MARCH 12

New 4-Tube Universal

15 CENTS

RADIO WORLD

REG. U.S. PAT. OFF.

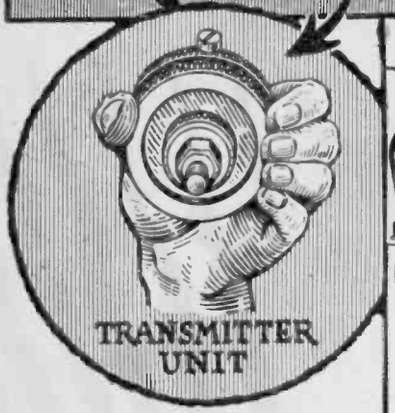
10 Motorboating Cures

Why Amplify Low Notes?

Value of Neat Wiring

THE 4-TUBE UNIVERSAL RECEIVER IN THE COURSE OF CONSTRUCTION

Thousands of Radio Fans use these Ingenious TRANSMITTER UNITS!



Here's a marvel of Engineering design — a practical miniature transmitter, used by thousands of radio fans and experimenters for amplification purposes.

It is a most novel unit, having hundreds of uses. Every amateur should have two or three of these amplifiers in his laboratory.

With each unit is mailed an eight-page instruction pamphlet. It shows how to use these units.

Our supply is limited; avoid disappointment by ordering today. The coupon below is for your special convenience—just fill in your name and address, mark in the number of units you desire, enclose the necessary amount and we will ship them to you at once postpaid.

SPECIALLY PRICED

WHILE THEY LAST

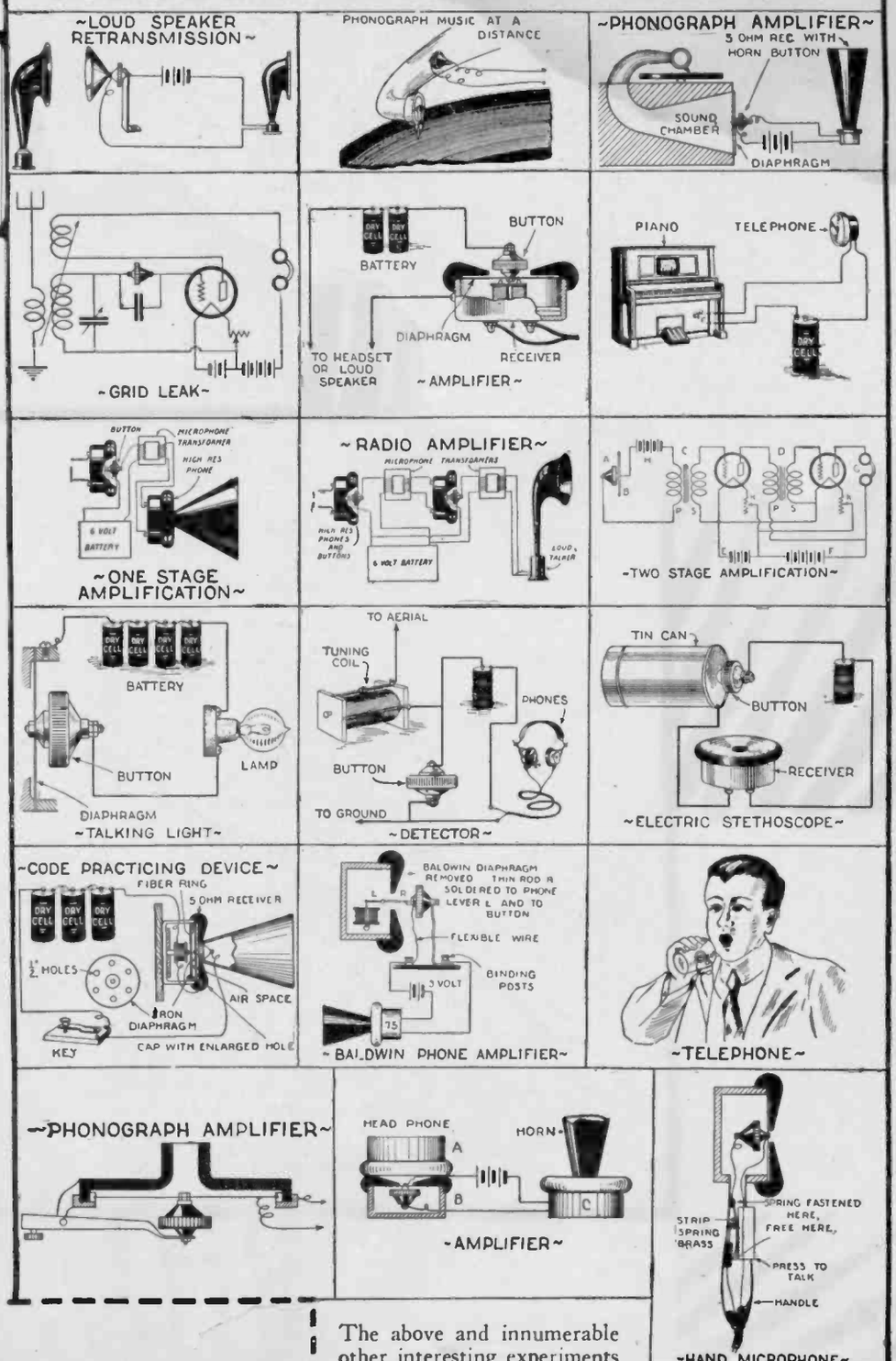
95c PER UNIT

OR TWO FOR $1.75

THE PRESS GUILD
66 W. Broadway, New York, N. Y.

ORDER BLANK

HERE ARE A FEW OF THE USES FOR THESE UNITS



THE PRESS GUILD,
66 West Broadway, New York, N. Y.

Enclosed find 95c / $1.75 for which send me postpaid one / two amplifier units as advertised.

Name .....

Address .....

City, State .....

R. W. 3

The above and innumerable other interesting experiments are possible with these amplifiers. Every amateur should have at least one or two in his "Lab" or workshop. An eight-page instruction pamphlet is sent with every unit showing scores of experiments.

Vol. X
No. 25
Whole No. 259
MARCH 12, 1927
15c Per Copy. $6.00 Per Year

RADIO WORLD

A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 145 W. 45th Street, New York, N. Y.

Phones BRYant 0558 and 0559

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March 3, 1897]

Let the Low Notes Through!

Amplify Them, As Cones Bring Them Out

By C. Jerome Cary

AS a justification of faulty design of radio equipment, some persons give very queer arguments. A case in point is the justification given for using a small stopping condenser and a low value of grid leak in resistance and impedance coupled amplifiers. It is admitted that when the stopping condenser has a low capacity or when the grid leak has a low value, the low notes are suppressed. But some deem it desirable for reasons of economy and convenience to use low values. Hence they are used despite their depressing effect on the low notes. The justification given is that since no loud speaker, even the best cone, is able to bring out the very low notes, it is useless to design the set so that the low notes are amplified. Now is not that a silly argument! Suppose we extend the same reasoning.

A little tin horn loud speaker is not able to bring out any notes below 1,000 cycles, so what is the use of designing amplifiers to bring out any notes below that frequency! Further, a very selective set will suppress the high audio frequencies, as will necessary by-pass condensers, and since selectivity and by-passing are both necessary, what is the use of designing the audio amplifier so that the high audio notes are brought out!

Should Not Suppress the Low

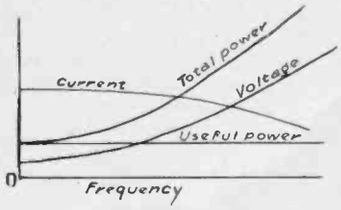
Still further, since radio is primarily entertainment, and since a receiver which is only able to bring out a 1,000-cycle note would be too monotonous to be entertainment, what is the use of designing an audio amplifier to bring out the middle tones! All this brings the necessary conclusion that it is useless to design an amplifier to bring out any notes.

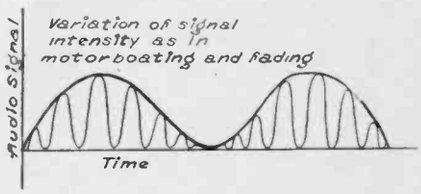
The fact that a reproducer does not bring out the low notes so well is the strongest reason for designing the audio frequency amplifier so that these notes will be brought out stronger than the high, if that is possible, so as to compensate in a measure for the deficiency of the speaker. Certainly there is no sense in suppressing the much-to-be-desired low notes in both the speaker and the amplifier.

Another fact about the cone speaker is that it is not so deficient on the low notes as some assume. It has got this reputation from the fact that it has been so often connected to amplifiers which did not deliver any low notes to it. Give the cone speaker a chance and it will do very well on the low notes, and under equal conditions it will do much better than any other type of speaker.

Why Notes Are Fairly Even

Another reason for the opinion that the cone speaker will not bring out the low notes is based on theory. On low notes the impedance of the speaker is too low to match that of the tubes ordinarily used for feeding it, and consequently the energy transfer on the low notes is not so favorable, apparently, as on the high notes. But it must not be forgotten that there is a phase angle to be considered. The only energy that is of any value is that which goes out into the air. There are two components of energy in the speaker; one wattless and one wattful. It is only the wattful that counts. On high notes the energy in the load is high but the proportion of the wattful energy is low. On the low notes the total energy is low, but nearly all of it is wattful. Hence when the outputs of the speaker on high and low notes are compared in the air, there is not much difference. The ratio of the wattful energy to the total energy is known as the power factor, or as the cosine of the phase angle between the voltage across the speaker and the current through it. The greatest value that the power factor can have is unity, and this it very nearly has on the lowest audio notes. The smallest value of the power factor is zero, and this value it approaches on the highest audio notes. If this were not so there would be a tremendous difference between the volumes at high and at low frequencies, the low being the greater. But fortunately the output is quite uniform over the audible scale.





THE CURRENT CURVE decreases as frequency increases because the total impedance in the circuit increases while the total voltage remains constant. The curve for voltage across the load rises as the frequency increases because the impedance of the load increases more rapidly than the total impedance in the circuit. The total power in the load increases up to the point where the load impedance equals that of the tube, then falls slowly. The wattful component of the output power decreases slowly as the frequency increases. In slow frequency oscillation or motorboating of a radio set (diagram at right) the strength of the signal rises and falls periodically and regularly. It resembles very closely fading phenomena. The signal may be stopped completely at the troughs of the waves as shown in this diagram. The similarity of the two phenomena is brought out in a startling manner when viewed with a cathode ray oscillograph.

Beginner's Dictionary

Watt—The unit of power in the electrical system. The size of this unit is such that 746 watts is equal to one horse-power, or approximately, ¾ of one kilowatt is one horse-power. The wattage in an electrical device is obtained by multiplying the current in amperes by the voltage in volts. Thus if the current flowing through a heating device is 6 amperes and if the voltage across the resistor when that current is flowing is 110 volts, the power dissipation in the heater is 660 watts.

Wattless Power—When there is reactance in the circuit there is a difference in phase between the voltage and the current. The total power is still defined as the voltage times the current but since the voltage and current are not in step a portion of the total power is not dissipated in heat or in useful work. That portion is called wattless, though it is still measured in watts.

Wattful—If the phase difference between the voltage and the current is less than 90° a part of the current is in step, or in phase with the voltage. It this part of the current is multiplied by the voltage the useful wattage is obtained, which is dissipated as heat in the device or is converted into useful work. This part is sometimes termed wattful power just to distinguish it from the wattless component.

Power Factor—The numerical ratio between the wattful power and the total power is called the power factor of the circuit or device. For pure direct current the power factor is always unity. In a series tuned circuit the power factor is also unity for the frequency at which the circuit is in tune. Also in a parallel tuned circuit, such as is used to input radio frequency amplifiers, the power factor is also unity provided that neither the coil nor the condenser have any resistance. A perfect tuning coil has a zero power factor as has a perfect tuning condenser. This means that nearly all the power is wattless. The condensers ordinarily used in tuning are very close to "perfect" while the coils, even the best, deviate much more from perfection. A circuit in which both the coil and the condenser are perfect, could such a combination exist, would be useless in a radio receiver because it would be too selective.

IR Drop—The IR drop in a resistor or coil is the fall of potential or drop in voltage in the device because of dissipation of energy in the resistance of the device. Thus the IR drop in a common lamp which is connected directly to a 110 volt line is just 110 volts, since the difference in potential or voltage between the two ends of the filament is 110 volts. The numerical value of the IR drop is obtained by multiplying the current by the resistance, according to Ohm's law. The IR drop multiplied by the current is the wattful component of the power in any circuit.

The Ten Tell-tale Points
Concerning Motorboating In AF Circuits

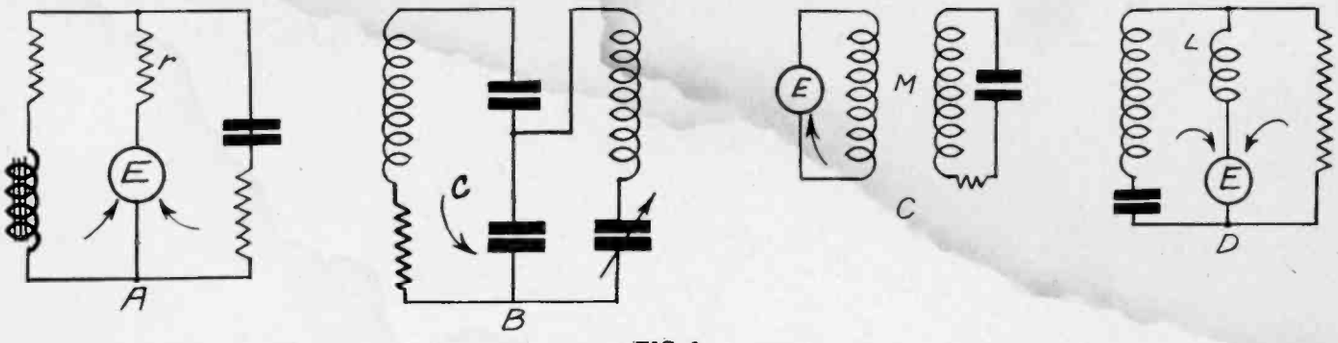


FIG. 1

Simple examples of common impedances. In A the resistance r, which represents the resistance of the voltage source E, is common to the two circuits connected across the source. In B there is a condenser C in common with both the circuits, and the reactance of this condenser is a common impedance. In C there are two apparently separate circuits, but the mutual reactance represented by M constitutes a common impedance. In D there is an inductance coil L, the reactance of which is a common impedance between the two circuits connected to E.

By J. E. Anderson

Consulting Engineer

THE low frequency oscillation in amplifiers which has been called "motorboating" is caused by regeneration through an impedance which is common to two or more plate circuits, or two or more grid circuits, in an audio frequency amplifier.

This low frequency oscillation is generically the same thing as the audio frequency squealing which used to give trouble in reflex and other transformer coupled circuits; it differs only in frequency. While the direct cause is a common impedance, a necessary concomitant cause is amplification. For a given common impedance the circuit will oscillate provided that the amplification is high enough; and conversely, for a given amplification the circuit will oscillate provided that the common impedance is great enough and has the proper characteristics.

As a rule a circuit in which there is an odd number of plate circuits on a common impedance will oscillate, if at all, at low frequencies, and a circuit in which there is an even number of plate circuits on a common impedance will oscillate at high audio frequencies. A circuit which is of the type that oscillates at high frequencies is stable at low, while a circuit which oscillates at low frequencies is usually stable at high. Simpler circuits are either stable or unstable over the whole of the audio scale.

Odds and Evens

Those circuits which oscillate or squeal at high audio frequencies do not give much trouble, because the reason for the trouble in all cases can be removed very easily by means of a shunt condenser of moderate size across the common impedance. The rule above in reference to the behavior of odd and even circuits applies to resistance and impedance coupled amplifiers and to some types of connection in transformer coupling.

If the above rule does not seem to apply in a given case it is well to examine the circuit carefully to make sure that the troublesome section of it has been correctly classified as to oddness or evenness. It is quite possible that a common impedance in an even amplifier is negligible while the common impedance in three plate circuits of the same amplifier is high, so that in effect the circuit is really odd, though it might have been classed as even and stable. Such possibilities are often met with in amplifiers fed with B battery eliminators supplying different voltages to the various audio tubes. For the purpose of classifying the circuit as to its evenness or oddness, the detector is to be regarded as one of the audio tubes.

Now that a blanket indictment has been found against the common impedance as the cause of oscillation in an amplifier let us examine some of the circuit factors that affect the oscillation and try to discovers some means of reducing the trouble.

Separate Batteries

No. 1—The cure of any trouble is the removal of the cause, hence low frequency oscillation in an amplifier may be stopped by removing the common impedance. But the only way of completely removing the common impedance is to use separate batteries or separate eliminators for all the plates in the audio amplifier. This is not an economically practical solution. The next best thing is to reduce the common impedance as much as possible. Just to the extent that we are able to reduce the common impedance by practical means to that extent are we able to solve the problem of motorboating. But the solution is not simple economically in the better designed amplifiers. That is, it is not easy to stop the low frequency oscillation and at the same time retain the amplification at the low frequencies.

Low Resistance Batteries

No. 2—The simplest way of reducing the common impedance at all frequencies is to use a storage battery for all the tubes in the set. The impedance of such a battery is a pure resistance and its value is negligible. The next best solution of the problem is to use a battery of strictly fresh dry cells for the plate supply. This must be discarded for a new battery as soon as the trouble starts, which in some cases it will do as soon as the cells have been given the regular period of use.

