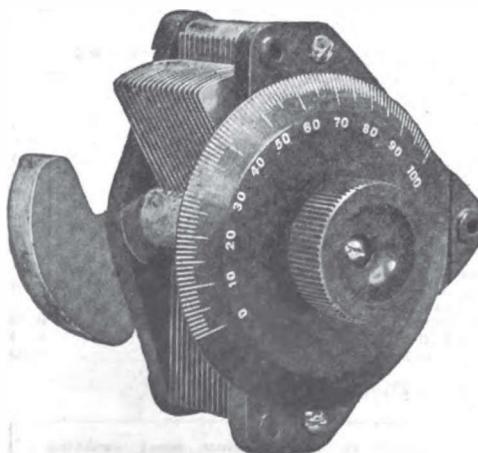
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is needed for every type set. Highest
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127 Radio Bldg.,

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(Die Cast Type)

| No. | Capacity | Type | Size | Weight | Price |
|-----|-----------|--------------|---|----------------------|--------|
| 1 | .0011m.f. | Mounted | 4 $\frac{1}{4}$ x4 $\frac{1}{4}$ x3 $\frac{1}{4}$ | 1 $\frac{1}{4}$ lbs. | \$5.00 |
| 2 | .0006m.f. | Mounted | 4 $\frac{1}{4}$ x4 $\frac{1}{4}$ x2 $\frac{1}{2}$ | 1 $\frac{1}{4}$ lbs. | 4.50 |
| 3 | .0011m.f. | With Dial | 4 $\frac{1}{4}$ x3x4 | 2 lbs. | 4.75 |
| 3 | .0011m.f. | Without Dial | 4 $\frac{1}{4}$ x3x4 | 2 lbs. | 4.35 |
| 4 | .0006m.f. | With Dial | 4 $\frac{1}{4}$ x3x3 $\frac{1}{2}$ | 1 $\frac{1}{4}$ lbs. | 4.25 |
| 4 | .0006m.f. | Without Dial | 4 $\frac{1}{4}$ x3x3 $\frac{1}{2}$ | 1 $\frac{1}{4}$ lbs. | 3.85 |

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates.

Unmounted types will fit any panel and are equipped with counter-weight.

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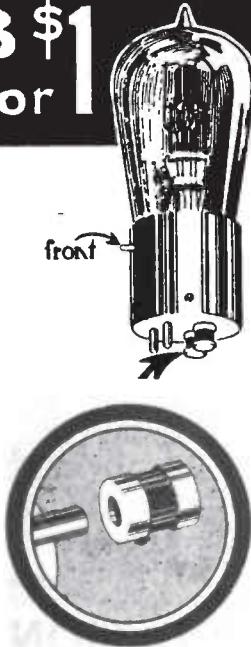
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PROTECT Your VACUUM TUBES INDEFINITELY!



Multiplies the Life of your Set

Destructive excessive amperage cannot reach the delicate filaments of any vacuum tube if protected by a

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SAFETY FUSE

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Slips directly on filament terminals of any standard socket without distorting springs or lowering efficiency. RADECO Safety Fuses positively protect your tubes indefinitely.

RADECO Safety Fuses are equally valuable in all C. W. work preventing injury to meters resulting from shorts. Send today cash, money order or certified check.

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35c. each

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For Back or Front of Panel
Mounting, 6 ohms, 1½
amps., 1¼" dia.

\$1.75 Post Paid
Immediate Shipment.

Standard VT Socket
Improved Contact Type
\$1.00 Postpaid
Copper foil condenser
35c P. P.

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Include postage on 4 lbs.

Complete in handy wooden case and adjustable phosphor bronze "jiffy" connectors. Better than block batteries—if one 4.4 V. unit weakens prematurely, it can be removed and replaced—thereby not impairing total voltage, which makes this the best battery value to be had at any price. Set of 10 Renewal Units, 44 volt, \$3.10 postpaid.

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—include postage on 20 lbs. per 1000 feet.
100 amp. 600 volt lightning switches, \$4.00

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We Have the Complete Parts

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| Acme Choke Coils, Double Coil | each 8.00 |
| Acme Modulation Transformer, semi-mounted | each 5.00 |
| Western Electric 1 mid. Condenser; tested 1,000 volts | each 2.50 |
| Conn. Telephone Transmitter | each 3.50 |
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| UV-201 Pliotron Amplifier. 6.50 | | cased | 4.75 | No. 345 7.50 |
| UV-202 5 Watt Transmitter. 8.00 | | Murdock No. 367 .0005 en- | | Murdock Variocoupler No. 346 8.50 |
| (We supply full directions with either detector or am- plifier.) | | cased | 4.50 | |
| AUDION CONTROLS | | | | |
| Clapp-Eastham ZRD detector panel | | Clapp-Eastham ZRD detector panel | \$12.00 | |
| Acme Y-1 detector | | Acme Y-1 detector | 10.00 | |
| Adams Morgan No. 70 con- trol | | Adams Morgan No. 70 con- trol | 6.00 | |
| TELEPHONES | | | | |
| Brandeis Superior with Navy Band | | Brandeis Superior with Navy Band | \$8.00 | |
| Brandeis Trans-Atlantic with Navy Band | | Brandeis Trans-Atlantic with Navy Band | 12.00 | |
| Brandeis Navy type with Navy Band | | Brandeis Navy type with Navy Band | 14.00 | |
| Western Electric type 1002A 15.00 | | Western Electric type 1002A 15.00 | | |
| Murdock No. 55. 2000 ohms 4.50 | | Murdock No. 55. 2000 ohms 4.50 | | |
| Murdock No. 55. 3000 ohms 5.50 | | Murdock No. 55. 3000 ohms 5.50 | | |
| C. W. TRANSFORMERS | | | | |
| Acme 200 watt mounted... 82.00 | | Acme 200 watt mounted... 82.00 | | |
| Acme 50 watt mounted... 15.00 | | Acme 50 watt mounted... 15.00 | | |
| MODULATION TRANSFORMERS | | | | |
| Acme A-3 semi mounted... \$5.00 | | Acme A-3 semi mounted... \$5.00 | | |
| CHOKE COILS | | | | |
| 150 M.A. Single coil..... \$4.00 | | 150 M.A. Single coil..... \$4.00 | | |
| 150 M.A. double coil..... 6.00 | | 150 M.A. double coil..... 6.00 | | |
| 500 M.A. single coil..... 6.00 | | 500 M.A. single coil..... 6.00 | | |
| 500 M.A. double coil..... 8.00 | | 500 M.A. double coil..... 8.00 | | |
| CHOKES | | | | |
| Clapp-Eastham ZRV Variom- eter, without dial..... 85.75 | | Clapp-Eastham ZRV Variom- eter, without dial..... 85.75 | | |
| Clapp-Eastham ZRV Variom- eter with 3-inch dial..... 6.50 | | Clapp-Eastham ZRV Variom- eter with 3-inch dial..... 6.50 | | |
| Clapp-Eastham ZRC Vario- coupler, with knob & dial 7.50 | | Clapp-Eastham ZRC Vario- coupler, with knob & dial 7.50 | | |
| Clapp-Eastham ZRC Vario- coupler, with switch and points | | Clapp-Eastham ZRC Vario- coupler, with switch and points | 9.00 | 75 watt mounted..... \$12.00 |
| J. J. Nightingale Variometer 4.50 | | J. J. Nightingale Variometer 4.50 | 150 watt mounted..... 16.00 | |

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New Grebe Portable Radio Station Type KT-1

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Absolutely the newest and neatest combination
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Set in attractive and durable case.

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KENNEDY
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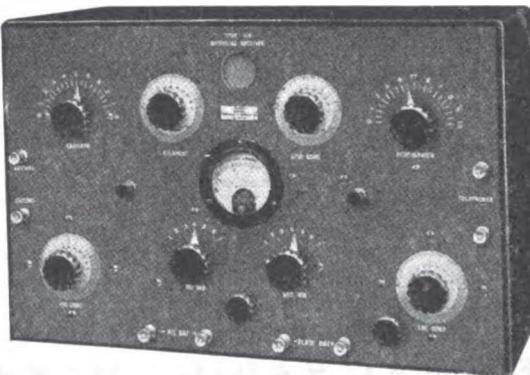
ANNOUNCING

THE NEW KENNEDY UNIVERSAL REGENERATIVE
RECEIVER

TYPE 110

EFFECTIVE RANGE: 175 TO 25,000 METERS

DETECTS
REGENERATES
OSCILLATES
On all wave
lengths in
common use.