Large By-Pass

No. 3—The only practical way of reducing the common impedance is to connect a large by-pass condenser across it, and that method is effective unless the frequency of the oscillation is very low, say below the lower limit of audibility. For the lowest frequencies this cure for the trouble becomes unpractical for economical reasons. It requires too large a condenser. This method should be the first one tried in the great majority of cases.

All other methods of stopping low frequency oscillation of the motorboating nature depend on changing the circuit from odd to even, changing the frequency at which the oscillation takes place, on reducing the amplification at the frequency at which the oscillation occurs, or on introducing phase changes into some of the circuits so that they are ineffective in aiding or opposing the oscillation. There are many ways of making these changes.

Plate Separation

No. 4—A circuit may be made even from odd by putting one of the end tubes, either detector or last tube, on a separate source of plate potential. This is most readily applied to the detector, since that may be fed from a single block of dry cells while the power tube requires more.

Filtered Detector Output

No. 5—The circuit may also be changed from odd to even by using a very high inductance choke coil in one of the end tubes and passing the AC component direct to the filament through a series condenser and the load. This is usually done in the case of the last tube when it is desired to protect the speaker windings from the heavy DC in the plate circuit of the last tube. Whether this method is used in the last or in the detector plate circuit, the inductance of the choke coil and the capacity of the series condenser must both be very large, or no great improvement will be noticed at the lower frequencies of oscillation. This method is more effective on the last tube than on the detector. If this method is applied to one of the interior tubes the result may be either a greater tendency to oscillate or to stop the oscillation, depending on the nature of the circuit and the position of the tube in which it is applied. To illustrate what inductance is necessary in some case to alter the circuit effectively, a 50 henry coil in shunt and 10 microfarad condenser in series with the speaker did not appreciably change the intensity nor the frequency of motorboating. A choke coil of about 500 henrys and a condenser of 8 mfd. completely stopped the oscillation in the same circuit.

Audio Choke

No. 6—Sometimes an audio choke is put in series with the coupling impedance or coupling resistance with favorable results in an unstable circuit. Two things

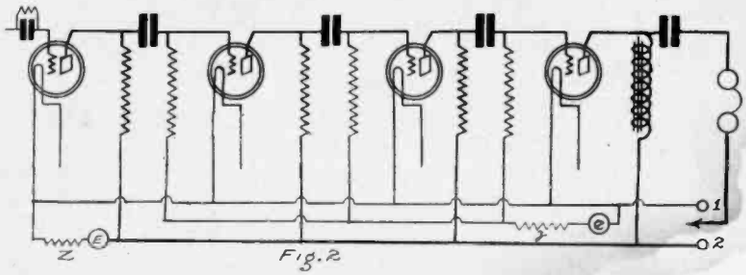


Fig. 2

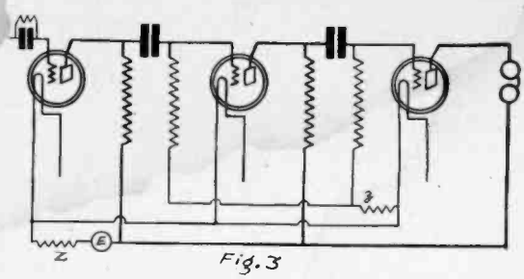


Fig. 3

Fig. 2 shows a typical amplifier circuit in which there are common grid and plate impedances. Z, which is in series with the plate voltage source E, is common to all the plate circuits, while z, the impedance in series with the grid bias source e is common to three of the grid circuits. The circuit may be either even or odd according to the frequency and the connection of the speaker. When the speaker return is connected to point 2, the circuit is even and stable. When the return is connected to point 1 the circuit is odd and unstable for high frequencies, but for the lowest frequencies it is even and stable. The criterion is the relative values of the impedances of the two parallel circuits. When the detector is placed on a separate source of B power the circuit becomes odd and unstable for low frequencies. Fig. 3, is a typical amplifier circuit which is odd and unstable. It will oscillate on very low notes and is most difficult to control. The circuit may be controlled by varying the common grid impedance z, but this is accompanied by a reduction in volume.

are responsible for the improvement. In the first place the coupling impedance is increased so that the common impedance becomes a smaller proportion of the total impedance in the plate circuit in which the choke is placed. Feedback into this stage is thus cut down. In the second place the phase of the current in the circuit is changed by the added choke coil so that any feedback from the other plate circuits is rendered less effective in aiding oscillation. This method is naturally more effective in an impedance coupled circuit since the resistance in series with the coil is less and the change in the phase angle is greater. If the motorboating frequency is very low it is useless to try to insert a low value inductance coil. It should have much more than 100 henrys.

Higher Plate Resistor

No. 7—Sometimes in resistance coupled circuits motorboating will stop if the plate coupling resistor is increased or if another is added in series with it. The effect here is, like in the preceding case, to make the common impedance a smaller proportion of the total impedance in the plate circuit operated on, and thus to decrease the feedback.

Reduced Plate Voltage

No. 8—Sometimes the reduction of the plate voltage will stop the motorboating. Relative changes in the values of the common and the total impedances in the plate circuit are responsible for the improvement. Reducing the plate voltage will increase the plate resistance of the tube and at the same time it is likely to reduce the actual common impedance. The amplification also is reduced by the change in the voltage and that in turn increases the common impedance that must be present to cause oscillation.

Small Stopping Condensers

No. 9—One of the simplest methods of stopping motorboating at the lowest frequencies in direct coupled circuits is to use a small stopping condenser in the grid circuits, because the stopping condenser suppresses the low frequencies to such an extent that the common impedance is not high enough to cause amplification. This method is much resorted to because small condensers cost less, require less space in the set, and are not so likely to leak as the larger condensers. But the set is not a high quality set when this method of stopping the trouble is used. The low notes do not come through. They can't be stopped in the amplifier and be effective in the loudspeaker at the same time.

Low Grid Resistances

No. 10—A method which accomplishes exactly the same effect as using a small stopping condenser is to use a low value of grid leak. This is even simpler than the other, since many values of grid leak may be tried without any rewiring. Hence a leak which will just stop the trouble may be selected. But before this value has been found the low notes have been suppressed to an extent which will take the receiver out of the quality class and put in the mediocre. If there is any difference between No. 9 and No. 10, the shade of advantage is in favor of No. 10, since that not only reduces the amplification on the low notes but reduces it on all the notes to a certain extent. The condenser method is slightly more discriminatory.

Capacitative Impedance

A standard four-tube resistance coupled amplifier (counting the detector) in which the reproducer is connected directly into the plate circuit of the last tube, which plate is supplied by a common source of plate power, is stable on all frequencies provided that the common impedance is capacitative. If it is inductive it may oscillate at a high frequency, say around 2,000 cycles, as can easily be verified by removing the by-pass condenser across the output of the filter. When this is removed the common impedance becomes inductive, and then the four-tube circuit in question is unstable at higher frequencies.

The best way of stopping motorboating is to reduce the common impedance by by-pass condensers or by decreasing the resistance and inductance of the filter system or both. This will stop the motorboating without at the same time cutting down the amplification. An even circuit is stable even with the high common impedance, but this impedance considerably cuts down the amplification and is not conducive to best quality. But cutting down of the impedance of the filter system cannot be carried to the extent where the AC hum will come through.

Biasing Resistor

In many circuits the grid bias is obtained from a drop in a resistance which may be common. This common impedance in the grid circuits may have similar effects on the amplification. It may either cause the circuit to be stable or it will cause motorboating exactly the same as the common impedance in the plate circuits. This might be verified by putting a variable resistance of high value in series with the grid biasing resistor in a set thus biased.

If the circuit motorboats by virtue of a common impedance in the plate circuits it can be stopped by inserting a resistance in the grid circuits, or vice versa, that is, oscillation of low frequency may be induced by putting a high enough resistance in common with the grid circuits. From phase relations and appearances it would seem that the same rules as to even and odd circuits would apply to the grids as well as to the plates, but calculation and experience indicate that the reverse is true. This is now being investigated.

One interesting fact in this connection is that when a receiver is motorboating by virtue of a common plate impedance it may be stopped by opening up one or more of the grid circuits. One effect of doing this is to make the common grid impedance very great. It does not seem to affect the operation of the amplifier tubes for some time after the circuit has been opened, except possibly to improve the output. The stability and the improvement are not permanent for obvious reasons. The grid stopping condenser will not hold the correct negative charge which it has just prior to opening and the bias gradually goes positive by leakage.

It is obvious from the above that low frequency oscillation in an amplifier, caused by a common impedance in the plate circuit, may be remedied by inserting a suitable value of resistance in a suitable manner in the common branch of two or more grid circuits.

Uniform Reduction

The effect is probably to reduce the amplification to an extent sufficient to stop oscillation, and nothing particularly is gained by using this method over some of the others. Since the required resistances involved are quite large it is possible that the reduction in the amplification is uniform over the entire audible scale and is not appreciably affected by the reactance of the stopping condenser.

In one case the required common grid resistance to stop oscillation was about one-fifth of the value of the grid leak in series with either of two equal grid leaks. Similar results were obtained when an attempt was made to start motorboating by a similar method.

GLOSSARY FOR BEGINNERS

Impedance—The total opposition offered to an electric current in a circuit. It is composed of two parts, reactance and resistance.

Reactance—The opposition offered by a circuit to changes in value of an electric current flowing in the circuit. Thus a reactance opposes both a reduction and an increase in the current. The reactance of an inductance coil is directly proportional to frequency and the reactance of a condenser is inversely proportional to frequency.

Resistance—The opposition offered to a current by virtue of electronic friction in a conductor. This represents loss of energy.

Common Impedance—An impedance, either reactance or resistance, or both, which is a part of two or more circuits, and which constitutes a coupling between them.

Common Plate Impedance—An impedance which is common to two or more plate circuits. An example is the resistance of a B battery which is used for all the tubes in a receiver.

How to Figure Resistors
For C Biasing on Plate Current Plan

By Frank Logan

WE are all familiar with the fact that the potential of the grid in respect to the filament controls to a considerable extent the amount of plate current flowing from the plate voltage source. The amount of voltage or difference in potential which may be either positive or negative which exists across the grid and filament is usually termed the C bias voltage and may be obtained in a number of ways.

Two years or more ago, when it was the custom to limit plate voltages to 90, and power tubes were not generally available, the common means of obtaining this bias was to return the grid lead of the tube circuit to either the negative or positive filament post, and to rely upon the drop in potential across the tube filament and rheostat to produce a biasing effect. In the case of a detector tube, where the plate voltage applied is normally quite low, this method still works satisfactorily and the introduction of an external source of C bias voltage is unnecessary.

However, where the plate voltages applied are greater than 67, as is now usually the case with both radio frequency and audio frequency tubes, the amount of bias which can be obtained by this method is too low. Distortion would be evident in the signal, since the tubes would not operate on the correct part of the grid curve if no other source of grid potention were available.

In the case of audio frequency amplifier tubes the distance which the grid can "swing" on the grid curve has a very definite relation to the amount of energy which can be handled satisfactorily without distortion. This fact was generally recognized some time ago and led to the introduction of C, or grid bias, batteries. These were in almost all cases dry cell batteries of small size arranged with convenient voltage taps in steps of 1½ volts.

Grid Bias and Power Tubes

In the last year or so, power and semi-power tubes have been introduced which bring another problem in biasing voltages. These new tubes require grid bias voltages ranging from 12 to 40.5 volts. A 171 tube often strikes the purchaser as somewhat of a joke—on him.

The purpose of this article is to show how the experimenter who now possesses an AC B eliminator of almost any type, may obtain the necessary grid bias voltages from the same source as the plate voltage without finding it necessary to completely reconstruct or redesign the eliminator.

Most of the present day AC eliminators are equipped to furnish a maximum voltage far in excess of the actual demands of the power tubes with which they are used. This is particularly true of eliminators originally intended for use with Raytheon type B rectifier tubes, as these eliminators can have the maximum voltage increased 25 to 30 per cent by the use of the new BH tubes.

Need of Constant Change

It is generally known that the line voltages are not constant. In many sections of the metropolitan area it is not an unusual thing to find the voltage at the light socket varying from 90 to 125 volts, depending upon the time of the day and the load placed upon the line when the voltages are tested. This of course means that the output voltage of the eliminator varies and quite naturally the voltage applied to the plates of the tubes varies also.

By drawing the grid bias voltages from the same source as the plate voltage, an increase in plate voltage, and consequently in plate current, will result in an increase in bias voltage and vice cersa.

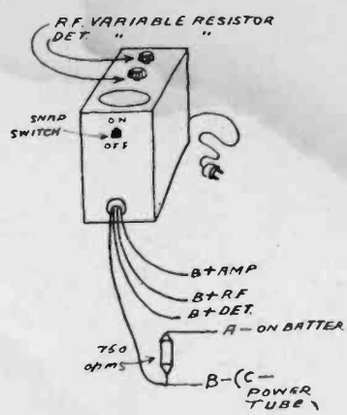


FIG. 1

The C bias obtained from a resistor that is in the common lead results from the voltage drop due to plate current flow. In the above example all the plate current flows through the 750-ohm resistor, from A minus to B minus.

Calculating Values

Before going into the actual construction of a C bias voltage device for use with your present eliminator it will be helpful to review the methods by which the values for the resistances used in these circuits are obtained.

Ohm's Law is a formula which is helpful in solving any problem which comes up in direct current work. As practically all radio eliminator work after rectification at least deals with direct current, an understanding of Ohm's Law will aid materially in showing the reason for the use of a particular resistance or voltage at a particular point in a circuit.

This law is concerned with the relation of three factors which are always present in an electric circuit. The resistance measured in ohms; the electrical pressure, which is measured in volts; and the current, which is measured in amperes.

The relation between these factors in electrical circuit is expressed by Ohm's Law in any of these three methods:

$$E = I \times R,\ I = E/R,\ R = E/I$$

As you see, it is possible to find one of the three factors in this formula, when the other two are known.

Fig. 1 shows an eliminator. The resistance (750 ohms) has a particular value for the grid bias voltage to be obtained.

Filament Carries the Current

Current flowing from the plate of the tube through the filament and back through the negative B return must, of necessity, flow through the 750-ohm resistor before the circuit can be completed. Since there is current flowing through the resistor, which has a definite ohmic resistance value, there is a voltage drop across it which will depend upon the amount of current flowing it.

Assuming one Vitrohm resistor, the end at the negative B lead of the eliminator will possess a low potential in respect to the negative A battery. By tapping off at the proper points of a chain of resistors any desired bias voltage might be obtained.

The C Bias Unit

Fig. 1 shows a method of obtaining bias voltages from any eliminator. In this case only one bias voltage is available for given current flow but tapped units afford full choice. From what has gone before, it is obvious, however, that any number of bias voltages may be obtained and any amount of bias voltage is available, depending upon the resistance used.

As a practical example of this theory we will choose a problem which requires that we obtain a negative bias voltage of 9 for a CX-112 tube. The first step is to place a milliammeter in series with the negative B line of your eliminator where the arrow crosses the line in Fig. 1, while the receiver is operating. This is to find the one missing factor of Ohm's law. If it is found that 34 milliammeters (0.034 amperes) flow in the circuit, we can now substitute 9 volts for E in the equation and 0.034 amperes for R. Solving the equation, we found that approximately 265 ohms will be required to produce the 9-volt drop needed.

Cherchez La Resistance

To find the resistance of the Vitrohm where three voltage taps are to be brought out, the following problem may be taken as an example. The current consumed by the receiver is found to be 50 milliammeters and 4½, 9 and 40 volt taps are required for this particular receiver.

Again making use of Ohm's Law, we find that to produce the 4½ volt drop, we will require a resistance of 90 ohms, an additional resistance of 90 ohms for the 9-volt tap, and an additional resistance of 620 ohms for the 40 volt tap.

This gives us a total resistor of 800 ohms, tapped at 90 ohms and 180 ohms.

There is no necessity for taking into consideration the variation in the amount of current flowing through each section of a tapped Vitrohm resistor where more than one bias voltage is wanted or the additive effect of the grid current of each tube, as these are normally zero. That is, no grid current will flow until the grid of the tube becomes positive. When this condition exists, good reception is impossible, as overloading of the tubes has taken place with consequent distortion.

Condensers Recommended

A condenser should be put across each of the grid bias taps. These condensers are very important and should never be less than 1 mfd. in capacity. They may, however, be of the low voltage type, as the maximum voltage they will ever be shunted across is in the neighborhood of 50.

As these resistors are used to supply a grid potential and are in the high potential end of the grid circuit it is absolutely essential that they contribute no fluctuation to the voltage produced across them, for that would result in noisy reception.

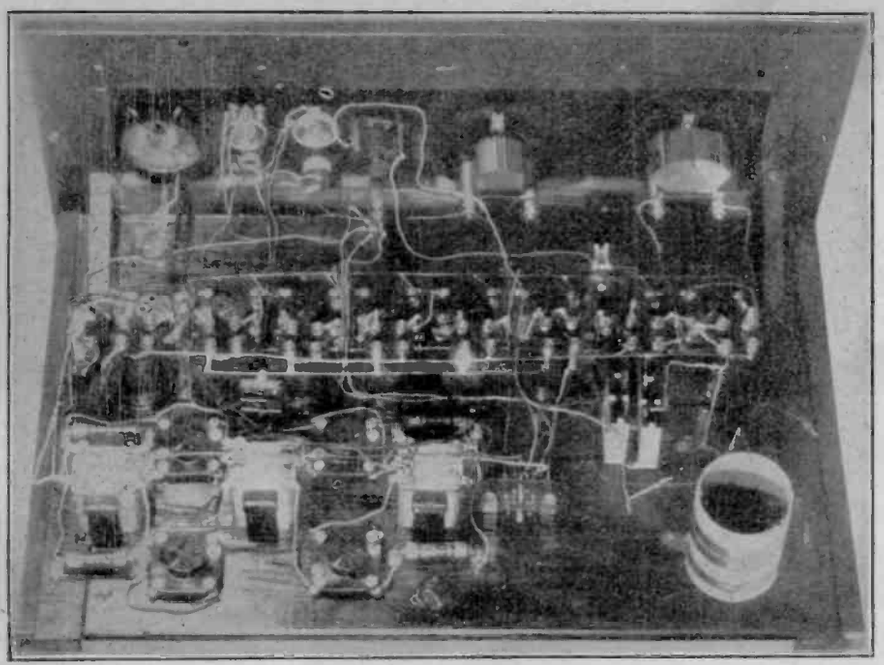
The final point to take into consideration before starting work with the screw-driver and soldering-iron is that any voltage which is taken for C biasing purposes removes an equivalent amount from the maximum plate potential available. It does not mean, however, that if a tapped resistor is used which supplies bias voltages of 10, 20 and 30 volts that a total of 60 volts is removed from the plate supply, but that a total of 30 volts is taken from the maximum plate supply.

Niagara Falls' Roar Broadcast by WMAK

Niagara Falls, N. Y.

The familiar toll of the Liberty Bell. Big Ben. and even the rushing sounds of the Pacific Ocean, have already been broadcast many times. For the first time, however, the powerful roar of Niagara Falls was recently broadcast by WMAK, Buffalo, incidental to the opening of a local studio of this station. Microphones were installed in the Cave of Winds.

Neat Wiring Important
How It Affects Actual Working of Set



THIS SET is poorly wired, although it works well. The connections were made quickly, and bell wire used as being conducive to great speed in completion. Acid-core solder was used. Hence some of the joints are going to spring apart soon.

By Walter J. Webster

ALTHOUGH countless articles have appeared on the importance of proper wiring of sets, there are still many examples of sloppy work. The accompanying photograph is shown for the purpose of illustrating how ugly in appearance the wiring may be. Annunciator wire has been used carelessly in this hook-up. That in itself is all right, as such wire is a good conductor and is heavy enough to carry the current without heating and without loss. But on account of the pliability and the nature of the insulation its use does not leave a neat looking job. The insulation unwinds itself and leaves the edges frayed. Also the wire is not very easy to handle and is difficult to form into straight lines. bend into graceful curves, or to tuck away in inconspicuous places.

One dictum that has been made since the beginning of radio time is to avoid acid core solder because it corrodes the copper wire. But such solder was used in the present set. It cannot be seen in the picture, of course, but at the time the photograph was taken it had already left its mark. The use of acid core solder was perhaps necessary as a result of the use of untinned and oiled wire. Solders which are good for radio purposes are not good for removing oil and grease from wire, while acid is effective.

Still, the Set Works

Although the wiring of the set shown is all that it should not be, the set works in spite of that and it works well. It will continue to work until the acid has had time to eat away the finer conductors, which will not be long, in view of the corrosive nature of the acid used. Then the set will cease to function.

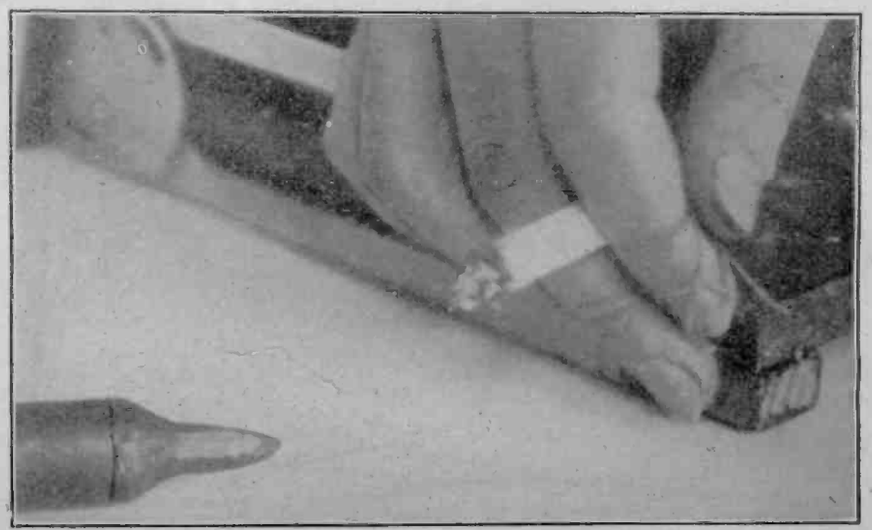
If annunciator wire is used for connecting a receiver resort should not be taken to acid to facilitate the soldering. The terminals to be soldered should be cleaned mechanically by scraping with a knife or rubbing with emery cloth. The rosin core solder should be used.

A clean and well-tinned soldering copper heated to the proper temperature will materially help in making a neat and permanent joint. The irregularities in the leads are not important from an electrical point of view though they are of first importance from an aesthetic point of view. And besides, when a set is wired in an unsightly manner you can safely bet that it is not the best possible electrical job, as the spirit of carelessness is likely to pervade all.

Physical Reason

There is another reason why acid core solder should not be used. When the solder is heated the acid sputters. If any of the tiny drops should fall on the clothing of the operator holes would be burned into it. Also if any of the drops should fall on the hands or face of the operator, tiny burns would result.

While one operator was soldering with this type of solder a small drop fell on the tip of his cigarette. He smoked the cigarette without realizing that this had happened, although he did recall later that there had been a bitter taste. It made him sick. Acid in itself is poisonous and violently attacks the mucous membrane of the mouth and stomach, if it should get that far. It is also ruinous to the teeth. While the little drop of acid that fell on the cigarette was not sufficient to cause severe illness it is possible that it carried with it some of the metal in solution. Solder contains lead and lead is a deadly poison. The acid used in connection with soldering is hydrochloric, or what is commercially known as muriatic acid.



Acid-core solder should not be used for radio purposes, for electrical reasons, nor for any home purpose for physical reasons. Some of the acid sprays on the fingers, gets on a cigarette tip and hence into your system.

Seaman's Eye Saved By Radioed Advice

When the American merchant liner, American Banker, arrived recently in New Work City it was learned that radio had again served as a disseminator of medical advice from ship to ship.

An iron speck had fallen in the eye of Peter Kruif, a seaman aboard the American freighter Tomalva, the eye soon becoming infected. No doctor was aboard this ship and therefore the radio was put into action. Dr. C. A. Francis, surgeon of the American Banker, was reached. He suggested that an electro-magnet be used to draw out this piece of iron, at the same time giving complete details on the construction and use of such a device.

All the advice was followed and shortly afterward, the Banker received word from the Tomalva, that the iron was successfully removed. The generator used in the radio transmitter was also used to furnish the power for the electro-magnet.

MESSAGE TO NORTH IN ESKIMO

Bishop Alfred Turquetil, a French missionary who has spent a large portion of his life in the Arctic among the Eskimos, recently sent a message to his Arctic friends in their own tongue by way of radio station KDKA in Pittsburgh. When he left the North he had explained to the Eskimos that he was going to Pittsburgh that he might use "the talking machine that has the greatest voice."

PILOT LIGHT DRAIN

A pilot light (flashlight bulb) draws from .2 to .25 ampere, usually, or about the same as a type A tube.

Radio World's Universal four-tube Receiver

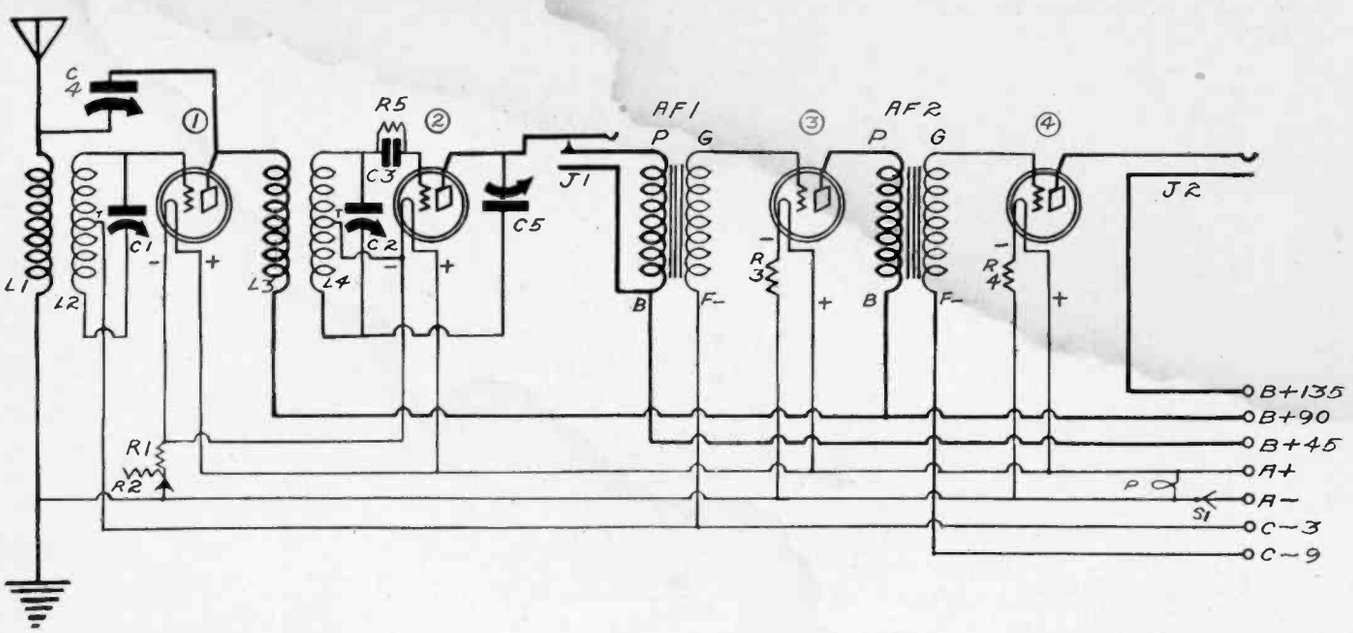


FIG. 1

In the new four-tube Universal receiver R2, a rheostat, is the volume control. It governs the heating of the RF tube and the detector tube. R1 is a 112 Amperite, to prevent application of the full 6 volts to the filaments of these tube. R2 also extinguishes tubes 1 and 2 when one desires to use only the audio channel in conjunction with a phonograph pickup. The reversely connected jack J1 is placed on a strip at rear of the baseboard. This is the first diagram of this particular circuit ever published.

By Herman Bernard

Associate, Institute of Radio Engineers

THE fulfillment of the expectations from a four-tube receiver depends largely on adequate quantity of induced energy from one stage to another and proper establishment of selectivity values. These ends have been accomplished to a marked degree in Radio World's Universal four-tube receiver.

The circuit consists of a stage of tuned radio frequency amplification, a regenerative detector and two stages of transformer-coupled audio. This statement is familiar enough, to be sure, in connection with four-tube designs. But the seemingly little refinements introduced into this fundamental circuit make it superior to most other models of this nature, and probably the equal of any.

The induced energy in the radio frequency side is kept at a high level by utilizing generous sized primaries for the transformers. These primaries are L1 and L3 in Fig. 1. Indeed, there is energy to spare, and, generally speaking, it is purposely dimished a little so that the sacrifice may be made upon the vastly important altar of selectivity. The connection of the grid return to a midtap (T) of the secondary is used for heightening the selectivity without adding extra stages. Of course the regeneration in the detector stage contributes very generously to the selectivity. In fact, the midtap method is used as auxiliary to the inherent selectivity of the rest of the circuit.

Negative Bias Helps

A fact often overlooked in circuit design is that small negative grid bias, all by itself, is a great aid to selectivity. The bias increases the grid-to-filament impedance. If you will regard the impedance theoretically as a pure resistance, then you can understand that the higher this resistance the farther it is removed from having the effect of short-circuiting. Any ordinary piece of conductive wire, placed across the secondary, would short-circuit the grid-to-filament circuit and stop signals completely, but a high enough resistance would permit signals to come through, and, generally, the higher this resistance the greater the capability of the circuit to accept the desired frequency. With 90 volts on the plate the negative grid bias for the radio frequency tube may be conveniently from 2½ to 4 volts.

There is a little sidelight on this which is important. In the filament resistors—the rheostat R2 and the Amperite R1—there is a drop of at least one volt and this voltage drop contributes a negative grid bias equal to the drop, due to the manner of connection.

There are several ways of looking at this, but they all bring about the same conclusion. Assume that the A battery represents 0 and plus 6 volts across the terminals, with minus A equalling 0 and plus A equalling 6. Now, the negative filament is 1 volt less negative than minus A, hence is 1 volt positive. If the grid were returned to minus A (on the battery) the negative grid bias would be 1 volt since minus A is 1 volt more negative than minus F. Now, if you add a C battery, connected with positive side to minus A, you add the total value of the C battery in volts to the 1 volt.

Same Bias for Both

The total of 3 volts negative bias is not adamant. You may use a 1½-volt cell, even a flashlight cell, and thus obtain 2½ volts negative grid bias, including the drop in the rheostat, or you may use 3 at battery, plus 1 automatic, hence 4 volts. With the higher bias volume is slightly less.

The same bias used for the RF tube is employed for the first audio tube, but a higher bias is used on the last audio stage, because a power tube is in socket 4. A convenient method of biasing the entire set is to use two 4½-volt Eveready C batteries in series, or get one of the new Eveready C batteries built in 9-volt blocks, and tap off. The final audio grid is connected to the open minus post (minus 9), while the RF and first AF grid returns are made to the 3-volt post.

The only remaining point of importance governing the grid returns is the connection of the midtap of the detector input secondary to minus filament. This enables utilization of the special detector tube (2) to fullest advantage. With 45 volts on the plate operation is enjoyed at that point on the tube's characteristic curve best suitable for detector action.

High efficiency in operation of the complete receiver is obtained from the conjunctive advantages of selectivity, tone quality and ease of operation. Selectivity has been pressed to the safest possible limit. Of course, by one method or another, almost any degree of selectivity is obtainable, but it is necessary to call a halt at that point where distortion is caused by lopping off side bands of the received wave.

Set Makes Fine Showing

A thorough test of the receiver was made under average conditions in New York City. The first objective was to be able to tune through locals to bring in distance. This was accomplished very neatly and regularly, after the receiver had reached the state of development shown in Fig. 1. Many other designs were tried, but none equalled this one. Chicago stations were tuned in on the speaker between 8 to 10 P. M., when the locals in and about New York were going full blast. Without the maximum aid of regeneration this was not possible, but the regenerating condenser, C5, which is of small capacity, afforded excellent control, and carried the experiments to the desired conclusion.

It will be noticed that C5 is common to the plate and grid circuits of the detector tube. The grid return is made to the midtap. Thus one-half of the inductance is in the grid circuit and the other half is in the plate circuit. The inductance in the plate circuit is just right to permit of smooth regeneration control by C5. It goes a step further. It permits C5 to be adjusted to a low capacity setting so that it contributes no regeneration at all, at any broadcast wavelength, and thus the regenerative feature may be omitted for local reception, where it is not usually

needed, anyway. Then any child can tune the set without causing a single squeal to be emitted, either through the speaker or into the air to the disgust of neighbors.

But this end is achieved only by proper balancing of the radio frequency tube (1), and this done by setting the small variable condenser C4 to some given value, determined by experiment, and likely to be somewhere near full capacity setting (50 micro-microfarads, .00005 mfd).

Volume Control

The filament circuits of the RF and detector tubes have a rheostat and also an Amperite in the negative leg. The reason for both is that the rheostat is used as a volume control, while the Amperite makes it impossible to heat the tube beyond the prescribed 5 volts. Otherwise overheating of the filament might easily arise, due to cutting out too much of the rheostat resistance, but the Amperite introduces the element of safety, and thus prevents reduction of tube life due to paralysis, especially as so many wrongly believe they are getting more out of a set the hotter they heat the filaments.

Some may inquire why a rheostat is used as a volume control, since the regeneration condenser will serve the same end. It is true that the condenser will control volume, but it had better be used as a sensitivity control, while volume is regulated otherwise. The values of sensitivity and volume are not always satisfactorily represented by any single setting of the regeneration condenser. Strangely enough, some distant stations may come in louder than some constructors would desire. Then, if the regeneration condenser were used as a volume control, it would immediately tune out the station, whereas the rheostat R2 would not do so until considerably after the lessened volume level had been passed. Moreover, the rheostat is not critical as a volume control, while the condenser C5 is likely to be so.

Audio Transformers

The audio circuit has a separate Amperite in the negative leg of each of the two tubes. The transformers used in the audio circuit were selected because of their highly desirable characteristics in conjunction with this circuit and the prescribed tubes. For instance, the first stage audio transformer, AF1, has a high impedance primary, especially efficient in conjunction with a special detector tube like the CX-300A. The turns ratio should be low. The transformer used here had a ratio of 1-to-2.7. In the second audio stage a transformer of still lower ratio is used, for instance 1-to-2. It is important that the low audio transformer ratios be obtained by building up the primaries rather than by cutting down the secondaries.

The receiver is adaptable to phonograph pickup. The jack J1 makes this possible. For such pickup only the audio tubes need be lightened, hence the RF tube and the detector tube may be extinguished, even while the switch S1 is at "on" position. The rheostat R1 is used for extinguishing the filaments of tubes 1 and 2.