Licensed
under
Armstrong
U. S.
Patent
No. 1,113,149

Surpassing even our highest hopes when we undertook its development, this latest addition to the Kennedy line is of interest to everyone who uses a radio receiving set.

Our engineering staff spent many months in developing this unit and released it for production only when its performance surpassed every requirement we had set for it. By our long specialization in receiving equipment we have built up a reputation which is so precious that we can afford to put the Kennedy trade-mark on only the highest quality product.

We have spared no effort to make this the best receiver on the market. We honestly believe that it is.

These are some of its features:

- Variable inductive coupling between primary and secondary.
- Extremely sharp tuning because of very efficient inductance units.
- Special Kennedy bank-wound moisture-proof inductors.
- Generous overlap between inductance steps.
- Large balanced primary and secondary variable condensers.
- Micrometer adjustment of secondary condenser
- Variable grid condenser with air dielectric, permitting most effective use of all types of available receiving tubes.
- Adjustable feed-back circuit.
- Fine adjustment of plate voltage by means of potentiometer connected between terminals of filament battery.
- Weston ammeter for measuring filament current.
- Bus-bar type insulated wiring.

Further details in Bulletin 101, mailed on request.

Ask your dealer for a demonstration. Compare the performance of this receiver with any other you have ever seen. The users of Kennedy Equipment are our best advertisers.

THE COLIN B. KENNEDY COMPANY

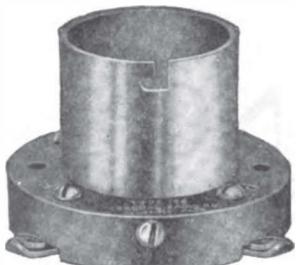
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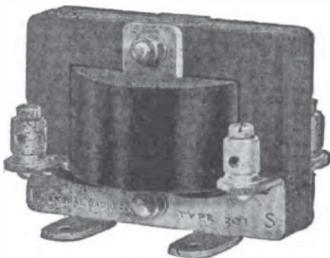
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TYPE 156 SOCKET



TYPE 231 TRANSFORMER

Your dealer can obtain a complete supply of the standard parts, such as switches, binding posts, etc. used in the assembly of our instruments.

Standardize on General Radio Equipment Throughout.

GENERAL RADIO COMPANY

MASSACHUSETTS AVENUE AND WINDSOR STREET, CAMBRIDGE, MASSACHUSETTS

Rebuilding Your Set For Results

Summer is the season in which to rebuild your set so that you may get the maximum of results during next winter. By rebuilding your set now, you will have more time in which to look over all of the available radio apparatus and to make a careful selection of those instruments most suited to your needs.

We have several instruments built particularly for the discriminating experimenter. In making your selection we invite you to consider these instruments. They are fully described in Bulletin 904Q, copy of which will be sent on request. Prominent among these instruments are the following:

TYPE 156 VACUUM TUBE SOCKET \$1.75

Adapted for Receiving or transmitting tubes. Positive contact springs.

TYPE 214 RHEOSTAT \$2.50

Made for receiving and transmitting tubes, and panel and portable mountings.

TYPE 231A AMPLIFYING TRANSFORMER \$5

Designed to give the maximum amplification possible with a UV-201 tube.

TYPE 231M MODULATION TRANSFORMERS \$5

Designed to give the maximum modulation possible without distortion using a UV-202 tube.

TYPE 127 HOT WIRE METERS \$7.75

Flush or front of board mountings, and a variety of ranges. For filament and antenna currents.

A.R.R.L. MEN!

150 TO 25,000 METER REGENERATIVE RECEIVER IS HERE—THE "REGENIFIER"

The most remarkable, as well as welcome, piece of radio apparatus has been developed! No longer is it necessary to change wires and connections or plug in numerous coils, to get all the stations. The Regenifier is the latest innovation of the popular regenerative circuit and applies this unapproachable circuit to a wavelength range covering every wavelength used, without the sacrifice of sensitivity or efficiency on any of the wavelengths

covered. It is a marvel for C.W. reception.

In operation it is the last word in simplicity. Has only three controls each being variable over entire wavelength scale, there being no change-over from short to long waves. Its super positive control of oscillations and amplification together with its remarkable flexibility of operation has destined it to become the property of every exacting radioman. Encased in genuine Oak Cabinet 7x7x21 inches; panel Bakelite, four inch dials used, all metal parts highly nickelated.

No matter what model you buy, for any wavelengths you desire, the Regenifier will prove superior to any other receiver of similar nature. Each instrument guaranteed for two years. Order YOUR Regenifier at once.

Send For Circular

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Omaha

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THE BIG THREE "QST," "RADIO NEWS," "PACIFIC RADIO NEWS." ONE YEAR SUBSCRIPTION TO ALL THREE. \$5

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50 MAIN ST. SAN FRANCISCO

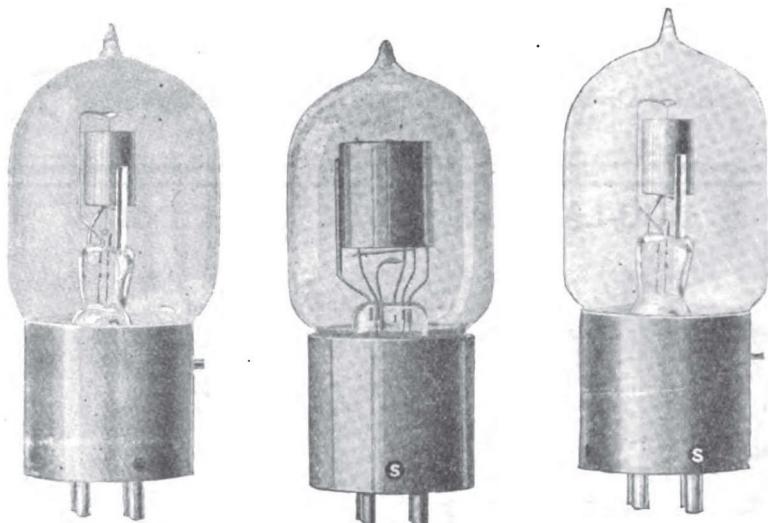
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how to find out-

A-P Tubes have been imitated but never equalled. Those who use them know. Read this letter. Scarcely a day passes but what we receive, unsolicited, enthusiastic testimonials similar to the following:—

Gentlemen:—"We have recently received a shipment of E.R.'s and Amplifier oscillator tubes. It is our policy to test out all tubes received, under actual operating conditions. They were absolutely the finest bunch of tubes we ever received. It is indeed a pleasure to be able to sit down and with a clear conscience write a letter stating that we are at last receiving really good tubes for the amateur." THE PRECISION EQUIPMENT CO., 2347 Gilbert Ave., Cincinnati, Ohio, by H. F. Brickel, Vice President.

A-P Tubes are licensed by the Radio Corporation of America under the DeForest Audion and Fleming patents for amateur and experimental use in Radio communication.



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AMPLIFIER-OSCILLATOR

—the amplifier used by the
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THE A-P
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—the most sensitive detec-
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TRANSMITTER TUBE
—an efficient undamped

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in radio-telephony. Price

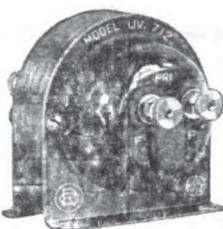
Order from your dealer or write direct. And for the best book on Radio ask your dealer for "Elements of Radiotelegraphy," by Lieut. Ellery W. Stone, U. S. N., or order direct from—

The Atlantic Radio Supplies Co. 8 Kirk Place, Newark, N. J.
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use A-P tubes for efficiency

THE NEW INTER-TUBE AMPLIFYING TRANSFORMER

Model
U. V. 712
Price \$7.00



For use with
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U. V. 200
and U. V. 201

After many months of experimental work the General Electric Company has produced an inter-tube transformer of exceptional efficiency. This is Model U. V. 712 which we take pleasure in introducing.

Experimenters who are troubled

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Write for our new special bulletin showing the use of amplifying transformer U. V. 712.