How Pickup Works

Those not familiar with the phonograph pickup may appreciate a few words as to what it does. It enables the playing of a record on your phonograph, the amplification of the sound through the audio channel of your receiver, and the reproduction of the sound by your speaker. Hence the sound does not come from the phonograph tone chamber, but from your radio speaker. Nearly all phonograph pickup devices incorporate a volume control, also. Naturally the volume control of the radio receiver would not do, because in this case it is a rheostat on the unused radio side.

The jack J1, therefore, is reversely connected, so that it plugs into the audio channel, instead of into the detector.

FIG. 2

The balancing condenser C4 is placed at right rear on the baseboard, as you look at the back of the set. Note the midtap connection to L2; also the wooden strip (one is put at left, another at right) to elevate the baseboard, so the cable is unobstructed.

LIST OF PARTS

L1L2, L3L4—Two General Radio 200-600 meter coupling coils, type 277-D.

C1, C2—Two General Radio .0005 mfd. variable condensers, type 247-F.

R5, C3—One Bretwood de luxe variable grid leak with .00025 mfd. grid condenser attached

C4—One General Radio 50 mmfd. microdenser, type 368-B.

C5—One General Radio 12 mmfd. microdenser, type 368-A.

J1—One Yaxley single circuit closing jack. No. 2.

J2—One Yaxley single open circuit jack, No. 1.

R1, R4—Two 112 Amperites, with mountings.

R3—One 1A Amperite, with mounting.

R2—One General Radio 6-ohm rheostat, type 301.

S1—One Yaxley battery switch, No. 20 (window and pilot light, P, optional).

AF1—One General Radio audio transformer, 1 to 2.7 ratio, type 285-D.

AF2—One General Radio audio transformer, 1 to 2 ratio, type 285-L.

1, 2, 3 and 4—Four General Radio sockets, type 349.

Two Karas Micrometric dials

Two Eureka dial pointers.

One 7x21-inch Lignole front panel.

One 8½x20-inch baseboard.

One pair of Benjamin adjustable subpanel brackets.

One 6-lead Birnbach cable.

Two binding posts, Ant. and Gnd.

One metal strip for securing cable to baseboard.

One hard rubber or bakelite strip, 10½x 1½ inches.

Two angle brackets to mount strip.

ACCESSORIES

Three Eveready 45-volt standard heavy-duty Layerbilt B batteries, No. 486.

Two Eveready 4½-volt C batteries.

One 7x21-inch Corbett sloping cabinet.

Two CX-301A tubes for sockets 1 and 3, one CX-300A for socket 2 and one CX-112 for socket 4.

One Octacone loudspeaker.

Constructional Data

The set is built on a 7 x 21 inch front panel, whereon appear the two Karas dials, the knobs for the rheostat, R2, the regeneration condenser and the switch. A pilot light is optional.

The coils used have 13-turn primaries and 50-turn secondaries. The wire may be No. 24 single silk covered. The outside diameters of the bakelite tubings on which the coils are wound is 2¾ inches. The form should be at least 2¼ inches long. Each of the secondaries is midtapped, by looping the wire at the 25th turn, so that the insulation may be scraped off later, for soldered connection. The separation between primary and secondary is ¼ inch.

The secondaries thus are suitable for tuning with .0005 mfd. variable condensers (C1 and C2). Most commercially made coils, designed for .0005 mfd. tuning, have good-sized primaries, and are adaptable for use in this receiver, even though wound somewhat differently than prescribed, or on different diameter tubing, or without any tubing for support. But few of them have mid-tap provision, so if any coil you have lacks this, simply scrape off the insulation at the middle of the winding. The coils used in the laboratory receiver happened to have mid-tap provided, put there for a purpose other than the one for which they are used in this receiver, which was a lucky coincidence.

Karas Dials Recommended

How the parts are arranged on panel and subpanel will be shown next week in photographs of the completed receiver.

Enough has been said to permit informed radioists to go ahead right now with the construction. However, subsequently the construction will be discussed in detail.

The tuning condensers used in the laboratory model turn very smoothly, hence no special precautions need be taken when using the marvelously smooth working Karas Micrometric dials. It is important to use Karas or similar dials in this receiver, because any dial that permits hand contact with even the ordinarily grounded side of a coil will not do at all. The whole dial front must be of insulation material, so "no metal can touch you." The reason lies in the fact that both terminals of the secondaries are at high radio frequency potential (the midtap being at low potential). Therefore dials having exposed metal will introduce body capacity, otherwise avoided.

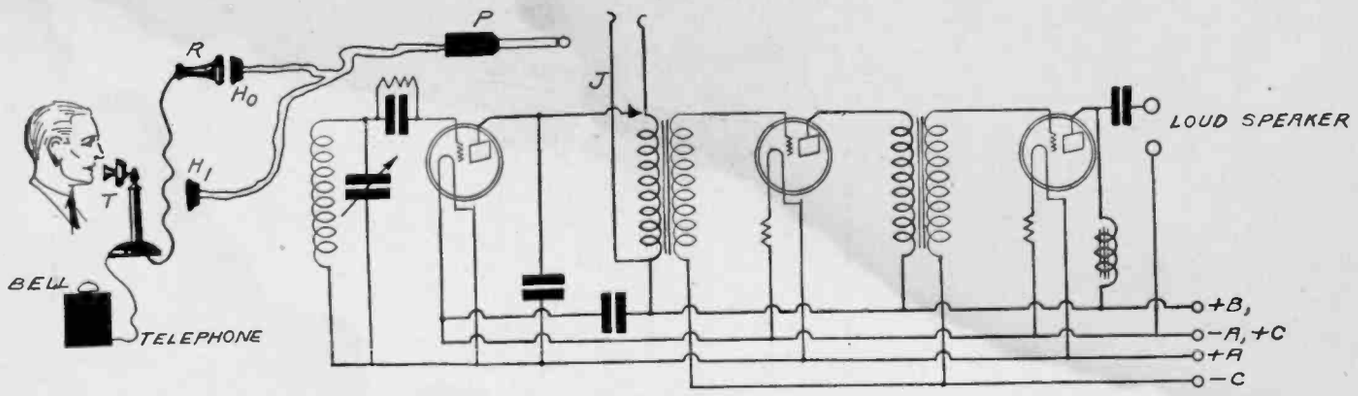
If the particular condenser to which the Karas dials are going to be attached has a friction arrangement of any kind, to keep the movable plates in place (this does not apply to General Radio condensers) and this friction arrangement holds the plates rather tightly, it is necessary to decrease this friction by loosening whatever adjustment is necessary to loosen the movable plates.

The plates should be loosened until they will just about drop of their own weight when the condenser is turned upside down. As a matter of fact, it is not necessary for the plates to have any friction whatever when using Karas Micrometric dials.

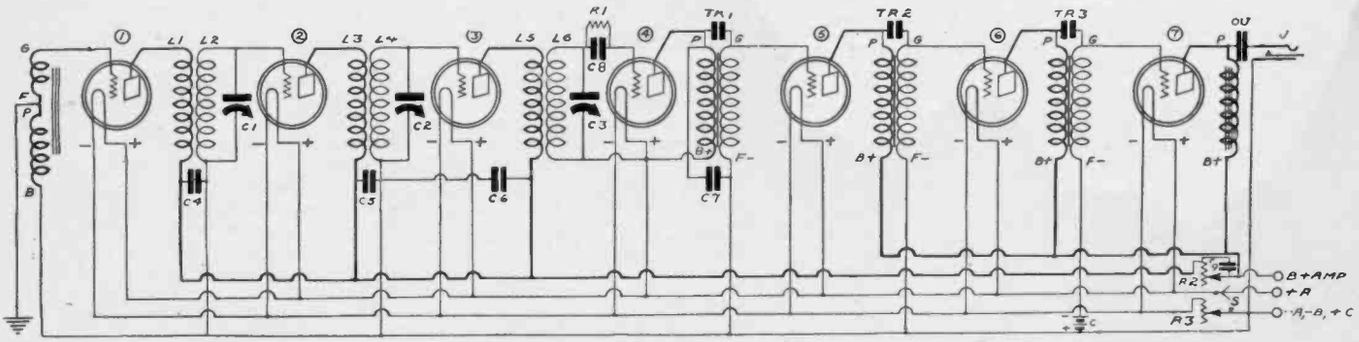
After the condenser plates have been loosened—if they need loosening—a drop of oil should be placed on the rim of the brass friction disc. Use the finger to distribute the oil all around the raised portion which strikes the panel when the dial is applied.

(Continued next week)

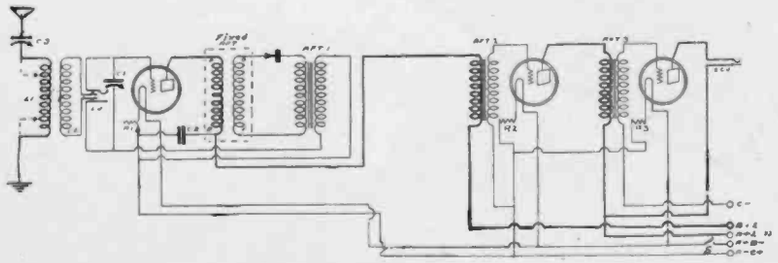
Hookups for Experimenters



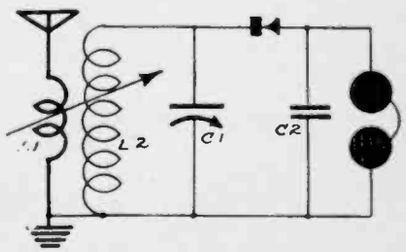
SO THAT you can listen to your own voice as well as the person's to whom you are speaking via the telephone, through the loudspeaker of your radio set, the above arrangement can be carried out with great success. H1 and H0 are the headphones, T the microphone and R the receiver of your telephone. Complete details on this stunt are given in the Feb. 12 issue of RADIO WORLD.



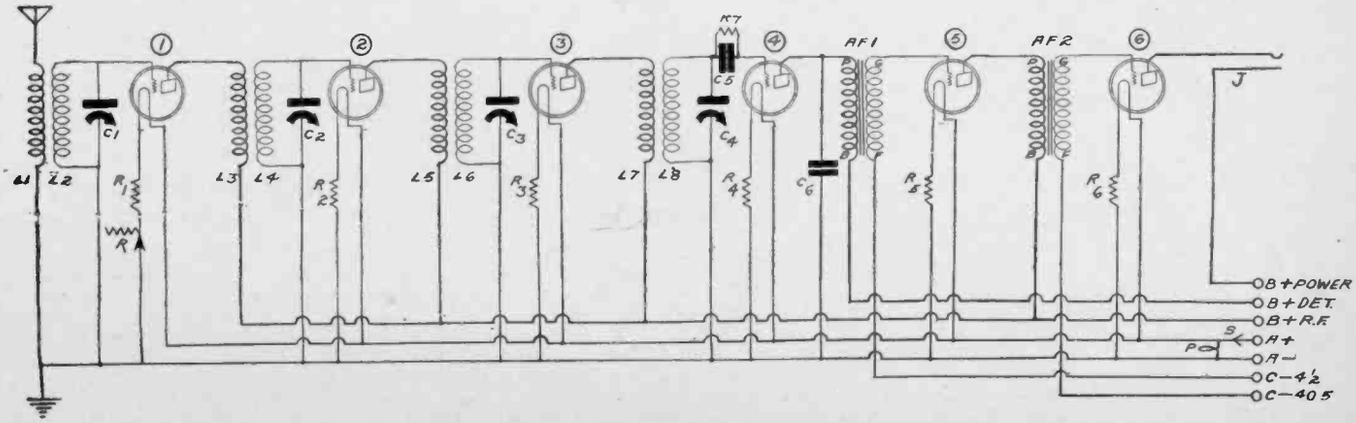
IF YOU live in such a place, where it is totally impossible to install an outdoor antenna, and you do not wish to use a loop or indoor antenna, the above seven-tube receiver will fit the bill nicely. Three stages of radio frequency amplification, two of which are tuned, a non-regenerative detector and three stages of double impedance audio frequency amplification are employed. A ground is usd to collect the energy. This receiver was described in the Nov. 27 and Dec. 4 issues of Radio World.



AN EASY to build, efficient three-tube reflex receiver, using a crystal as a detector. Provision is made via a loop jack, for use of the antenna or a loop.



THE FAN who lives close to the broadcasting station, can build this simple crystal set and enjoy good earphone reception with excellent quality.



A SIX-TUBE receiver, which employs three stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer audio frequency amplification, which is capable of bringing in far distant stations with great volume, through the locals. Any standard tuned RFT, with condensers of the proper capacity can be used.

Bureau Ascribes Fading to Effect of Sky Layer

Finds Also That Higher Power Does Not Cure the Evil, But Does Maintain Signal Intensity Proportionately High

The results of an intensive study of radio fading, made by the Bureau of Standards, Department of Commerce, in co-operation with university and other laboratories, have lent new corroboration to the hypothesis that fading and night-time transmission of radio waves to great distances are due to the action of a conducting surface high in the atmosphere. The full text of a statement of the department concerning the result of the study follows:

Radio progress depends upon an increasing knowledge of the vagaries of radio-wave transmission. Radio transmitting and receiving devices have been highly perfected, but received signals are still subject to variations and distortions. In order to secure data on the causes of these variations, the Bureau invited a number of university and other laboratories to co-operate in their study. The principal work was the conducting of special radio transmissions from broadcasting stations, during which all the laboratories made simultaneous graphical records of fading.

New Data Recorded

This work shed a great deal of light on the nature of radio-transmission phenomena. From the results it was possible to determine the dependence of fading on distance, frequency, and other conditions. The fluctuations, known as fading are extremely great, and, in addition, there is a wide variation in the average field intensities received from night to night.

However, there was discovered one type of regularity in the average intensity of fading signals which had not previously been suspected. This was a definite relation of the ratio of average night to day intensity. This relation was found to have important theoretical bearing in explaining the difference between day and night time transmission conditions.

The results lent new corroboration to the hypothesis that fading and night time transmission of radio waves to great distances are due to the action of a conducting surface high in the atmosphere.

Variable Absorption

This hypothesis had been published by the Bureau in 1921, as a result of some fading observations made at that time. The characteristic fading observed at considerable distances is found to be caused by variable absorption in the upper atmosphere, and the relatively fast fading is largely the result of interference between the wave transmitter along the ground and the wave which has traveled via the upper conducting surface in the atmosphere. One interesting result is that there was little correlation found between radio reception conditions and weather.

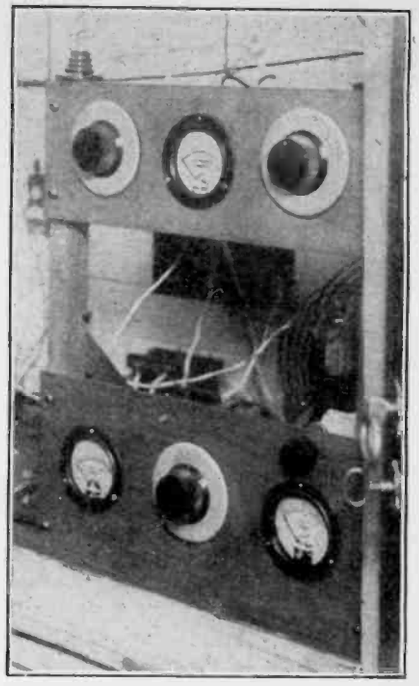
The work was accomplished by a number of special studies. Measurements made upon received signals at very high frequencies (short waves) showed that the transmission was, in general, irregular, and that the portions of the day for best transmission were markedly different for different frequencies.

Power Ratio Maintained

A study of the effects of high-powered broadcasting was made. It was determined that fading, when expressed as percentage fluctuation, is not different for different amounts of power, but that the area reached with signals of a given intensity is approximately proportional to the power.

This work on radio-wave phenomena involved design and construction of apparatus for measuring field intensities and fading. One of the devices was a portable set for measuring field intensities of broadcasting stations, designed to meet the particular needs of the Radio Inspection Service. Measurements made with such an apparatus are the best means of determining the actual radiating power of a broadcasting station.

SET ON YACHT



(Underwood & Underwood)

THE 36-METER transmitter built and designed by George C. Freisinger, Radio 2ABT, which is installed on Count Von Luckner's four-masted schooner yacht "Vaterlan," now anchored in the Hudson River. The call letters of this station are DCZ. The operator is Fritz Johnsko, 26-year-old German. The set is capable of reaching all parts of the world.

4 Toronto Dodgers of Licenses Fined

Toronto, Ont.

Four owners of radio receiving sets who had neglected to comply with the law and obtain licenses for their radios for 1927, were charged before Magistrate T. H. Brunton in county police court recently with breach of the radio act. The charges were laid by Frank Denton, solicitor for the department of marine and fisheries, which department enforces the act.

"Numerous owners of sets have neglected to get their licenses and the department are anxious in fact, insistent that they should do so. The licenses only cost $1 and they can be procured in 12 post-offices and 153 stores in the city," stated Mr. Denton.

"You have been disobeying the law, but I don't think you meant to, so I'll make it as light as possible for you," his worship told the men. They were fined $5 and costs each.

San Francisco Talks to London By 'Phone

When the London to San Francisco telephone service was inaugurated recently all records for long distance telephony were broken. The distance covered by the voices was 7,278 miles as the crow flies, and much greater than in actual distance traveled.