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| Turns | Wave Length | Price | LOW DISTRIBUTED CAPACITY |
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| 50 | 250-700 | .60 | |
| 75 | 400-900 | .65 | |
| 100 | 500-1400 | .70 | |
| 150 | 600-2000 | .75 | |
| 200 | 1000-2500 | .80 | |
| 250 | 1200-3500 | .85 | |
| 300 | 1500-4500 | .90 | |
| 400 | 2000-5000 | 1.00 | |
| 500 | 3000-6000 | 1.20 | |
| 600 | 4000-10000 | 1.40 | |
| 750 | 5000-12000 | 1.60 | |
| 1000 | 8000-15000 | 1.85 | |
| 1250 | 10000-20000 | 2.40 | |
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"RADIO'S BEST BUY"
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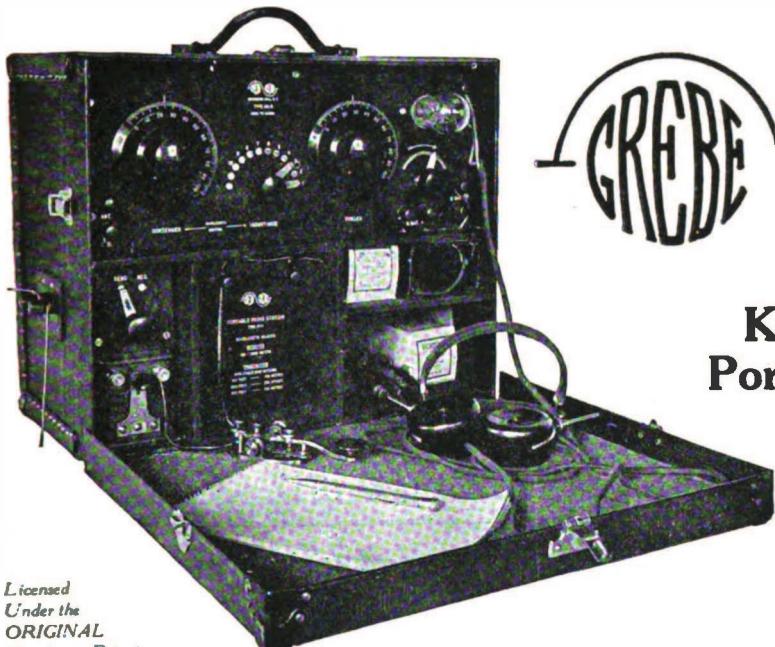
SIX Stages of audio frequency amplification!

See John Firth & Co.'s August advertisement.

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No need for you to shut up shop when Summer comes, that is, if you own a



Licensed
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At last here's the outfit that makes Summer radio work a pleasure.

Take it out into the country and send up a few hundred feet of antenna on a Grebe Radio Kite, and surprise yourself at its range.

Find out the range of your home station.

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KT-1
Portable

If you live near a body of water, procure a canoe or row boat and you have a ship station that sails under power of your kite.

Then, when Winter comes again, merely replace the CR-Regenerative Receiver in its cabinet and use it in your station for *real results*.

See it at your Dealer's, today!

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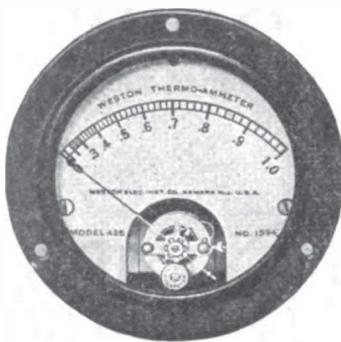
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Model 425 Thermo-Ammeter



Flange diameter, 3 1/4 inches
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to measure the radiation current and be certain that you are putting current into the aerial.

Model 425 is a small size instrument harmonizing with all other standard radio equipment. It possesses exceptional characteristics which make it the ideal instrument for radio service; its low power consumption allows the greatest possible energy to be put into the aerial; its 50% safe overload capacity is a protection against accidental burn-out; its size is conservative of space; it operates on either audio or radio frequencies.

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Offices in principal cities throughout the world.

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| DETECTORS | - | - | - | \$5.00 |
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We Stock a Complete Line of Acme, Clapp-Eastham, Murdock, DeForest, Moorhead, Remler, Grebe, Amrad, Baldwin, Burgess, and Apparatus of Many Other Makes.

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A Log-book for the Citizen Radio Station Operator, in which he can keep a complete record every day of stations heard and worked.
We can also supply an entirely new card system, one a plain postal card with your call letters printed on it, the other a double card, having a return acknowledgment postal for confirmation.

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RED-HEAD Radio 'Phones

Price cut from \$12.50 to
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At one Big Slash!

Buy Now---Profit by our
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IMPROVED 1921 MODEL
3000 Ohms

Latest and best we ever made

**HIGHER QUALITY AT A LOWER
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Newman-Stern sets the pace back to normal! The self-same Red-Head which literally swept the country and sold everywhere at \$12.50 are now yours for only \$8.00. They were admittedly the world's best buy at \$12.50; they have absolutely no competition at this new, low, bed rock price of \$8.00.

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Dealers: Write at once for our New Proposition on Red-Heads.*

We pay all transportation charges on ALL goods that we ship.

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**Complete
Postpaid to
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We rely upon the fairness of our customers. A refund or satisfactory adjustment will be made for any merchandise not found entirely satisfactory by you, its purchasers. You are to be the sole judge. Your decision will be ours.

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Being one of the very oldest firms in the country dealing in radio apparatus the best manufacturers have appointed us as their distributors. We list a few of the well-known companies we represent: Remier, Murdock, DeForest, General Radio, Amrad, Grebe, Acme, Federal, Radio Corporation, Magnavox, Burgess, Signal, Federal, Baldwin, Tuska, Corwin, Adams-Morgan.

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NAA (Arlington) tested minerals are the original tested crystals—absolutely the best that money can buy for radio detector and wave meter work. Exquisitely sensitive.

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On Radio Apparatus is now ready. Bulletins describing more complete and advanced equipment will soon follow.

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"77"



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Because GOOD "B" Batteries Make GOOD Business.**

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Small price—Popular size—tremendous PEP.
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C.W.—450 VOLT D.C. GENERATOR—C.W.
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Get your C.W. set working, fellows. This generator will supply all the high voltage D.C. you need. It's rated at 450 Volts, 400 milliamperes, or 180 watts at 3500 R.P.M., but will carry 600 milliamperes safely without overheating. The voltage will go up, of course, if you use less than the rated 400 milliamperes. A resistance must be used in the field circuit at all loads.

This generator is equipped with Fafnir ball bearings—a sign of the highest quality and a point not to be overlooked.

1/2 H.P. 110 VOLT, 60 CYCLE, 3500 R.P.M. MOTOR
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This motor is really underrated and can be used for all around work but is especially suited to be coupled directly to the generator described above. It also is equipped with ball bearings. These machines are made exclusively for us by one of America's best motor manufacturers and are guaranteed to be just as represented. This offer is a bargain. Judge for yourself. Dealers write for particulars.

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Ain't it a grand and glorious feeling

WHEN TRAFFIC IS DULL AND YOU SIT AND PUZZLE OVER WHAT KIND OF A TUBE YOU'RE GOING TO USE ON THE NEW CW AND RADIOPHONE SET.



WHY — SUDDENLY YOU HEAR A PHONE STATION CALLING 1, 2, 3, 4, ETC., AND THE Q.M. COMES IN VERY 'Q.S.T.' —



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AND HE TELLS YOU HE HAS A RADIOTRON — THAT SETTLES IT, DOESN'T IT?



*WITH APOLOGIES
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A power tube for every need



A Popular Size
Radiotron U. V. 202
Rated at 5 watts
Price \$8.00

Radiotron U. V. 202

5 WATTS—Price \$8.00

Filament requires 7.5 volts at 2.35 amperes. Plate requires 350 volts at .045 ampere.

Radiotron U. V. 203

50 WATTS—Price \$30.00

Filament requires 10 volts at 6.5 amperes. Plate requires 1000 volts at .15 ampere.

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Filament requires 11 volts at 14.75 amperes. Plate requires 2000 volts at .25 ampere.

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New model for use with 5-Watt Radiotron.

Radio Corporation of America

Sales Division, Commercial Department Suite 1803
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A few specials below reprinted from our catalogue. Right in stock, ready to ship!