Coolidge Address Surely No Secret

Because of a last minute change in schedules the KFI announcer frantically urged his audience to tune in at 9:15 the following morning to hear President Coolidge's address. After this announcement had been made about six times on the night of February 21, a receptionist telephoned the station and in a disgusted voice said: "What's the idea? Any darn fool knows that President Coolidge's address is the White House, Washington, D. C."

Detroit Mayor Orders Rail Line Investigated

Detroit.

Radio listeners of Detroit have brought pressure to bear on the city council to investigate interference in the Detroit area. Complaints have been made that the Detroit Street Railways power lines have set up unpleasant noises in radio sets in many parts of the city, and the listeners intend to have the trouble eradicated.

Mayor John W. Smith has appointed a commission to look into the matter of the street car interference and trouble set up from other sources, believing that the public generally is entitled to clear radio reception, if it can be attained. Engineers connected with Detroit broadcasting stations say it is possible to remove the cause of the trouble without serious expense.

ANNOUNCES AGE NIGHTLY

Los Angeles.

KFI, one of the oldest stations in the United States, signs off each night by giving the total number of nights it has been on the air. On April 14 the total will be 1,825 consecutive nights.

Trainer Is Elected Listeners' President

Springfield, O.

W. L. Trainer was elected president at the meeting of the Springfield Broadcast Listeners' Club recently. Other officers elected were: C. E. Miller, vice-president; Russel Ulery, treasurer, and Leon A. Redmon, secretary.

The club has, since their organization, eliminated over 50 cases of local interference. Co-operation with the Ohio Edison Company and the telephone company has effected the elimination of 35 other cases.

Roxy Back on Air But from WJZ Chain

S. L. Rothafel, better known as Roxy, returned to the air over station WJZ on March 7 with a larger and more brilliant aggregation of artists than ever. Some of the familiar names on his new gang are Maria Gambarelli, Douglas Stanbury, Gladys Rice and William Robeyn. Many other artists have been added to the gang, and one of the features will be a mixed chorus of 100 voices and a complete symphony orchestra of 110 pieces.

AT YOUR SERVICE

How to Avoid Corroded Contacts

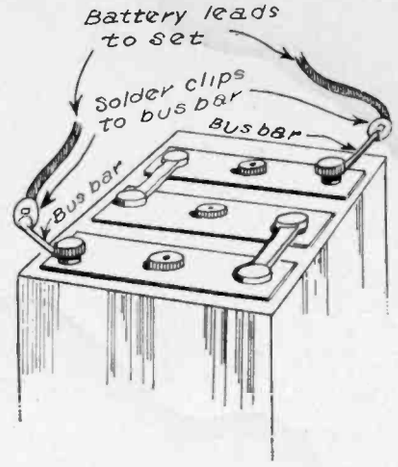
By Robert L. Eichberg

At some time or another most set owners have been bothered by noises which were first attributed to static, then to loose connections and finally traced to corroded terminals of the A battery, or perhaps the B battery, if a storage B battery is employed. All of you probably have noticed upon examining your storage battery that a whitish substance forms on the positive terminal and that this eats into the wire or clip to which the wire is attached.

The most common way of overcoming such corrosion is to scrape the battery terminal and the connecting wire and to cover both with vaseline so that the air cannot get at the surface.

For several years the writer has been employing a method which not only eliminates corrosion entirely, but also keeps the connecting wires so placed that the acid fumes of the battery cannot destroy their insulation. The process is a simple one and the materials needed are only some 6-inch pieces of bus bar, a soldering iron and some solder. A piece of bus bar is soldered to each of the battery terminals and the clip on the lead wire is then fastened to the other end of the bus. This keeps the contact connection a good distance from the battery and keeps the wires where the fumes cannot reach them.

While we are on the subject of corrosion caused by batteries perhaps it might be well to touch upon the damage done by spilled acid. The most frequent cause of acid getting on furniture, clothes, rugs, etc., is a hydrometer which drips. To avoid these acid drippings take your hydrometer reading while the tip of the instrument is in the battery filling hole. Squeeze the bulb and empty the hydrometer carefully before its spout is removed from the hole. When carrying the hydrometer, carry it with the tip up and the bulb down. Then it cannot drip if empty. It should be kept point down in a Mason jar, so that there is no danger of the acid dripping on anything, or the acid-covered point be brushed against inadvertently.



HOW BUS bar is used to connect to the terminals of the flexible battery wire from the set and to the storage battery terminals to prevent corrosion. After you have soldered the terminals to the pieces of bus bar and inserted them on underneath the caps, be sure to make the connections as solid as possible, so that should you accidentally pull the wires, you will not pull the connections off entirely. This can also be aided, by making huge loops on the ends of the bus bar and then tying or running the wire around itself several times on each loop.

However, accidents will happen sometimes. If acid should, by chance, be spilled it should be neutralized immediately before it has a chance to eat its way into the substance. Any alkaline liquid will neutralize the acid. To be a little more definite, if you apply common household ammonia to the spot at once, the action of the acid will be stopped. The spot should then be washed thoroughly with clear water, then washed with ammonia and rinsed once more with fresh clear water. In this way, if the remedy is applied in time, the greatest part of the damage which acid might cause can be prevented.

Questions and Answers

[*Questions pertaining to servicing of radio receivers will be answered by Robert L. Eichberg, Director of the Extension Division of the Federated Radio Trade School, 4464 Cass Avenue, Detroit, Michigan, and all inquiries should be sent direct to him at that address. Also questions on radio merchandising, advertising, etc., may be asked. Mr. Eichberg is familiar with radio from all of these various angles, having been engaged in radio selling and advertising for some of the country's foremost radio concerns for several years.*]

* * *

BEING A steady reader of RADIO WORLD, I would like a little information. I built an 8-tube Victoreen Super-Heterodyne and for the past week I have been troubled with a crackling noise, like static. I have a set of new wet B battries and contacts are all good in set. I also cleaned socket and tube prongs, but it did not help any. I am also bothered with body capacity. Is there any way to fix a set of this kind, so stations will only come in on one place on the dial?

(2)—Could I use two Amperites in the audio stages, and a 30 ohm rheostat on second detector, instead of three 30 ohm rheostats as per diagram.

(3)—How many turns of wire should I use on a loop, for a Super? I am using all 201-a tubes at 90 volts and 45 volts on detector, 4½ volt C battery, and Marco illuminated dials on both condensers.—Carl Myers, N. Y. City.

(1)—You can usually fix up your Super-Heterodyne to avoid hand capacity by making sure that the grid connections are run to the stator plates of the variable condenser and by keeping the grid leads away from the panel. If this does not do the trick, fasten a piece of copper or tinfoil shielding to the inner side of the panel and ground it to the —A battery. When doing this, make sure that the shield is cut away so that none of the other apparatus will touch it. In regard to the crackling noise you hear, you may have a loose connection or a poor soldered joint somewhere in the set. Also your battery terminals may be corroded or a grid leak may have broken down. Also see that the little electric light bulbs in your dials are screwed in tightly, because if they are giving intermittent contact, they will cause this crackling sound. Selectivity is also enhanced by checking up poor connections.

(2)—Yes, you can use two Amperites in the audio stages and a 30-ohm rheostat on the second detector instead of using three rheostats.

(3)—Wind 90 feet of No. 22 wire on a 1½-foot frame.

* * *

I AM taking advantage of the service to RADIO WORLD readers and coming to you with my troubles.

(1)—How can hand capacity be eliminated when turning the loop on a TRF receiver? Regularly, neither leg of any battery is grounded although I have tried grounding the A battery and also the rotor plates of the tuner without improvement. I regularly use an open circuit antenna. The loop works quite good, though as to direction and volume for 1,000 miles and little over.

(2)—How many turns of what size wire are necessary for a .00038 mfd. variable condenser to tune a loop having four sides of 25 inches each?

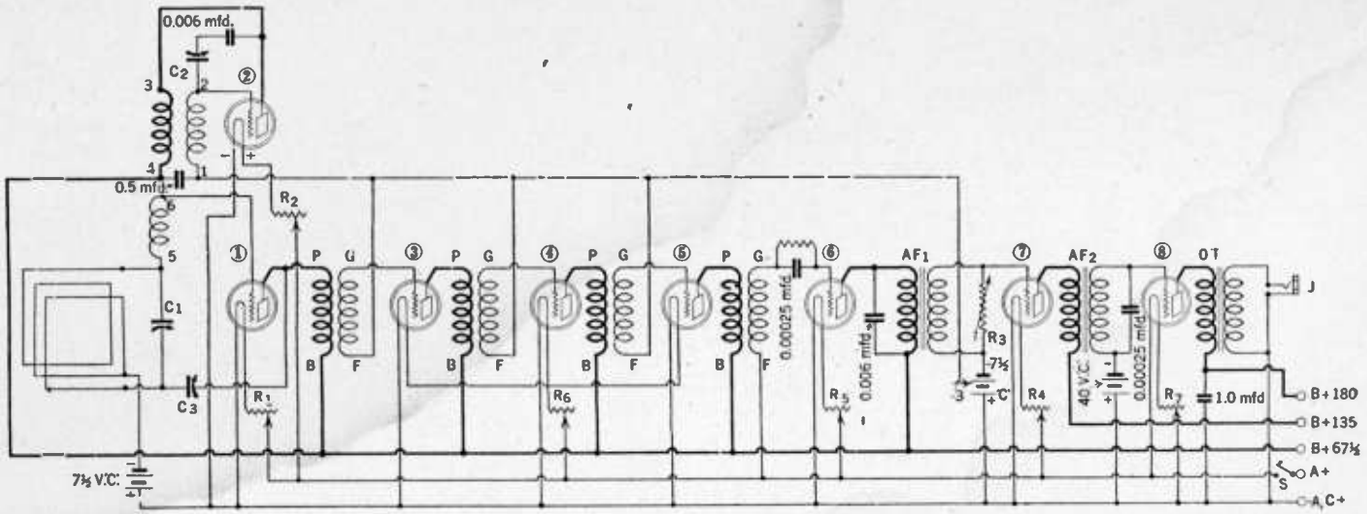
(3)—I own a neutrodyne receiver, which I find very difficult to neutralize. So that I may get volume, I lose selectivity and vice versa. I have a Clarostat in series with the B lead to the RF tubes. Were it not for this, I would not be able to operate the set at all. Now what causes this over-regenetion and how can it be stopped? The coils used are of the neutrodyne type, being mounted at a 54 degree angle, six inches apart. When the primary winding is wound in the same direction as the secondary, I get more volume, but no selectivity. Now, I have the primaries wound opposite to the secondary, and I get all the selectivity I desire.

I have tried neutralizing the set by changing the grid from minus to plus, also with balancing condensers with no success. The only partly successful way was the Bernard system, the application of more negative grid bias to the RF tubes. But instead of 4½ volts of the negative C being sufficient as he prescribes, I had to apply about 40 negative to squelch oscillation and that killed the selectivity so that three or four stations came in at once, all without the slightest trace of squeal but, who wants that condition? I am hoping that you of all radio men that I have bothered with my trouble, can give me a solution to this, my mystery. In the meantime I am making three new coils on a 2 inch diameter using No. 28 wire and I am going to try, if you recommend it, to place the coils at right angles to each other. I have replaced everything in the set so far but the coils. This is going to be my last station. If it works, I am going to try to neutralize it again and if it does not I will simply have to give it up as a bad job. Now I have one more question to ask you.

(4)—I wish to make a 6-tube set out of mine. Can an RF choke be used as an untuned RF transformer or to be more to the point, as a single winding antenna coupler to precede the tuned RF stages, and will it oscillate from 200 to 600 meters?—Louis T. Thoma, Cincinnati, O.

(1)—When bothered with hand capacity when tuning the loop, the remedy is usually found by taking a piece of wooden dowel rod and drill a hole to fit it in one of the uprights, using the dowel as a handle for turning the loop, thus keeping your hand away from it. I am surprised that grounding the A battery did not stop the hand capacity, but perhaps you have a poor ground. You might check up on your ground and try it again.

If you are using metal end plate condensers with the rotor connected to the end plate, you should connect the rotor so



THE circuit diagram of the Lincoln Super-Heterodyne. The regular Lincoln Super-Heterodyne intermediate frequency transformers, and oscillator coils are used. Complete information on this set was given in the Dec. 4, 18 and Jan. 1 issues of RADIO WORLD. It will be noted that the filaments of all the tubes are controlled by rheostats. The C bias method of detection is used in the first detector tube, the grid leak condenser combination being used in the second detector.

these condensers go to the A battery and the stators to the grids of the tubes. The A battery should be grounded. Keep grid leads and plate leads at least 3 inches from the panel. If these instructions are followed, there should be no hand capacity. Try putting a tinfoil or copper foil shield on the back of the panel and ground this shield. This is in addition to the other suggestions made. Some types of condensers have both sections insulated from the frame, e. g., Remler, and are a cure for both capacity. Also see discussion of dials in Herman Bernard's article in this issue.

(2)—I assume that your aerial is wound in spiral form rather than the less common box type. If tuned with a .00038 mfd. variable condenser. 13 turns of Litzendraht wire will cover the wave band.

(3)—The suggestion that I would make is that you take these new coils you are building and set them at right angles as you suggest. Try using the potentiometer method of controlling oscillation, and use only 45 to 67½ volts on the plates of the radio frequency tubes. This should give you control of the set, so that you can keep it just below the oscillating point for all wavelengths. It is not wise to build a set so that it cannot oscillate at all because you will lose efficiency on the higher wavelengths.

(4)—Do not try to use radio frequency choke as an antenna coupler. It is designed for an entirely different purpose and will not function properly if used as an untuned radio frequency transformer. Such transformers may be purchased from the Acme apparatus company and various other companies. I would be very much interested in hearing what success you have with the various suggestions I have made. You certainly have had considerable trouble with your set.

* * *

I HAVE an Erla Balloon Circloid Five, a five-tube tuned RF receiver, which originally was equipped with a potentiometer for balancing and volume control. This control not being satisfactory I have discarded the potentiometer and added neutralizing condensers, connecting them from grid to neutralizing posts on the coils. The set now seems to be very critical. Changing the length of the aerial now throws it out of balance. I can take the second RF tube out of its socket and it does not seem to make any difference in volume, only changes the tuning of that stage. The set does not lack volume. Can you suggest a better way of neutralizing this set and why I have as much volume with the tube out?

(2) This set is equipped with metal shell socket. Would I get better results if I used Bakelite?—A. V. Borton, Fayette, O.

(1)—The reason that your Erla Balloon Circloid Five operates as well when the second radio frequency tube is out of the socket as it does when the tube is in place is because it is incorrectly neutralized. The best way to neutralize a set is to tune in a strong local station on a fairly low wavelength, then remove the tube from the first stage and replace it with one that has one of the filament prongs blocked with a piece of spaghetti so that the filament will not light. The neutralizing condenser of that stage is then adjusted, until the signal which comes through is at a minimum. Then replace the tube in the first stage and go through the same procedure in the second stage. A set neutralized in this manner should be entirely satisfactory. When the aerial is changed, the first tube may have to be reneutralized. Using more turns on the antenna primary aids ease of neutralization. Try a primary to secondary ratio of 3-to-1 Also see neutralization method used in the Universal in this issue. Try this on your first stage.

(2)—It would probably be better to replace the metal shell sockets with the new UX sockets made entirely of Bakelite or rubber.

* * *

I WOULD like to know what is the best B battery eliminator to use with a Victoreen Super-Hetrodyne.—Earl Knox, Biloxi, Miss.

I am not in a position to recommend any specific make of B battery eliminator to you. However, I will say that you should determine the total milliampere draw of your set and get an eliminator that will provide sufficient current, while the maximum voltage desired is maintained. There are many makes on the market that will prove satisfactory.

* * *

I INTEND building a set for a friend. Now, unfortunately, he lives within ten city blocks of a high-power broadcasting station, WABC. My plan was to build a Diamond of the Air, regenerative detector, preceded by one step of RF. I fear it might not be selective enough. Would a tuned RF circuit two steps RF, non-regenerative detector, be more suitable for this purpose? If you recommend latter system kindly mention name of circuit.—Louis Deuster, Richmond Hill, N. Y.

A Diamond of the Air should be as selective as, if not more selective than, a non-regenerative set employing two stages of tuned frequency. Your Diamond of the Air, with a fairly short aerial or with a fixed condenser in the lead-in, should prove as satisfactory as anything you are likely to be able to construct. I suggest that under the circumstances you shield the entire inside of cabinet and rear of front panel.

* * *

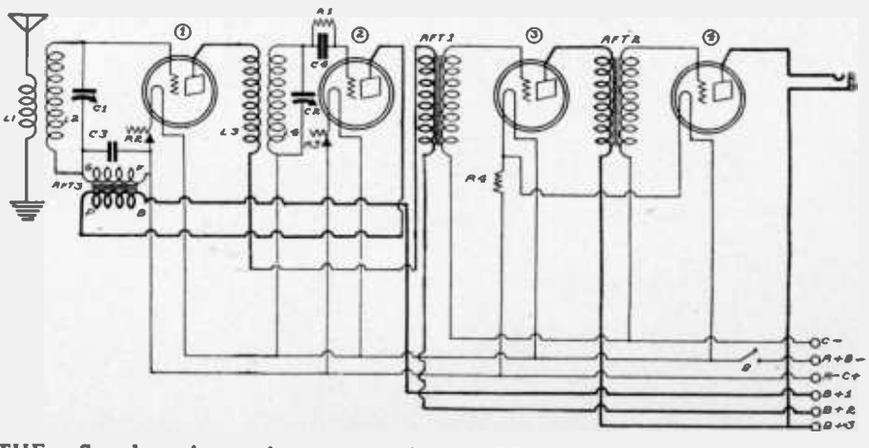
PLEASE SHOW the circuit diagram of the Lincoln Super-Heterodyne, using two stages of transformer audio frequency amplification, and an output coupler.—William Banner, Los Angeles, Calif.

The circuit diagram of this set is shown on this page.

* * *

I HAVE three audio frequency transformers, two of them having a 2-to-1 ratio and the other having a ratio of 4-to-1. I also have two tuned radio frequency transformers, which are to be used with .0005 mfd. variable condensers. Could I have the circuit diagram of four-tube receiver using these parts. I intend using 201A tubes.—Michael Va Vore, Pittsburgh, Pa.

The circuit diagram of such a set is published herewith. You will note that the first tube is reflexed.



THE reflexed receiver, using a stage of tuned RF amplification, wherein the tube in this circuit also acts as an AF amplifier. Twenty ohm rheostats control the det. and RF-AF filaments. The straight AF filaments are controlled by a 112 Amperite.

Radio Commissioners Nominated by Coolidge

Senate Gets Names of Admiral Bullard, Proposed Chairman; Caldwell, Editor; Sykes, Lawyer; Bellows, WCCO Director, and Dillon, Supervisor

Washington.

President Coolidge nominated five persons to constitute the Federal Radio Commission, under the Dill-White law, and sent the names to the Senate for action. The nominees:

William H. G. Bullard, Republican, Rear Admiral, U. S. N., retired, of Media, Pa.; term, six years. He was in charge of Naval radio from 1912 to 1916. He is proposed as chairman.

Orestes H. Caldwell, Republican, Bronxville, N. Y., radio editor; term, five years.

Eugene O. Sykes, Democrat, Jackson, Miss., term, four years. He is a former judge and is proposed as counsel.

Henry A. Bellows, Democrat, Minneapolis, director of WCCO of Minneapolis-St. Paul; term, three years.

John F. Dillon, Republican, San Francisco, supervising radio inspector; term, two years.

The President's desire to have Admiral Bullard be chairman was read from the fact that Bullard was nominated for the long term. Bullard served four years at the Naval Academy, where he originated the Department of Electrical Engineering.

Caldwell is editor of "Electrical Merchandising" and "Radio Retailing," publications of the McGraw-Hill Publishing Company of New York.

His home is fully equipped with radios. There is a radio connection in every room and all connections are tied up with an automatic clock-switching system. The family goes to sleep at night and wakes up in the morning by radio. He is a graduate of Purdue.

Sykes was until recently a Justice of the Supreme Court of Mississippi. He is 51. He is not technically versed in radio and is the only one nominated who isn't.

Mr. Bellows, born in Portland, Me., Sept. 22, 1885, is a graduate of Harvard and was on the staff of that University for a time. He was managing editor of "The Bellman" at Minneapolis 1912-19, and "The Northwestern Miller" 1919-25 and has been director of WCCO since 1925.

Mr. Dillon was born in Belleville, Ohio, March 6, 1886. He enlisted in the Army Signal Corps in 1894. Later he was appointed radio inspector for the Department of Commerce at Chicago and subsequently was transferred to San Francisco as supervisor for the Sixth District.

Senator Dill, Democrat, State of Washington, announced he would oppose the confirmation of Bellows, Dillon and Caldwell, as "under the control of Secretary Hoover." The action the Senate takes on the nominees is being watched closely.

Men, Not the Law, Pivot of New Control Board

Coolidge, Hoover, Dill and White Agree That Elimination of Interference Depends on Commissioners, Individuals, Rather Than on State

Washington.

If the members of the Federal Radio Commission are men of ability and courage and give first consideration to the interests of the public, the new radio law eventually will clear up interference to reception. Otherwise, the purposes of the law will be defeated. Such is the opinion of President Coolidge, Secretary Herbert Hoover, Senator C. C. Dill, Representative Wallace White and Chief Radio Supervisor W. D. Terrell.

Of course, Government officials hope and believe the Commission will be a good one. It is common knowledge that Mr. Hoover had a lot to do with its selection. His views on the subject are well known and it is assumed he preferred men who would carry them out.

Question of Courage

But there are a few pessimists who insist that there is a big possibility that the Commission will not have the courage to refuse licenses to a sufficient number of stations to prevent interference.

Immediately after the President had signed the bill Chief Radio Supervisor announced that there were 733 broadcasters—an increase of 223 since last July, when the air was considered crowded. The implication is that 223 or more stations must be closed down or else compelled to operate with greatly reduced power and consigned to waves where they will not interfere with high-grade stations.

It is believed the Commission will have a fight on its hands if it attempts either to close down stations or reduce their power.

Not Hard, Says Dill

Senator Dill does not think it is a hard problem.

"The Commission merely has to choose whether it was created to please the broadcasters or serve the public," says he. "I don't see anything complicated about that. Of course, if the Commissioners are going to be delicate about everybody's feelings, that's a different proposition."

Secretary Hoover believes the Commission will clear the air of interference.

"The completion of radio legislation makes it possible to eventually clear up the chaos of interference and howls in radio reception," says he. "The new Commission will no doubt require time to work out its problems and the public should have patience until it does so."

Way Is Clear to End Chaos, Says Hoover

By Herbert H. Hoover

Secretary of Commerce

The completion of the radio legislation makes it possible to eventually clear up the chaos of interference and howls in radio reception. The new Commission, which is to determine who shall have licenses to broadcast, at what times and with what power, will, no doubt, require some months to make rearrangements of broadcasting stations which will be necessary. It will require some patience on the part of listeners while the Commission works out the problem.

Stations Operating Total 733

There are today 733 stations broadcasting for public entertainment and information and there are a total of 18,119 radio sending stations of all sorts.

This new Act makes a fundamental change in the whole radio system. Every license for radio transmission now outstanding is automatically terminated. This applies to the whole 18,119 stations—broadcasting, amateur, transoceanic and all others. No new licenses can be issued and no action can be taken upon applications now pending until the Commission is formed.

Owners of licensed stations may under the law continue to operate them for a period of 60 days without incurring the penalties provided in the Act for unlicensed operation. Every station owner who desires to operate after the 60-day period must apply to the Commisison for new license, and should do so within the 60 days.

All persons who are constructing or desire to construct new stations must apply to the Commission for construction permits. Stations completed without obtaining such a permit in advance can not be licensed.

Secretary Receives Applications

Applications for station licenses are to be filed with the Secretary of Commerce as heretofore, although they can be acted upon only by the Commission. New forms are required and the form must be fixed by the Commission. It may be expected that the Commission will be appointed and will prepare the forms at an early date, and that they will then be available to those desiring to apply for licenses.

Operators' licenses, as distinct from station licenses, remain under the control of the Department of Commerce, but all such licenses now outstanding are terminated by the new law and new licenses must be obtained.

Operators' Licenses

The Department will, however, issue operators' licenses under the new law to all persons who are now licensed. This will be done upon the request of any licensed operator, without examination and without expense, the new license to cover the unexpired period of the one now outstanding.

The Department will authorize all existing stations to continue the use of the call letters heretofore assigned until such time as commission action or other change in the situation makes an alteration necessary or advisable.

WHITE'S IDEA

Representative White believes that if a radio law had been enacted two years ago the present problem never would have arisen. But he has confidence in the Commission and believes it will be successful in eliminating interference.

7 New Ones Put Station List At 733

Washington.

The doubtful honor of having received the last license under the 1912 Radio Law goes to the Popular Radio Shop, at Memphis, Tenn, which received a permit to broadcast just a few hours before the President signed the Dill-White radio bill. The license was the last one of seven to be signed by Commissioner of Navigation Carson, making a total of 733 stations. The seven new stations follow:

Call	Owner, Location	m	kc	watts
WNBQ	G. P. Brown, Rochester, N. Y.	407.6	736	15
KRLO	Freedman Land, Los Angeles, Cal.	440	681	250
KGFN	Haraldson & Thingstad, Aneta, N. D.	222	1,350	15
KGFP	Mitchell Broadcast Co., Mitchell, S. D.	263	1,140	15
WNBO	J. B. Spriggs, Washington, Pa.	215	1,395	15
KEX	Western Broadcast Co., Portland, Ore.	447.5	670	20,000
WNBR	Popular Radio Shop, Memphis, Tenn.	316	949	25

Following are the last minute changes in broadcasting stations before enactment of the Radio Law:

The call of KTCL, Seattle, changed from KGFA. The station is now owned by the American Radio Tel. Co.

The call of KPNP, Muscatine, Iowa, changed from KGEX.

The power of WHBQ increased from 50 to 100 watts.

The wave of WJBY, Gadsden, Ala., changed from 260 meters, 1,153 kc, to 270.1 meters, 1,110 kc. Power increased to 100 watts.

KFXB, Los Angeles, Calif., wave changed from 202.6 meters, 1480 kc. to 352.7 meters, 850 kc. Power increased to 4,000 watts.

KOCW, Chickasha, Okla., wave changed from 252 meters, 1,190 kc, to 270.1 meters, 1,110 kc.

WHT, Deerfield, Ill., wave changed from 238 meters, 1,260 kc, to 399.8 meters, 750 kc.

WKBF, Indianapolis, Ind., wave changed from 244 meters, 1,229 kc, to 243.8 meters, 1,230 kc. Power increased to 500 watts.

KUT, Austin, Texas, wave changed from 230.6 meters, 1,300 kc, to 272.6 meters, 1,100 kc.

12 Petitions for Licenses Are Returned

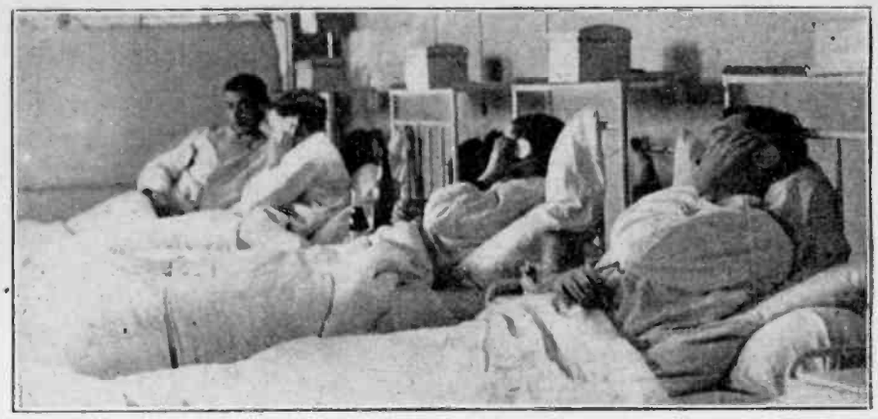
Washington.

Applications for around a dozen broadcasting stations reached the Department of Commerce just a few hours too late to receive licenses before enactment of the Dill-White Radio Law. These applications were returned by Chief Radio Supervisor Terrell with the information that the Department of Commerce no longer has the authority to issue licenses and that application must be made to the new Federal Radio Commission.

Meantime Mr. Terrell warns that newly constructed stations which operate without a license are subject to the penalties of the law and greatly jeopardize their chances of ever getting a permit to broadcast

Mr. Terrell estimates that there are between 109 and 200 stations, construction of which must be halted until a construction permit is issued for each.

RECEPTION AIDS PATIENTS



(National Feature)

A PARISIAN philanthropist recently installed individual radio receivers for every patient in a hospital in Paris. Each set which is placed on top of the bed gets its energy from the main power amplifier located in a special room. Photo shows patients listening in. The curative effect on convalescents is being studied.

Four Studios Are Used to Keep Program Going

WOC Thus Avoids Delay Between Broadcasts By Large Groups, and Spares Audience Necessity Of Listening to Tuning Up By Musicians

Davenport, Ia.

Officials at WOC have just completed the construction of a new studio in order to care properly and efficiently for increased demands for "time on the air." The new broadcasting room, to be known as the "Green Studio," is the largest of the studios and is located on the floor below the transmitting room, control room and main studios. The floor in the new green room is covered with heavy carpet of a neutral shade, while the walls are heavily draped with green velvet. On one side, visitors can witness the actual broadcasting through two plate glass windows. WOC now uses four studios, the red, blue, green and the Oriental, the latter located in the residence of Dr. B. J. Palmer, president of the school owning the station. Permanent broadcasting facilities are installed in the Palmer School Auditorium, where bands, choirs and similarly large groups can be accommodated at almost a moment's notice; and where, in addition, 1,200 people can also witness the broadcasting. Frequently, when special programs are brought from other parts of the country by long distance telephone lines, the public can assemble in this auditorium and hear the important events by means of the loud speaker public address system installed there. Recently a large audience was on hand in the hall to hear President Coolidge's address before the joint session of the House and Senate in connection with the national celebration of the 200th anniversary of the birth of George Washington scheduled for 1932.

The use of several studios at any station is a distinct advantage in that it permits the dozen or more artists engaged for each program to "set-up," tune up, and so forth, while another group is broadcasting from another room. The programs then run on one after the other, with no more delay than the fraction of a second that it takes the announcer to throw one switch, and as most people know, delays are the bugaboo of announcers. The confusion arising from one group leaving and another group entering the same studio is entirely overcome.

182 Stations Building Must Suspend

Washington.

More than 182 broadcasting stations under construction must immediately suspend all operations until they have obtained a license or building permit from the Federal Radio Commission. This is the statement of officials of the Department of Commerce in making public changes in the broadcasting field between July 1, 1926, and February 15, 1927.

At the same time, 373 stations which are being planned and upon which construction would begin within the next month must also obtain a building permit before actually beginning the work of construction.

The report of the Department of Commerce reveals that the Federal Radio Commission will have 733 stations on its hands which, if permitted to continue operation, must be squeezed into 89 wavelengths. If the waves were divided equally, this would mean around eight stations on each wavelength.

Since the breakdown in regulation last July there have been licensed 230 new stations; 50 stations have changed location; 197 stations have changed power; 111 stations have changed waves; 182 stations are under construction; 78 stations are planning to increase their power, while plans are indefinite for the construction of 373 stations.

Of the new stations licensed since last July 40 are using 500 watts or more power. Forty-two of the old stations have also increased their power to 500 watts or over.

The Eighth District, with headquarters at Chicago, ranks first in new stations with 65, while Detroit is second with 35, and New York third with 26.

Still, plans for more are under way.

Bill to Oust WHAP Stirs Its Director

Washington.

Rash remarks regarding immigrants, negroes, Hebrews and Catholics are constantly being broadcast by station WHAP, in N. Y. City, Representative Dickson, Democratic, of New York, charged in Congress. He has introduced a bill to amend the new Radio bill for the prevention of the broadcasting of any derogatory remarks or statements, regarding religion, politics or race. He said:

"The use of these slurs through the air is becoming so great that you cannot have peace in a country which guarantees freedom of speech, liberty and the pursuit of happiness."

Ford Tells His Side

Franklin Ford, studio director of WHAP, said that no slurs on race or religion had been broadcast from his station. Arguments had been made against breaking down the immigration laws by Hugh White Adams, he said, and added that this probably was what Representative Dickstein had reference to.

"Nothing has been broadcast from this station against Jews as Jews," said Mr. Ford. "We have broadcast protests against indecent plays as fostered by Jews, but that doesn't indict all Jews, just as we have protested against activities of Protestants, which doesn't indict all Protestants.

"We have never attacked the negroes, although we have broadcast the views of Marcus Garvey, the man who wished to found a negro republic in Africa.

Tells of Illegality

"It is against public policy to restrict public opinion, so long as the libel laws are not violated, and to restrict our broadcasting would be un-American and unconstitutional."

Ford's name was ordered stricken from the jury list by Judge Otto Rosalsky in December, because of talks he had broadcast from his radio station.

WBAW Moving

Nashville, Tenn.

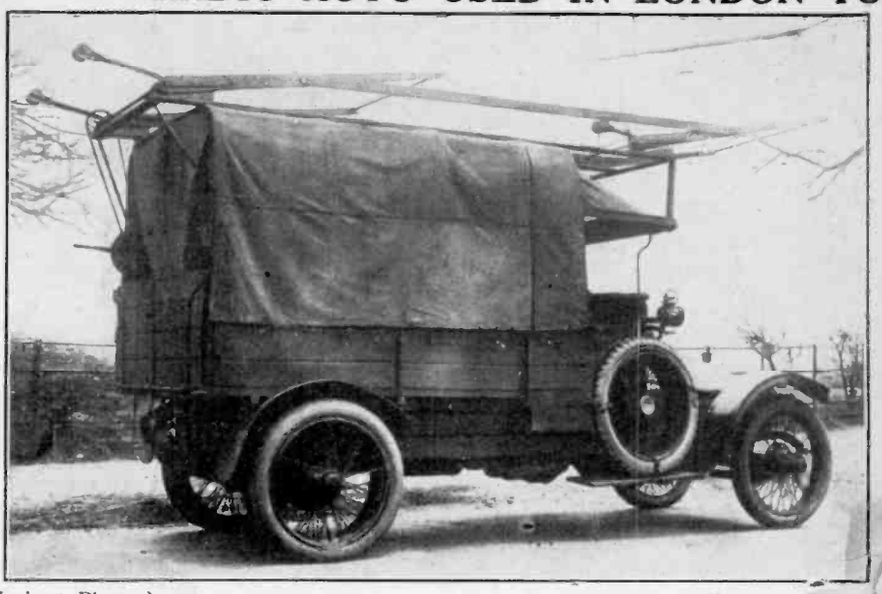
WBAW, owned and operated by the Waldrum Drug Company, of Nashville, has begun the removal of its transmitter and broadcasting equipment from its old location in the annex of the First Baptist Church Sunday School, to its new location at Shelby avenue and Tenth street.