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| No. MW-1 Radio Corporation $\frac{1}{2}$, 1, 1.5, 2 and 5 m. ohms, complete each | 1.25 |
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| Grid leaks only | .75 |
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Send ten cents in stamps for Catalog No. 22. Over 100 pages, over 150 illustrations, over 600 items.
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DEPT. A.

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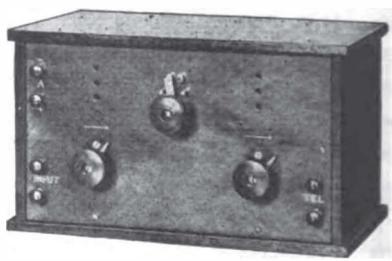


The "Miraco" Vacuum Tube Detector

The new "MIRACO" Detector contains features not found in others at double the price. There is ample space in the hinged covered cabinet for "B" batteries and additional binding posts on the back of panel enable the operator to connect them inside.

\$7.85
Postpaid.

Complete ready to use, only



The "Miraco" Two Stage Amplifier

The "MIRACO" Two Stage Amplifier is distinguished for its unusual amplification and quietness in operation. May be operated from same "A" and "B" battery used for your detector. But cabinet includes a shelf for additional "B" batteries for the amplifier. A switch automatically changes the circuit from one to two stages of amplification.

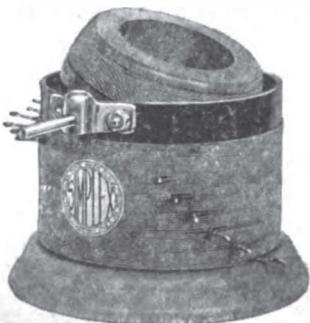
Complete ready to use, only **\$29.50**

These "MIRACO" units are ideal for radio-telephone and telegraph work during the static season.

Postpaid.

THE MIDWEST RADIO CO., Dept. E., 3423 Dury Ave., Cincinnati, O.

SIMPLEX VARIOCOUPLER



Price as illustrated \$6.00
Simplex Variometer \$6.00

This instrument is designed along the same lines as the Simplex Variometer. The Primary tube is of black polished formica, 4 inches in diameter, the secondary ball and base is of thoroughly seasoned natural finished wood. The windings are of the same size wire as furnished on the Variometer No. 19 cotton covered, and the Primary is tapped in two groups, one of single turns and the other of seven turns each, making it possible to secure any combination up to 49 turns.

These taps are all tinned ready for soldering to leads. Bearings are similar in construction to those furnished on the Variometer having the same contact springs. Furnished with a shaft long enough for panel mounting.

The Simplex Variocoupler when used with two Simplex Variometers, makes a combination above the average Regenerative Set.

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For the last few months we have been telling you of the "RESULTS" accomplished by the EASTERN RADIO INSTITUTE. This month we want to tell you of its "ADVANTAGES."

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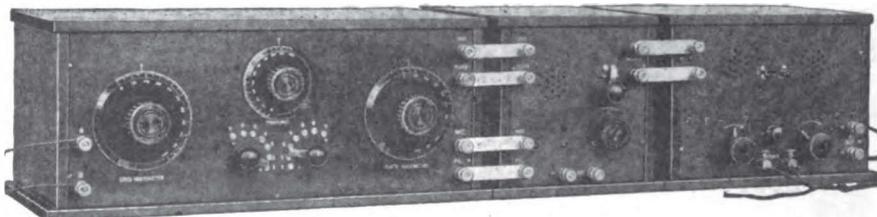
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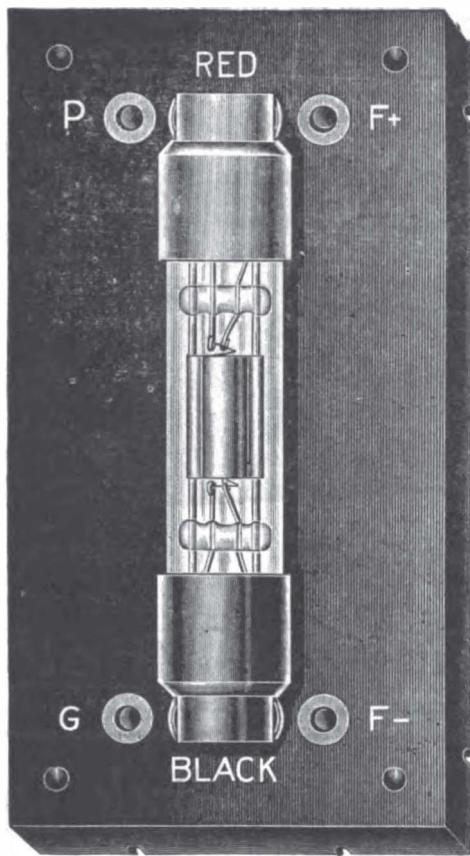
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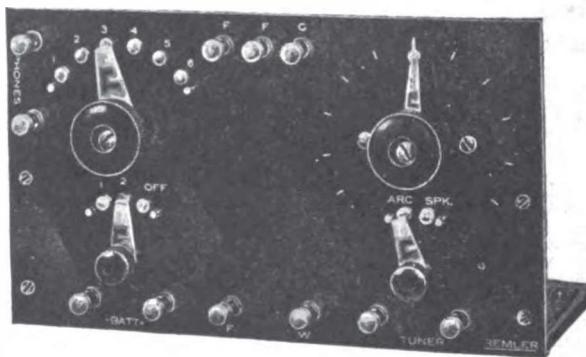
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Variometer, without dial..... \$4.50
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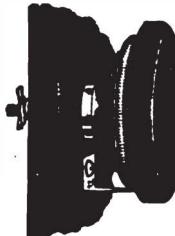
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We Originate Benwood Synchronous Gaps Others Imitate

The finest rotary quenched synchronous spark gap that has ever been produced.

Cut of this new complete unit not available for this issue but we list herewith several of the outstanding and exclusive BENWOOD features.

**SILENT IN OPERATION—VISIBLE SPARK—NEW TYPE GLASS
INSULATORS—REMOVABLE AND RENEWABLE POINT ROTOR
(exclusive feature pat. applied for)—3600 RPM. SYNCHRONOUS MO-
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By driving this gap 3600 RPM. enables the use of a

FOUR POINT ROTOR

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**A REAL GAP AT A \$60.00 (bakelite case)
PRICE YOU CAN AFFORD \$65.00 (Aluminum case) Write for Circular**

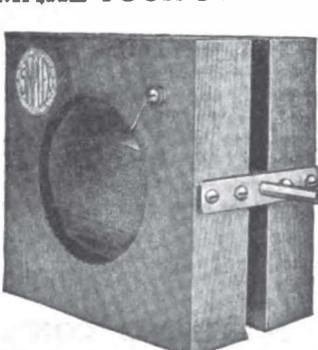
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Detector Panel \$9.50

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FIRST TRAIN TO THE
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And Oh Boy, that banquet will be one great affair!

Come along, fellows, and spend five of the happiest days of your life with a real live crowd at Chicago during convention week.

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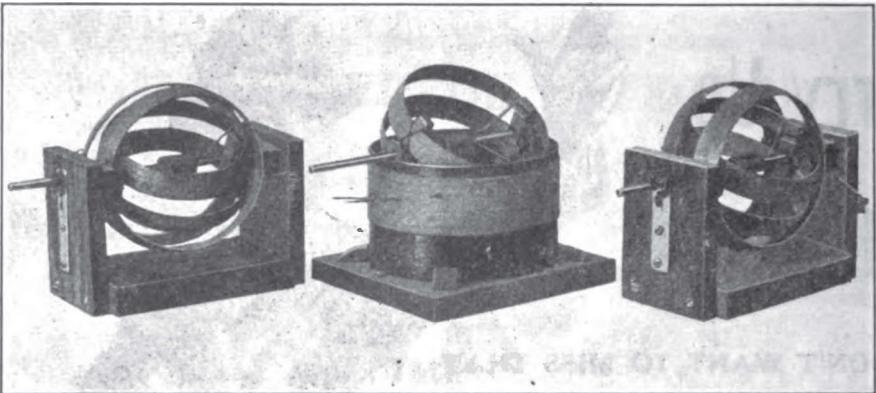
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Three New Ace Products

Type AVA Tuner.....\$45.00

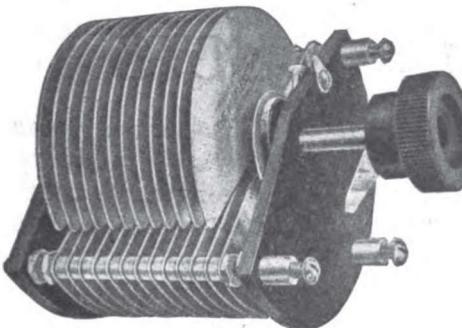
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WANTED-- The Name of
Every Radio
Man Who Has
Had Trouble With His C.W.
Condenser.

**This One Won't Give
Trouble.**

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We want every amateur who uses a variable condenser to know our product. Our new bulletin showing our entire line of variables will be mailed for the asking. Where shall we send your copy?

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PRICES:

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Regularly equipped with knob and pointer and mounting screws. A metal dial will be supplied instead of the pointer at 75c extra, or a high grade moulded bakelite knob and dial with graduations filled in white, will be furnished at \$1.00 extra.

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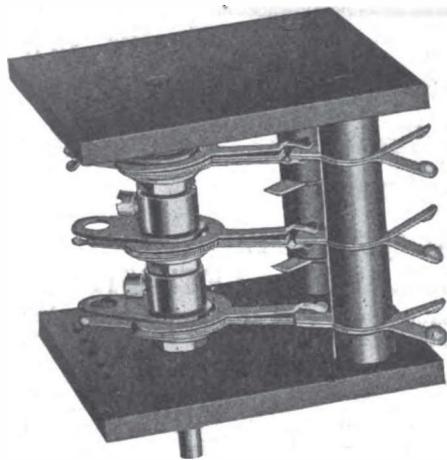
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Improved Spark Gap—entirely machined product. Provision made for interchangeable and renewable teeth. 9" O.D.—teeth 1/16" x 1" special aluminum alloy. XX grade bakelite insulation. See cut in June QST

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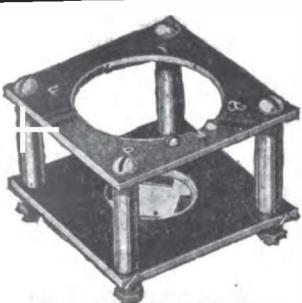
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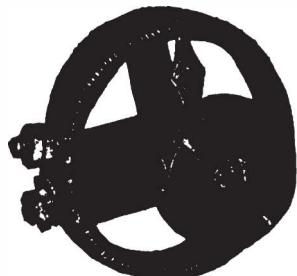


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BY departing from conventional design in audion sockets we have combined the advantages of all, the disadvantages of none and a price lower than any. Think of it—a sturdy, easily mounted socket that is heat proof, has bakelite-dielecto insulation, handy binding post etc., all for 75c.
HERE'S a smooth running rheostat
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Type 122 Rheostat
PRICE 90c. POSTPAID

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ROSE RADIO SUPPLY

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Ernest Thomson Seton, the naturalist, says Owls have the most sensitive ears known.

Brandes Wireless Receivers are more sensitive—an improvement on Nature. The two telephones are perfectly matched in tone and this exclusive Brandes feature adds force to the supersensitive mechanical tympanums.

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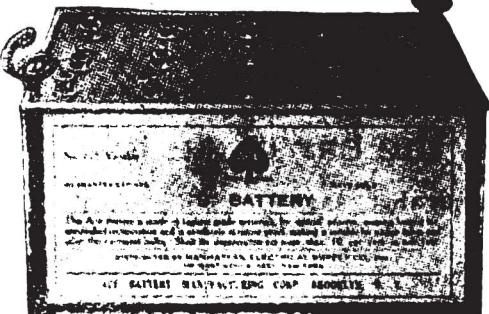
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Ace "B" Batteries

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Plain

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400

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1

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\$1.50

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F-F Battery Boosters are automatic and operate unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up.

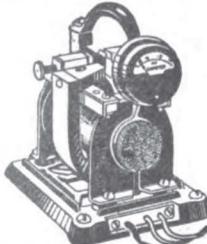
The ammeter shows you Service Station Service just the amount of current flowing. The full wave of current is rectified thru adjustable and easily renewable carbon electrodes which maintain a constant efficiency and last for thousands of hours. Everything complete on one compact, self-contained unit.

The F-F Booster is a Magnetic Rectifier for 105-125 Volt 60 Cycle Alternating Current. Bantam Type 6 charges 6 Volt Battery at 6 Amps. \$15 Type 18 charges 6 Volt Battery at 8 Ampères \$24 Type 166 charges 6 Volt Battery at 12 Ampères \$32 Also Boosters for 12 Volt Batteries at same prices

Shipping weights 10, 12 and 15 lbs.

Order from your dealer or send check for prompt Express Shipment. If via. Parcel Post have remittance include Postage and Insurance Charges. Will also Ship C. O. D. Also F-F Battery Boosters for charging batteries from Farm Lighting Plants, Direct Current Circuits and D.C. Generators. For Group Charging use the Full Wave Automatic F-F Rotary Rectifiers of 100 Volt 36 cell capacity. Order now or write today for descriptive Bulletin No. 31 or Rotary 31A

The France Mfg. Co. Offices & Works
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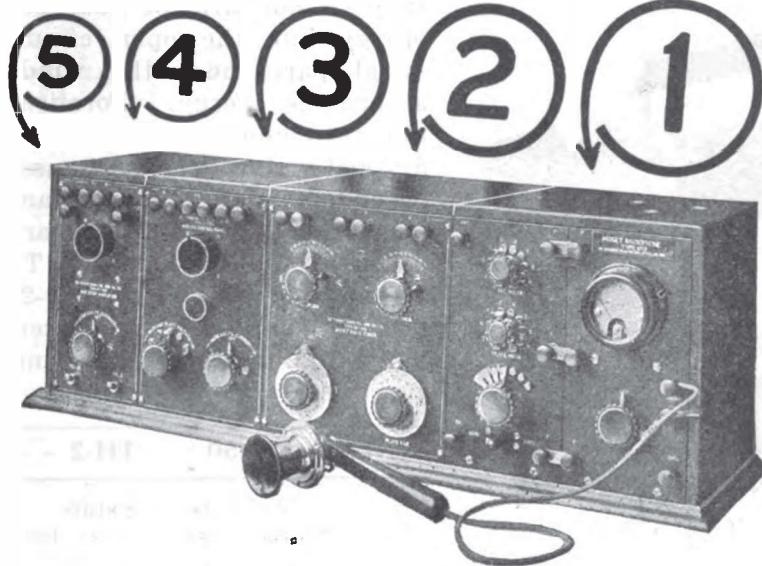
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If It's A Radiophone It's A DeForest Invention
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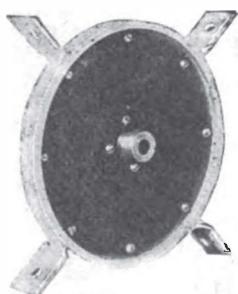
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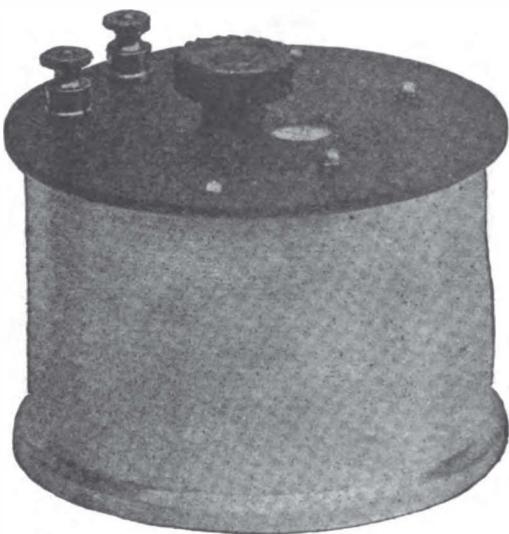
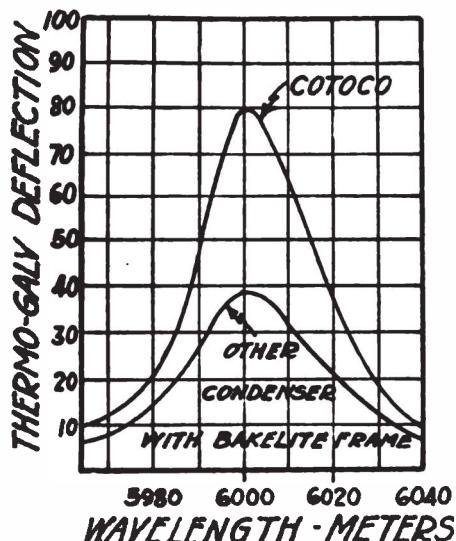