The new location, which was recently secured is one of the highest pieces of property in the city and is an ideal location for a broadcasting station on account of its great elevation. The removal of the station from the First Baptist Church takes away one of the oldest radio landmarks in the city, as the antenna of WBAW, formerly station WCBQ, attached to the steeple of the First Baptist Church, has been a familiar sight in Nashville and was the first radio broadcasting station in the city.

TASTES DIFFER WIDELY

Tastes in radio reception differ widely. Some persons are very fond of jazz, to the exclusion of classical music, while others hold exactly the opposite preference. Some are keen for distant stations, others regularly tune in only locals, and perhaps only two or three of them. Program directors and set manufacturers must do their best to try to satisfy all.

RADIO AUTO USED IN LONDON TO (



(Herbert Photos)

OWING TO the large number of robberies and murders carried out with the aid of autom has fitted out a radio equipped car, to patrol the outlying sections of the city. One phot tenna ready for use, while the other shows how the car appears when the loop is closed. travels about most of the time, so that its identity may not be easily disclosed. By a sim be very easily swung into action. A special powerful transmitter, capable of reaching h well as a DX receiver, is contained within the car. The same combination is used at headq making it impossible for the broadcast listener to eave

Broadcasting Studios Paving

Artists' Bureaus Are Being Demand That Microp Their Disposal, Too

A new chapter is being written to the old book of stories dealing with success on the stage—a chapter surpassing all the others in unexpectedness. Most of the other stories have become history—the factory worker's voice overheard by a grand opera star and the consequent rise to fame as a great vocalist—the chorus man's jump into the limelight when the famous comedian breaks an ankle—the unknown cabaret performer photographed by accident and signed at a fabulous salary the next day by a motion picture producer.

The newest success story is different from any of these. The plot runs something like this—a business man, law student or dentist wanders into a broadcasting studio and sings, plays or talks before a microphone. Immediately by telephone and by letter, radio listeners want to know how they can engage his services for personal appearances, and three days later he is offered thirty weeks in big-time vaudeville.

Like all super-success scenarios, this outline is not a typical example of an everyday happening. It has been done, and it may be repeated, but as a rule, a longer time elapses before a broadcast performer rises to fame in the theatre. The fact remains that broadcasting is discovering new talent and contributing some of the best of it to the stage. Microphone stars are daubing on make-up, donning coats, vests and collars and facing the spotlight, all because of popular demand.

The proof of the fact lies in what the Artists' Bureau of the National Broadcasting Company has accomplished in the year and a half since its establishment, as related by Samuel L. Ross, Manager of this department of the Company's activities.

Listeners Make Demand

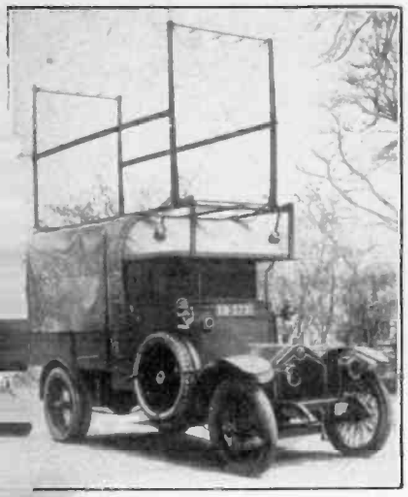
Regular listeners to WEAF and WJZ of New York have heard announcements of the Artists' Bureau over the air, stating that the services of any of the artists appearing regularly at the two New York stations might be engaged for personal appearances. Few members of the radio audience, however, realize that the Bureau came into being because of the demands of radio listeners to see as well as hear their favorite microphone performers.

At present, requests for talent reach the Artists' Bureau from many sources, and many of the regular performers at WEAF and WJZ are being booked for three or four outside appearances a week. The Bureau is equipped to furnish any sort of entertainment, ranging from the booking of an orchestra for a dance to the planning and supplying of a complete vaudeville bill.

Many of the requests received by the Bureau are from fraternal and other social organizations whose members have decided that an entertainment of some sort is the best means for raising money for some project the organization has in hand. The committee in charge of arrangements for the show is usually more or less unfamiliar with the best means of staging an entertainment, and its members are glad to apply to the Bureau for help with every part of their plans.

Through experience in staging similar entertainments, the members of Mr. Ross' department are able to gauge very closely

CATCH FELONS



is how the police alarm auto looks it is ready for action to aid in catching felons.

obiles in London, the Metropolitan Police shows the car with the special loop an- It is in the latter condition that the car ple switching arrangement the loop may eadquarters from very remote points, as uarters. The wavelengths used are secret, drop.

STARTS FROM BOTTOM

(Underwood & Underwood)

VICTOR FRESHMAN, son of the eminent radio manufacturer, Charles Freshman, experimenting with the new Freshman six-tube single dial receiver. Victor has a job in the laboratory of the factory in the Bronx, New York City.

CAN HE "OUTDO DAD?"

Having been very successful in his studies, Victor Freshman has started to work in his father's factory to see if he can even "outdo dad." Victor plans to become a sales executive.

Three Seized For Tuning In Wrong Music

Guta, Czecho-Slovakia.

Czecho-Slovakians must be careful as to the choice of stations, when tuning in on their receivers. Three were not careful, and jail resulted.

The three tuned in on a Budapest broadcasting station recently. As the closing piece of its program, the station, according to custom, played a spirited national air.

Three police happened to be passing. Since it is forbidden to play Hungarian music in Czecho-Slovakia they rushed in to capture the offender. The offender was only a loudspeaker. They could not arrest it so they broke it to pieces. The three Hungarians were arrested because they had caused a radio to bring the Hungarian music into the village via the ether.

Good Talent Aplenty, Station Test Reveals

Los Angeles.

New talent is always being sought by radio stations and KNX has an opportunity of selecting some from a large group of aspirants. The Evening Express newspaper, owner of the station, was conducting a personality contest and one of the judging points was a tryout over the air. The surprising thing to the station management was the amount of good talent that appeared. It was an agreeable surprise.

Paris Specialist Consulted by Radiophone from New Orleans

The first successful transatlantic telephone consultations between physicians recently concluded has called attention to the possibilities of international exchanges of medical advice. Recently a well-known French specialist, Dr. Imbert, received a telegraphic request from a former patient now living in New Orleans to get in telephonic communication with him as quickly as possible.

Since the nearest trans-oceanic connection was in London, the Paris specialist took the first train for London. As soon as he had reached London he explained to the telephone officials the nature of his call. He was placed at the head of the list for that day. Five minutes after the telephone service opened that morning he heard the voice of his former patient from New Orleans. After a brief conversation with the patient and a consultation with his local physicians the French doctor prescribed a course of treatment with the result that the American patient soon noticed an improvement in his condition.

Roxy Girl in 'Plane Is Too Scared To Sing

Miss Hazel Glenn, a concert singer and a member of Roxy's new gang, has made several attempts to sing to Broadway from an airplane soaring over the towers. Not a sound has been heard by the Broadwayites, although powerful amplifiers were used to amplify Miss Glenn's voice. The engineers in charge of the "stunt" explained that the reason was that their equipment was not suitable for transmitting a woman's voice. Miss Glenn, however, absolved the equipment of all blame by saying that she was just too scared to sing a note.

Way for Careers on Stage

Founded to Meet Listeners' hone Favorites Be At , For Special Events

how elaborate the entertainment should be and how much money the organization can expect to clear on it. If the budget for the show has already been made up, the Artists' Bureau goes over the figures carefully and suggests what changes appear neccessary.

How Work Is Done

Once the figure which should be invested in talent has been decided, the Bureau goes ahead with the complete plans for the entertainment. Acts are selected from the ranks of WEAF's and WJZ's performers with the view of providing a well-balanced bill. The material to be used by each team of performers is prepared and the muscial numbers arranged.

As a rule, a National Broadcasting Company announcer is included in the list of artists. He acts as master of ceremonies, introducing the various performers to the audience. Thereby, a smooth running performance and one which possesses a greater personal appeal than the average vaudeville show is assured. Likewise, a dance orchestra which has made a name for itself through its broadcasting is generally included.

Besides furnishing the performers and the necessary orchestras, the Bureau aids the committee in charge of the entertainment in many other ways. Details of the necessary publicity and advertising are arranged and carried out, the probable attendance is estimated and other routine matters are taken care of.

The popularity of personal appearances by foremost microphone artists and the appreciation of the complete service rendered by the National Broadcasting Company's Artists' Bureau are demonstrated by the manner in which requests for talent are coming in from organizations which the Bureau has served in the past. Through its work, the Bureau accomplishes a triple purpose—its aids various organizations in staging successful entertainments, it enables broadcasting artists to secure appearances they might not otherwise receive and in many cases it assists the sponsors of WEAF's and WJZ's program features to obtain wider publicity, since the performers are billed under their sponsored names.

Making Stage Headway

Not a few radio artists are coming into prominence as stage performers. Ohman and Arden, piano duo, have been featured in two Broadway musical comedies since they first appeared on the air with Roxy's Gang. They are in addition appearing regularly at WJZ. The Silvertown Cord Orchestra with the Silver Mask Tenor, formerly regular performers on the National Broadcasting Company's Red Network, are just completing six months as headliners in big-time vaudeville.

The Eveready Revellers, heard weekly through WEAF and other stations of the Red Network, were booked for the entire season at the Kit Kat Club in London largely through the prominence they gained in broadcasting . The Record Boys from WJZ and the Happiness Boys from WEAF have played many engagements in vaudeville, and many other broadcasting artists have been engaged for regular appearances.

A THOUGHT FOR THE WEEK

IS radio an art, a security, an entertainment, a public utility, or a business? This Rollo-like query calls for the answer: It's all of these—and much more. How much more depends upon the advance that the engineers and trade make during the present year, which, judging by the view from our vantage ground, looks to be full of promise and achievement.

RADIO WORLD

The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

TELEPHONES BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATION CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
(Just East of Broadway)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
FRED S. CLARK, Secretary and Manager
European Representatives: The International News Co. Breams Bldgs., Chancery Lane, London, Eng.
Paris, France: Brentano's, 8 Avenue de l'Opera

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, Lewis Winner
ART DIRECTOR, J. Gerard Sheedy
CONTRIBUTING EDITORS:
J. E. Anderson and James H. Carroll

SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

ADVERTISING RATES

	General Advertising	
1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5⅛"	231 lines	150.00
½ Page, 8¼"D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Time Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities ten cents per word, $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Eric Palmer, Editor, Reviews DX Program

Los Angeles.

The recent broadcasting of the opera "Il Trovatore" by KFI was reviewed the next morning by Eric H. Palmer (Radio Editor of the Brooklyn Daily Times). This is the first time that a radio presentation has been reviewed by a critic 2,500 miles distant. Critics agree, however, that radio programs of exceptional merit will soon be reviewed regularly throughout the entire country, no matter where they originate.

Mr. Palmer was very highly pleased by the artists and orchestsa of the San Carlo Opera Company, and complimented KFI on excellent transmission. He also had several good words for the KFI announcer, for the easy, familiar way in which he told the story of the opera and filled the necessary intermissions between acts.

Australian Reception from U. S. on Schedule

"Next Relay 7 A.M. Sunday," Says Confident Announcement—Farmers Break Record Retransmitting Six WGY Broadcasts, Originating 13,000 Miles Away

What is claimed to be a world record radio relay carried out six times during one month at a distance of 13,000 miles is recorded in "Wireless Weekly," a radio publication of Sydney, Australia. The article follows:

"Listeners interested in broadcast relays from America, are notified that the next relay will be at 7:30 a. m. on Sunday next."

The very ordinary wording of the above announcement, made by 6WF a couple of months ago, indicated a very ordinary occurrence at that station. Perth listeners show no excitement now when hearing the announcer of WGY, Schenectady, U. S. A., reading market reports and discussing the price of eggs. One Sunday morning recently they had the amazing experience of hearing a jazz item announced, and relayed from the Hotel Ten Eyck, Albany, N. Y., on the previous Saturday morning.

Six Sets Record

"Westralian Farmers have established a world record by relaying six transmissions from WGY. Each relay was carried out on 32.79 meters through WGY's short wave station 2XAF, and received in Perth at 6AG, operated by the manager of 6WF, Mr. W. G. Coxon. The feat is all the more remarkable when it is considered that the waves followed the dark portion of the globe, and the reception was obtained with three hours of daylight on this end. The distance traversed by the waves was over 13,000 miles, and no preparation was made by 2XAF. Previously, 2XAF had been relayed in South Africa, anl by 5 Don N. Adelaide.

"The first relay took place on September 13, and although interference was caused by a few local valve sets on the first occasion, the reproduction and volume was equal to that broadcast directly from the studio. Before the second attempt, however, an appeal was made to all enthusiasts to leave the air clear. Little trouble has been experienced since then. No doubt this is because better results are obtained by tuning to 6WF instead of direct to the American station.

"The crystal control used at 2XAF made possible a stable adjustment on the receiver picking up the music in Perth. On one occasion a windy morning made this difficult, but a remedy was found by staying the aerial more rigidly. The aerial consisted of a vertical tube, 15 feet high, with a counterpoise.

"The receiver used employed the well-known Reinartz circuit, with a two valve low frequency amplifier, while a two valve choke capacity coupled amplifier was used to transmit over the land line to 6WF from the receiver. No difficulty was found in tuning to 2XAF.

"During the relays all portions of the apparatus that could be earthed were done so, and the land line ran in lead covered wire for a distance of 50 feet until it was clear of the aerial system. No interference was caused whatever on the land line due, no doubt, to the early hour on Sunday morning during which the relay was carried out. At this time the lines are most free of the disturbing induction noises of the city.

Good Quality

"The music, after passing through five valves, was still good. Only transmitters using crystal control on these short wavelengths could give satisfactory reproduction after such a great degree of amplification. Ordinary transmissions were in progress from 2XAF, and no preparations were made by either station for the feat.

"During the morning hours short wave reception from America is invariably good, and no fading was experienced whatever, and mostly there are not any atmospherics to interfere on the short wave used by 2XAF. When special time signals were sent to Francis Gow Smith, conducting an exploring party to the interior of Brazil, an opportunity was taken to give to 6WF's listeners, by medium of another amplifier and microphone, a few particulars of the relay. While the description was being done, the loud speaker in the receiving room gave a back ground of time signals."

The demonstration was highly praised.

WBBM Runs Control Wires Into Bush School

Chicago.

Installation of remote control wires of WBBM has been made in the recital halls and Little Theatre of the Bush Conservatory of Music. The first student recital was broadcast from the concert hall. The weekly recitals of advanced students of the conservatory artist recitals and special radio concerts by the faculty artists will be broadcast every week. Plays by the department of Dramatic Art, Expression and Stagecraft will also be given air presentation.

"A hook-up with such a musical organization as the Bush Conservatory is one of the greatest steps the station can take toward the dissemination of the best in music today," said Kelly Smith, station director.

"In its twenty-five years of growth the Bush Conservatory has become a nation-wide musical influence. We hope to be able to make that influence felt in the development of radio programs."

Lester D. Mather, musical director of WBBM, who will announce all of the Bush programs, said: "Our alliance with the conservatory is not to be taken as an indication that WBBM is to become a high-brow station.

"Our policy is to give the radio public a sample of everything that can be broadcast, from symphony concerts to blues and back again. But we are determined to make every sample the best in its line. When we broadcast classical music we must produce it in a way that will bring out its greatness."

Weather: Slightly colder, followed by greater DX and detectives.

"Intelligensia Dementia"

* * * * *

5-Star Complete Final

THE RADIO TABLOID

Vol. Small, No. Less

Price—What Have You?

Another Dream Smashed

Detroit, March 11.—There is no truth in the rumor that Henry Ford is to enter the radio game and specialize in a new Elizabeth to be sold in bunches of five for a dollar, with a console thrown in on every three dollar purchase. The local radio trade is trying to get the world's first billionaire to speak over the air on April 1, the subject to be "Automobiles From Raspberries and How to Can 'Em."

BOOK REVIEWS

"How I Built a 13-Tube Set". By Alicia Smotherington Goulash, aged 2. Member of the Junior League of the American Institute of Physics. (Dodd, Scribner, Mead and Harper, N. Y. $12.95). A very good treatise on if, as and when it can be done—and why.

"Burning the Midnight Oil." By J. Pupin Moliere. (Shanks, Swash and Wolly, Schenectady, N. Y. $.08). A touching story of a DX-er who just wouldn't go to bed. Especially resounding and illuminating is the scene in which Mrs. Moliere crowns her husband with a washboiler because the light bills are going up.

"Confessions of a Grid Leak." By Thomas Forice. (Push, McGarry and Einstein, Yonkers, N. Y. $42.00.) A trifle risque but this book should be read by everybody who wants just this kind of a book. The chapter on irrigating the Arizona sandwastes is one of the best things ever written on the subject of calesthenics.

"A Plus B Equals Z." Anon. (Filch, Steel and Gettit, Atlanta, Ga. Two cancelled postal cards.) This book is worth twice the price of admission asked; maybe three times. The author should not have been ashamed to attach his name to a tome that is as full of facts as a Nick Carter novel. The second in this series is to be entitled "G Minus 1 Equals F" in two volumes, fully illustrated with pictures of the pygmies of Central America.

"The Radio Ear." By Dr. Alex Glue. (Scientific Book and Cruller Corporation, Ltd., London, Eng., £1 and a pint). Showing the development of the human ear from the time it was just an ear up to the present radio era when, thanks to head sets, it has luxuriated into a tropical cauliflower.