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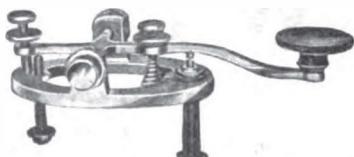


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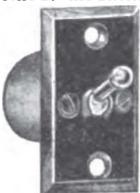
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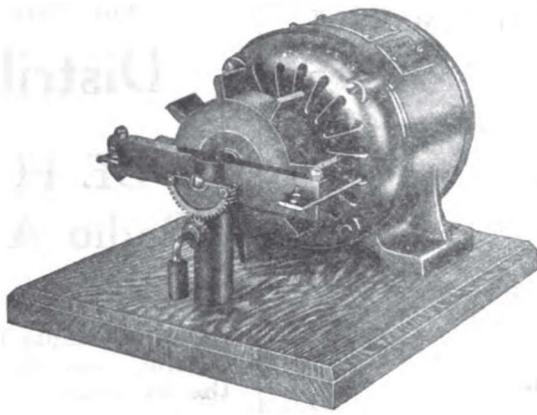
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J-RAY SYNCHRONOUS ROTARY GAP

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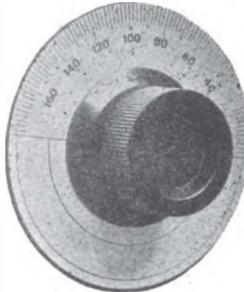
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Motor only \$45.00. F. O. B. St. Louis, Mo.**

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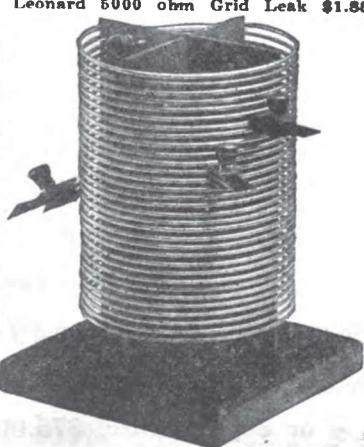
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Discovered: A cheap substitute for Mica Dielectric. Let us quote you on your 2000V. Test C. W. Condenser. 1800 V Grid Condenser .0005 MFD. \$1.00. \$2.25 Ward Leonard 5000 ohm Grid Leak \$1.88

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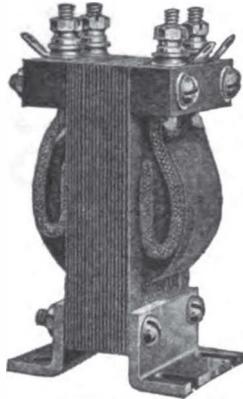
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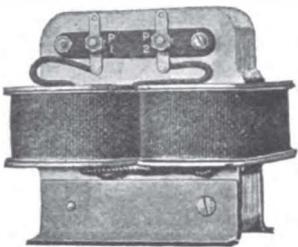


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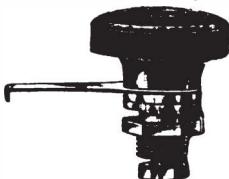
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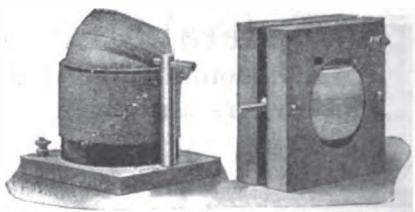
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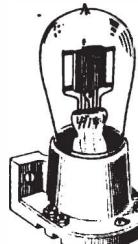
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FOR SALE: ½ K.W. Telefunken transmitter including motor-generator and accessories. Lester A. Pulley, Melrose, Mass.

NOW is the time to buy—New and Used Apparatus at special prices. Tell me what you need. W. Free land 34 Baldwin Ave., Newark, N. J.

FOR SALE: Complete regenerative audion panel with batteries, phones, etc. Works perfectly. Worth \$80. Will sell \$35. Write for full description. Denial Meyer, 9714 Lamont, Cleveland, Ohio.

BARGAINS! Few unused A. P. Tubes. Relays \$5.25, Amplifiers \$6.25, postpaid. Also two each Cunningham Tubes, unused, Detectors \$4.25, Amplifiers \$5.75, postpaid. Radio Sales Co. 251 Duboce Ave., San Francisco, Cal.

ALKALINE Storage "B" batteries give years of service without expert attention. Thirty two volts \$8; fifty volts \$10; sixty-eight volts \$12. Pictures and further information upon request. Kimley Electric Co., 290 Winslow Ave., Buffalo, N. Y.

FOR SALE: Murdock ½ K.W. Rotary \$10.25; Amrad ½ K.W. Quenched Gap \$12.25. Lawrence Kidd, 289 Broadway, Lawrence, Mass.

WANTED: 6 volt Amrad induction coil. Have Acme 500 watt and amp. transformer, C. W. generator, 0-5 H. W. Ammeter, all new. Geo. Neff, Jr., 68 N. Gore Ave., Webster Groves, Mo.

SPECIAL GARAGE MOTORS: Manufactured by the General Electric Co. 1 H.P. \$78.50—2 H.P. \$110.00—3 H.P. \$128.50—5 H.P. \$166.50. All sizes both single and Polyphase Motors for immediate delivery. Special charging generators all voltages. Write for catalog. Motor Sales Dept. 19, West End, Pittsburgh, Pa.

SELL: Complete ½ K.W. transmitter \$35. Regenerative cabinet \$10. Detector and 2 step with jacks controlling both A & B batteries, complete with bulbs and B batteries \$45. Two large automobile batteries fine condition \$15 each. Cap motor \$4. Also great lot miscellaneous parts. Printed list for 2c stamp. Hanes, Stroh, Ind.

SPECIAL GREBE OFFER. For a limited time we are supplying free of charge with each Grebe Type CR-3, Short Wave Regenerative Receiver the recognized standard among most all professional amateurs, your choice of a Paragon Vacuum Tube Control, a pair of 2000 ohm Murdock phones, Radiotron UV-200, VT Detector, or a Moorhead A-P VT Detector. Type CR-3, \$65.00. Only new and high-grade apparatus carried in stock. Orders filled within twelve hours. Unsatisfactory goods subject to return in five days. The Kohler Radio Laboratories, Department 3, Abilene, Kansas.

LOOK! Variometer-regenerative, \$19; 2-step amplifier, \$23; Western Electric phones, \$11; VT-1, \$6; VT-2's, \$8; 2mf. paper condensers, \$0.75; phone transmitters, \$0.90; tubular trons, \$5; Other stuff. Want camera. L. Peacock, 41 S. E. 7th St., Miami, Fla.

WANTED: C.W. apparatus. Sell ½ K.W. Transformer with preventers \$12.00. E. O'Neill, Downers Grove, Illinois.

FOR SALE: One K.W. 500 cycle self-excited generator; \$75.00. H. M. Warner, Great Notch, N. J.

SELL: or Swap ¼ K. W. Thordarson \$9.00, O. T. \$3.00, C.W. apparatus. Write for list. Henry Kulikowski, 483 Main St., Ansonia, Conn.

FOR SALE: 1 Grebe Audion Control Cabinet with tickler connections \$12. W'h Lub \$15. Hewey Jackson, Bower Springs, Kansas.

SELL: Vol. 5-6-7 I.R.E. Proceedings. Also back numbers of all Radio magazines.. W. A. Parks, Brookland, D. C.

SAY OM: Can save you money on apparatus and supplies. Handle all makes good apparatus. Prompt shipment. Radio orders given preferred attention. Send 2c stamp for printed list and prices. Hanes, Stroh, Ind. 9DBQ.

DeForest Radiophones A. C. Type O.T. with 3 Rect. tubes and 4 Radiotrons, \$1.50. J. C. Cox, 5130 Enright Ave, St. Louis, Mo.

FOR SALE: ¼ K.W. Thordarson transformer, \$13.00; Thordarson oil immersed condenser, \$13.00; both \$25. Also heavy O.T. and 2 K.W. United Wireless change-over switch. R. French, 1675 Pilgrim Pl., Akron, O.

DO WE? "Yes." We supply free of charge with each Radiotron UV 202 5 watt power tube (\$8.00) a special 5000 ohm size "M" grid leak (\$1.10), with midtap at 3500 ohms, and with each 50 watt Radiotron UV 203 power tube (\$30.00), a special 5000 ohm size "B" grid leak (\$1.65) with midtap at 2500 ohms. These grid leaks are designed and manufactured by the General Electric Co., for use with the Radiotron Power Tubes. Only new and high-grade apparatus carried in stock. Unsatisfactory tubes subject to return in five days. Orders are filled within twelve hours, and are shipped postpaid and insured. "Remember us." The Kohler Radio Laboratories, Department 3, Abilene, Kansas.

CABINET long distance set, battery, tube \$25. Navy transformer \$9. Large transformer \$10. Switches, Phones, Condensers, Write James B. Rich, Hobart, N. Y.

FOR SALE: One complete 15 unit DeForest receiving panel; includes crystal and audion detectors and 1 step. One complete set of Hawkins Electrical Guides. For full information Write Cramer La Pierre, Jackson, Mo.

FOR SALE: ½ K.W. type Thordarson Wound for 220 V 60 cycle \$20, Aluminum Enclosed Benwood \$25, (14 point), 220 V Westinghouse Induction motor 1/6 H.P. nearly new \$25. All letters answered R. E. Linthicum, 2013 Benning Rd., Washington, D. C. Radio 3KM.

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VARIOCOUPLERS WOUND on Bakelite tubes \$5.25. Variometers inside windings \$4.25. No. 22 DCC. Magnet wire \$0.30, ¼ pound, all sizes. Choke coils ideal for Radiophones. Oak Cabinets all sizes. Bakelite tubes and panels. Meade Bakelite and Radio Apparatus, 522 Central Ave., Brooklyn N. Y.

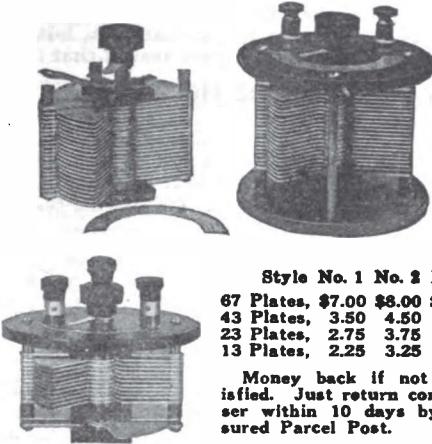
FOR SALE: closing down station. All parts and apparatus of telephone and spark sets also receiving set. including variables, transformers, rotary converter, tubes, storage battery, etc. W. S. Willis, 347 W. 14 Street, New York City. 2QM.

WIRELESS: The new Crosley V-T Socket, suitable for either base or panel mounting. Price only 60c.

(Continued on next page)

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The Condenser with "Star Spring" Tension
MADE RIGHT - STAYS RIGHT
Hard Rolled Aluminum Plates



Style No. 1 No. 2 No. 3
67 Plates, \$7.00 \$8.00 \$8.50
43 Plates, 3.50 4.50 4.75
23 Plates, 2.75 3.75 4.00
13 Plates, 2.25 3.25 3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

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Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3. Fully Encased Anti Profiteer. Less than pre-war prices. Fully assembled and tested. With Style No. 1, we will, if desired, furnish 3 inch metal Dial with large knob, instead of Scale and Pointer. Extra Price 75 cents. Or we will send Condenser with smooth $\frac{1}{4}$ " center staff, without Scale Knob and Pointer, at 15 cents off list, for those who prefer to furnish their own dial. Vernier with single movable plate applied to 13. —23. and 43. plate Condensers, \$3.00 extra.

Send Prepaid on Receipt of Price.

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c.

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SIX Stages of audio frequency amplification!

See John Firth & Co.'s August advertisement.

(Classified Ads., Concluded)

Also new variable condenser .0008 capacity. \$1.00 without dial. \$1.75 with dial. Also stock cabinets for radio apparatus and other specialties. Circulars on request. Crosley Manufacturing Company, Dept. Q.S.T., 1, Cincinnati, Ohio.

FOR SALE: Acme Transformer, Oil Condenser, Bemwood Gaps and large Oscillation transformer \$32.00. 8AAT.

25 Cycle $\frac{1}{4}$ and 60 cycle $\frac{1}{4}$ K.W. transformers, O.T. oil condenser, key. For sale by Alex. Darragh, Beaver, Pa.

BUILD YOUR OWN RADIOPHONE TRANSMITTER. 5-50 miles on B-Battery. Also radiophone receiver (instantaneous oscillator) no interference from spark transmitter, easily built at small expense. Detailed instruction and Diagram for Radio-Phone Transmitter \$1.00 for Radio-Phone Receiver \$1.00. Ernest C. Mignon, R. E. 366 Hudson St., Buffalo, N. Y.

FOR SALE: 2" Spark Coil A1 condition \$8.00. A. Grossboklin, 126 Humboldt St., East Rutherford, N. J.

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The Demand for Good Wireless Operators Far Exceeds the Supply

The New York Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by our Radio Expert, L. R. Krumm, formerly Chief Radio Inspector, Bureau Navigation, N. Y. Experts will impart their practical and technical knowledge to YOU in an easy, understand way. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished you will make it an easy to learn the Code as it was to learn to talk. All you will have to do, is to listen.

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185
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A COLOSSAL EVENT

The new RASCO catalog just off the press is one of the greatest events in amateur radio. There are many radio catalogs, but the RASCO catalog is an event by itself for the simple reason that it

Contains 50 Vacuum Tube Hook-Ups

This is the one and only radio catalog containing such wonderful free information. Complete hookups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few: The V.T. as a detector; detector and one-step amplifier; regenerative circuit; De Forest ultraduction; V.T. to receive undamped and amplitude-modulated signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuit; V.T. radio telephone; 4-stage radio frequency amplifier; two stage audio-frequency amplifier; coupling coil; coupling filter; Armstrong self-oscillating; radio frequency amplifier and crystal detector; C.W. transmitters; self-rectifying 2-tube C.W. transmitter; V.T. transmitter with 6 volt battery; radiophone using plate and grid modulation; one tube radio transmitter and receiver; experimental radiophone; radiophone using Octal oscillator circuit.

This list is only a partial one. You must positively see this wonderful book to appreciate it.

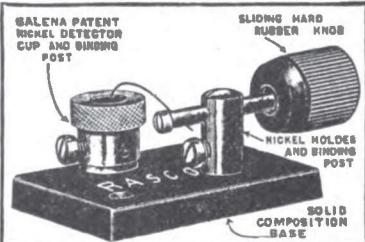
It is made to fit the pocket—has heavy covers to withstand the wear and tear which it is sure to have at your hands because it will be your constant companion.

And Oh! how things contained in this catalog! Lamp Nuts, Disk Knobs, Wire, Crystals, Litz Wire, Metalum, Ford Pipe Cap Nuts, Tin Foil, Name Plates, Spring Posts, Switch Parts, Metal Ribbons, Carbon Balls, Binding Posts, Switch Points, Knob Lever Carbon Grains, Metal Pointers, Contact Points, Lead Melting Metal, Carbon Diaphragma, Screws, Copper Strip, "Spaghetti," Name Plates, Sliders, Micro, Switches, Wire, Grounds, Resistors, Test Clips, Condenser Plates, Condensers, Antenna Connectors, Threaded Brass Bits, Ground Clamps, Etc., Etc.

The catalog contains 185 illustrations. On account of its great cost, this catalog cannot be distributed free of charge. It will only be mailed upon receipt of

15c in stamps.

THE RASCO "BABY"

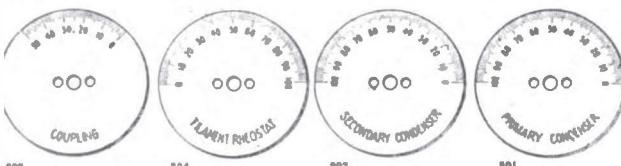


simply unscrew the knurled cap and insert your crystal into the stand, screw home the cap which leaves a goodly portion of the galena exposed. The contact is perfect, while the crystal can be easily removed from the stand. By slightly unscrewing the cap, the crystal can be changed in position, in order to explore other sensitive spots. The catwhisker is of phosphor bronze and is attached to the horizontal bar by means of a slotted head screw. Can be readily exchanged in less than two seconds. Wires can be connected to the binding post in a jiffy. All metal parts are nickel plated, and you will be proud of this little masterpiece.

No. 1390 Rasco Baby Detector complete with galena crystal, prepaid..... 50c

No. 1399. The same but furnished with an additional piece of tested radioisotope crystal, prepaid..... 75c

Ready for distribution June 30th.



RASCO DIALS

Again Rasco is setting the pace. Here are our new Rasco Dials. A variation in every respect. These dials measure 2 1/4" diameter and are made in heavy brass. They have two extra holes to fit our No. 139A. B Knobs (see last month's advertisement). The finish is silver white, lettering in black enamel, inside. There is nothing on the market like them. In fact, we have very few radio dials left. This is particularly true as we make six different types with following denominations: "Plate Variometer", "Primary Condenser", "Secondary Condenser", "Filament Rhombal", "Coupling", "Grid Variometer."

No longer do you have to guess what each dial on your set stands for, as each one is now mainly marked. Order by number. Large Dial 3/4" size. The smaller illustrations are only given to show style.

Prices all styles prepaid ea. 30c

A series of 6 dials complete prepaid, \$1.70

Please compare these dials with some other makes as there is positively no comparison between them. Must be seen to be appreciated. Money back if not satisfied.

DEALERS' GET OUR SPECIAL PROPOSITION

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Did you see our full page ad in the May issue? We received a good deal of criticism but we actually received orders. It appears that many goods are wanted. In one week we filled over 500 orders and each and every order was shipped within 24 hours! Surely a record. We even filled orders for articles not listed. Our prices are low—our service the quickest—and your small order is never overlooked. All our orders are small. One trial order will make you a life customer. Try us with a \$50 order. We can only "stick" you once!



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EVERY ORDER
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24 HOURS.**

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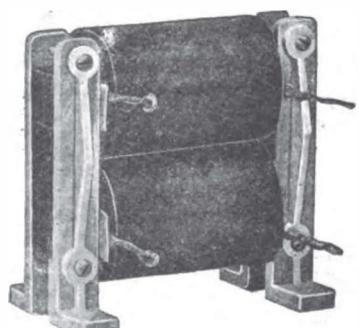
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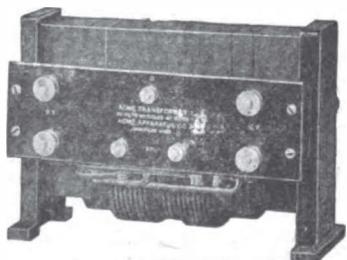
ACME APPARATUS



C.W. Power Transformer



1 1/2 Henry Choke Coil



Filament Heating Transformer

*The Apparatus with a
Guarantee.*

C. W. Power Transformers

For use with rectifying devices or for A.C. directly on the plates of power tubes.

Specifications 110 Volts 60 Cycles

| Output | Filament voltage | Filament current | Plate voltage | Plate current |
|--------|------------------|------------------|-----------------------|---------------|
| 50 | 10 | 2.5 | 350 | 100 |
| | | | Two filament windings | |
| 200 | 12 | 5 | 250-550 | 200 |
| | | | Two filament windings | |
| 500 | 0 | 0 | 1000-1500 | 400 |
| | | | No filament windings | |
| 600 | 12 | 13 | 1000-1500 | 400 |
| | | | One filament winding | |

1 1-2 Henry Choke Coils

For use in ironing out pulsations and for modulating single and double 150 MA capacity.

Filament Heating Transformers

allow the use of A.C. for power tube filament heating

Specifications 110 Volts 60 Cycles

| Output | Secondary voltage | Secondary current |
|--------|-------------------|-------------------|
| 75 | 8-10 | 7 |
| 150 | 10-12 | 13 |
| 300 | 10-12 | 26 |

Modulation Transformers

give maximum modulation without distortion.

*Your Dealer will be Glad to Show These.
Ask for Bulletins.*

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Transformer and Radio Engineers and Manufacturers

CONNECTICUT RADIO



You'll get the best out of your station
by using a
CONNECTICUT Variable Condenser



Others are doing it and find greater improvement. Finer tuning, sharper signals, more secure adjustments, all go to make this new Condenser the ideal instrument for getting the maximum possible results out of your station.

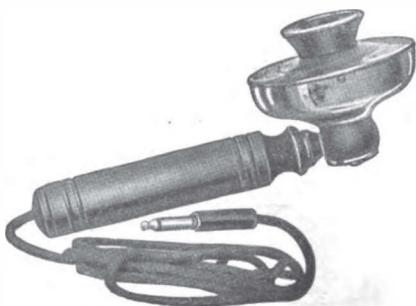
Furnished either as a portable or with flush plate for panel mounting. Packed with full instructions, for **\$6.50**, F. O. B. Meriden.

Send for our instructive illustrated booklet on the Condenser.

Hand Transmitters

Here is a new grade Radio Transmitter designed particularly for radio use and meeting perfectly all requirements. In every respect a quality product. The short mouthpiece fits it admirably for use at the operator's desk.

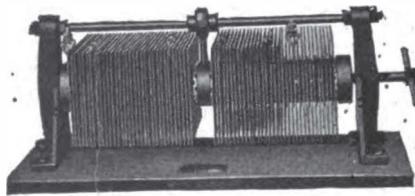
Specially priced at **\$11.**



CONNECTICUT TELEPHONE & ELECTRIC COMPANY
Meriden Connecticut



The Recognized Symbol of Superior Performance



TWO messages East, one message West, were relayed from Coast to Coast on Feb. 15th over the Amrad Transcontinental Line which consists solely of Amrad Gap stations. The lack of a nation-wide appeal to prevent QRM, the prevalence of heavy QRN in the East and the exclusive use of regular stock Amrad Quenched Gaps make this relay a unique bit of Radio History. 1XT, 2PL, 3VV, 8ML, 9PV, 9AFX, 5ZA, 6GE, 6DK and FD handled these messages, one of which covered the continent in four jumps, in less than 30 minutes. Critics who declare the Amrad Gap useless on 60 cycles and the hundreds of Doubting Thomases created by these critics are invited to send for our latest Bulletin Q which gives all the facts backed by actual proof. Here are a few Quenched Gap advantages:

¶ Absence of Noise: You can transmit all night and disturb no one. No vibration. Simply a purr.

¶ Freedom from Trouble: With our new leak proof gaskets, good for 3 months operation, you set up the gap once and forget it. No adjustments. One set of these new gaskets given free to Amrad Gap users who send gap number and 10c. postage.

¶ Sharpness of Wave: Used with an insulated counterpoise the decrement is very low. Your signals cause minimum QRM.

¶ High Antenna Energy: Very close coupling only can make this possible. Using an Amrad Gap the tighter the coupling the sharper the wave.

¶ High Amplitude: You must use a high voltage transformer to get maximum output at 200 meters. A high voltage transformer in turn produces maximum output at low spark frequencies. The 60 cycle note recommended for the Amrad Quenched Gap creates greater energy per wave train than any higher spark frequency regardless of type g used.

¶ Service: Our aim is to satisfy every present and future user of the Amrad Quenched Gap. We ask you to read carefully the peculiarities of quenched gap operation first; then buy with a willingness to follow our directions to the letter. Properly operated the Amrad Quenched Gap is the IDEAL gap; improperly operated it is not. Correct operation is just as easy as incorrect operation.

THE AMRAD TRANSCONTINENTAL LINE

1XE, 1OJ, 1EAV, 1XT, 1TS, 2PL, 3VV, 8FK, 8ML, 9PV, 9CS,
9BY, 9AFX, 5ZA, 6GE, FD, 6DK.

Inquiries invited from Amrad Gap operators desiring appointment
on the line.

AMERICAN RADIO AND RESEARCH CORPORATION

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NEW YORK

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to "Medford Hillside, Massachusetts"

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