—Prof. Butcher N. Bakelite.

Mme. Miss Picklefish, Noted Vocal Beauty and Vegetable Lady

Beauty to Sing from COD Soon

Madame Picklefish of the Spaghetti Opera Co. will sing over COD Monday night for the Hot Water Radiator Co. Miss Picklefish was born in Canarsie, N. Y. One day, when a child of six, her voice was discovered while she was gargling. Prof. Bluff took a big interest in her and she studied with him for a period of 60 years and then sang her first song. After her first appearance at Miner's, the Bowery, in New York City, her father opened a vegetable store and she has kept it well supplied ever since.

LOCALS

Cunningham sold some tubes last week.

Brother Crosley is going into the set business.

J. Atwater Kent announces a new model. Some boy, At.

There is to be another new radio store on Cortlandt St. If there's one thing Cortlandt street needs, it's another radio store.

Buy your set at a department store and have a lot of fun guessing.

Go to Bungle & Smash for your repairing (Advt.).

Alderman John Flengel burned out all his tubes last night. Mrs. Flengel hasn't shed a tear since.

Bill Grook's boy, Tom, is suffering from ingrowing earphones. Dr. Glease is attending him.

RADIO TABLOID

A very weakly illustrated paper for members of the National Radio Coo-Coo Nut Ass'n. Edited from its more or less magnificent offices in ward of Bloomingdale.

Editor—W. E. A. F. McGinsberg.
Managing Editor—V. G. Leak.
Technical Editor—O. Whatter Plug.
Financial Editor—H. Ford Gouldfeller.
Art Editor—J. Rembrandt Ben Day.

EARPHONE LOVE DRIVES AGONIZED BRIDE FROM ALTAR

She Complains of Auricular Nip Before Dashing From Church — Telephobia, DX Hounds' Ailment, Spreading, Says Noted Doctor of Higherputics

By COUTEAU PILLSPENCER
Doctor of Higherputics

Occupational diseases seem to develop in every line of work. Some of these are due to chronic irritation of the affected tissue, while others are due to acute, iterative shock of violent nature. Thus glass blowers suffer from a deterioration of the incisors, which after prolonged exposure to the cause will transform the pearliest set of teeth into a set resembling the serrations in a rip saw.

Another form of occupational disease is that suffered by workers with radium compounds. The radium gets into the body and attacks the bones with the result that they gradually become decalcified. The disease is usually fatal. Workers with lead compounds, particularly tetraethyl lead, suffer a like ultimate fate, prematurely.

The Cauliferous Ear

It is well known that the followers of the pugilistic profession suffer from several characteristic diseases, usually superinduced by acute, iterative violent shock. One of these is that known as cauliferous auricle, which is very painful in the early stages and exceedingly unesthetic even after the cure. Another of these is that known as deformation of the proboscis, which is induced by shock excitation of the tissues affected and characterized by collapsed nasal calciferous structure. The trouble may readily be remedied by stuffing the cavity with mineral wax, such as paraffin. Still another ailment to which pugilists are subject is acute conflagration of the solar plexus. This also is caused by shock excitation.

The Case of Telephobia

Not even radio listeners are immune from the ravages of occupational disease. Persons putting in long stretches of time listening to radio programs with a head set develop "radio ear," a trouble not unlike that following a nip of below-zero weather. This nip is enough to make even a bride forget herself so far as to flee the altar. An effective cure for this trouble was found in the loudspeaker. In Europe "radio ear" is still quite extensive.

Another trouble which has developed as a result of radio is what is called telephobia. The symptoms of this disease are nervousness, irritability, drowsiness the day after, insomnia during the nighttime, sometimes inordinate boasting, tingling or crashing sounds in the ears. The trouble is largely a nervous disorder superinduced by lack of sleep during sleeping hours, sleep during the waking hours, frustrated effort in getting the list of broadcasting stations nightly, and the psychological reaction to the disappointment. The only complaint of the patient comes from his better half.

The only successful treatment for telephobia is to remove the cause of the trouble, or to reduce it to a negligible extent. At least six treatments a week should be taken, leaving one single evening for DX hunting and that only for one hour between midnight and one o'clock in the morning.

Poet Speaking

"The ruling passion strong in death"
Might easily apply to Seth,
Who'd sit all night, his duties shirk,
To built a set that wouldn't work.

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only, by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., New York City.

When writing for information give your Radio University subscription number.

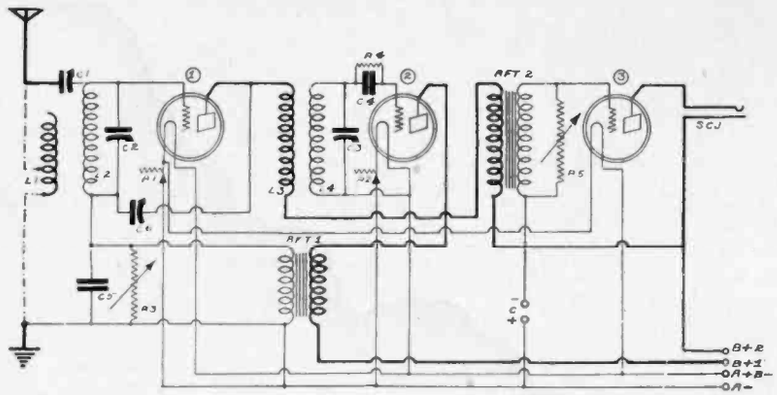


FIG. 525

The circuit diagram of the three-tube reflex, requested by Lester Muchio.

ONE OF my friends has just given me the following parts, which I would like to use to build a three-tube reflex set; two .00005 mfd. variable condensers; two .0005 mfd. variable condensers; three type X sockets; two variable high resistances (maximum 500,000 ohms); a 3 inch (enclosed diagram shows how form appears) with eighteen dowels, one-quarter inch in diameter; a spool of No. 22 double cotton covered wire; two, three to one ratio audio frequency transformers; a twenty-ohm, one and one-half ampere rheostat, and a ten ohm, one ampere rheostat. Please give the diagram for such a set, as well as data on winding the coils. (2)—What size cabinet and panel is required? (3)—How should the parts be mounted, using a baseboard?—Lester Muchio, Long Island City, N. Y.

(1)—The circuit diagram of such a receiver is shown in Fig. 525. The antenna circuit is so wired that either the midget .00005 mfd. variable condenser can be used to couple the antenna to the grid-filament circuit of the first tube, or that the primary winding L1, which is wound with the secondary L2 can be used to couple this circuit to the antenna circuit. The .0005 mfd. variable condensers C2 and C3 are used to tune the secondary circuits of both coils. The primary L1 consists of fifteen turns, tapped at the fifth and tenth turn. The secondary L2 consists of forty-four turns. The secondary L4 consists of the same number of turns. The primary L3 consists of ten turns. The primaries are first wound on the form. The secondary immediately follows. Leave about two inches of wire out at the beginning and the end of each winding. Place a piece of gummed cloth over each of the leads, and mark as to beginning or end. The exact manner of winding is shown diagramatically in Fig. 526. It will be noted that the wire is brought over two dowel sticks, then under to, and so on. Make these loops as tightly as possible. After you have concluded one complete form, take the dowel sticks out, slowly and carefully. Then bring some cotton through the spaces, left by the absence of the dowels, and tie for the purpose of holding. Now procure a dowel stick, which is about three feet long. Cut up into 4 equal sections. Use two for each coil, one directly opposite the other. You will find that by pushing the dowels so that at one end the top of the dowel is even with the top of the coil, a small portion will protrude at the other end. These ends are placed in small holes drilled in the baseboard. Either transformer can be used in the reflex stage or in the straight audio stage. The variable high resistances are shunted across the secondary windings of the audio transformers. The other .000005 mfd. variable condenser C6 is connected rom the plate of the first tube to the beginning of the secondary L2 of the first radio frequency transformer. C5, which is shunted across the variable high resistance R3 and the secondary of AFT2, has a capacity of .0005 mfd. The filaments of both the radio and the audio tubes are controlled by the ten-ohm rheostat. The filament of the detector tube is controlled by the twenty-ohm rheostat R2. C4 is a .00025 mfd. fixed condenser, while R4 is a 2 megohm grid leak. A single circuit jack is used at the total output. This is not necessary, binding posts, phone tip jacks, etc., serving the purpose just as well. The plates of both the AF and RF tubes receive a single B voltage, ninety volts. The plate of the letector tube received 67½ volts. The X or V—01A type tubes should be used for best results. This will require the use of a 6 volt A supply. A four and one-half volt C battery is used in the grid circuit, of the straight audio tube. The antenna used should be quite short, about one hundred feet total being the maximum length. (2)—A seven inch high and eighteen inch long cabinet and panel should be used. (3)—The baseboard should be six-teen inches long, seven inches wide and one-quarter inch thick. The two variable condensers should be mounted about five inches from end of the panel and centered from the top and bottom. The two rheostats should be mounted between the variable condensers. The high resistances, which are used for volume control, should be mounted in each corner of the panel. The coils should be placed very close to the variable condensers, connected in their respective circuits. The sockets are mounted toward the rear of the board, about one inch from this point. The binding post strip is placed close up against the edge in the rear. Angle irons should be used to mount the panel to the baseboard. The angles should be strong.

* * *

REGARDING THE six-tube receiver which appeared on page 11 of the Feb. 26 issue of RADIO WORLD. (1)—Could any iron core untuned radio frequency transformer be used? (2)—What capacities should C5, C6 and C7 be? (3)—Could twelve turn primary and fifty turn secondary coils, each wound on three inch diameter tubing with No. 24 double cotton covered wire, a one-quarter inch space existing between windings, be used as L1L2, L3L4, L5L6? What variable condensers should be used? (4)—Is it O. K. to use a 2,000 ohm variable resistance as R2? (5)—How many ohms in R3? (6)—Would a four and one-half C battery be O. K. on the radio side, as well as the first audio? (7)—Could two, three and one-half to one ratio AFT be used? (8)—Could clips be used to connect the output to the loud speaker? (9)—Is it O. K. to use —01A tubes throughout? —Alexander Rothstein, Poughkeepsie, N. Y.

(1)—Yes, provided it covers the wave-band from 200 to 550 meters. Be sure it is not of the intermediate frequency type. (2)—These should al! be of the 0.01 mfd. fixed capacity. (3)—Yes. Shunt these secondaries with .0005 mfd. variable condensers. (4)—Yes. (5)—About four, the wire used in the winding being able to pass at least two amperes. (6)—Yes, using ninety volts. The voltage on the radio side will have to be varied for best results. (7)—Yes. (8)—Yes. (9)—Yes. Use one hundred and thirty-five volts on the last audio output.

* * *

I HAVE built the five-tube receiver shown on page 8 of the Dec. 4 issue of RADIO WORLD, wherein resistance coupled audio amplification is used. I find that the control of the first radio frequency tube is critical. Could I insert a twenty-ohm rheo-

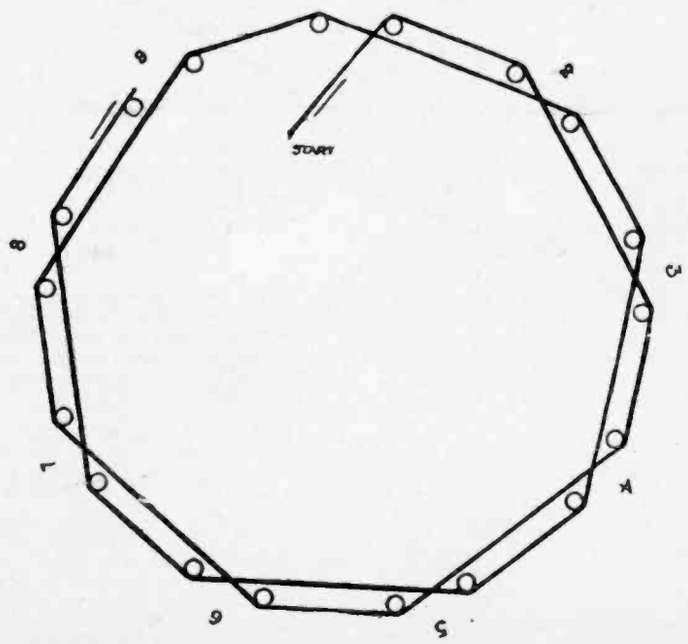


FIG. 526

The diagram of the basket weave form, sent in by Mr. Muchio, with correct markings for winding.

stat to control the filament, to stabilize the set a bit. (2)—I have quite a bit of trouble in tuning out a couple of locals around here. Would I get better selectivity if I wound the primary and secondary on the antenna coil separately. There are fifty-seven turns here, tapped at tenth turn. How could this be done? (3)—Would substituting L4 and L5, which is an untuned radio frequency transformer, by a tuned RFT, give me better results? I have a coil, which has the same constants as L2 and L3, e. g., thirteen turn primary and forty-seven turn secondary wound on a three inch diameter tubing, with No. 22 double cotton covered wire. Could this be used here?—Frances Graff, Jersey City, N. J.

(1)—Yes. Try inserting one in the filament circuit of the second radio frequency amplifier tube, also. (2)—Yes, this would increase the selectivity, also cutting down the volume a bit. The primary should consist of ten turns. (3)—Yes. Shunt the secondary with a .0005 mfd. variable.

* * *

I HAVE a four-tube receiver built on the same lines as the one diagramatically shown on page 13 of the Aug. 14 issue of RADIO WORLD, e. g., Federal 59 style. I would like to substitute the transformers with resistance stages. Is this possible? I intend to use a manufactured unit.—Maxwell Johns, San Francisco, Calif.

(1)—Yes. Be sure to keep the radio frequency and detector B plus leads separate from those of the audio amplifiers.

* * *

I WOULD be very pleased to have the following station information forwarded via the University columns. (1)—What stations operate on the 333.1 meter wavelength? (2)—Are there any stations operating on 340 meters? (3)—How many stations are located in Seattle, Washington, and what are the call letters?—Vincent St. John, Baltimore, Md.

(1)—There are five stations which use this wavelength. They are: KQW, San Jose, Calif.; KTNT, Muscatine, Ia.; KVOS, Seattle, Wash.; WBZ, Springfield, Mass., and WBZA, Boston, Mass. (2)—Yes. WOKT, Rochester, N. Y. uses this wave. (3)—Nine stations. They are: KFOA, KJR, KTW, KOMO, KFQW, KWQW, KROX, KFRC and KGFA.

* * *

I AM building the Diamond of the Air receiver and would like to know if the set can be successfully operated with the —01A type tubes, throughout, except in the detector stage, where I intend using a —00A type tube. (2)—Could I place a jack at the first audio output instead of the detector output?—Charles Mellis, Middletown, N. Y.

(1)—Yes. The use of the —00A type tube in the detector circuit will necessitate the use of a negative grid return, instead of the positive one now used. (2)—If you place a jack at the first audio output instead of at the detector as is now, the signal strength will be too intense to listen in with the phones. A jack may be placed at the second audio output, for hooking in the speaker, should the locals be too loud. The signals at the first audio output will also be too weak to use with the speaker on most locals.

* * *

I HAVE built the five-tube receiver described in the Radio University columns of the Oct. 2 issue of RADIO WORLD, and am well satisfied. There are, however, several additions that I would like to make. (1)—I would like to add a pilot light. How should this be connected? (2)—I am going to install a power tube in the last stage of audio. The plates of both tubes are brought to a single B post, e.g., ninety volts. Also the filaments are controlled by a single 112 Amperite. The C battery is common, also. Now, will all these connections have to be made individual, that is, a separate B and C voltage, as well as another Amperite? What tube would you suggest using? At the present time, the signals as far as the fourth tube are not very great. Please explain fully.—Chester Barrows, Atlanta, Ga.

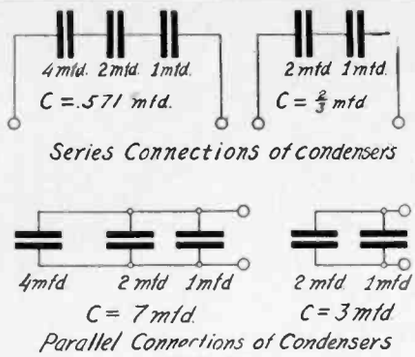


FIG. 527

How the series and parallel condenser connections are made.

(1)—This light should be connected across the A plus and minus post. The connection to the A plus lead should be made after the switch connections. That is, the light should light up upon the pulling of the filament switch. It will then indicate that the filament power is on. Should the light be connected across the line without the switch, there will be no means of disconnecting it and it will burn at all times. (2)—It is suggested that you use the 112 type of tube. Use a ½ ampere ballast resistor for the filament control, it being connected up in series with the negative leg. The B plus connection is separate, also. Use about one hundred and thirty-five volts. This will require a nine volt C bias. Should you desire more volume, use one hundred, fifty-seven and one-half volts, with a ten and one-half volt C bias. The F post on the last audio transformer is brought to the minus post of the new C battery combination, the F post of the other transformer being brought alone to the minus post of the four and one-half battery.

* * *

HOW MANY stages of transformer coupled audio frequency amplification using three to one ratio AFT, is it advisable to use in the one-tube set shown in the Radio University columns of the Feb. 12 issue of RADIO WORLD? (2)—Should ballast resistors be used for filament control? (3)—Should separate B leads be used. (4,—Will the —01A tubes work all right? (5)—How is the first transformer connected to the crystal detector output? (6)—Can I remove C3?—Cornwall Flagherty, Des Moines, Ia.

(1)—Two. (2)—Yes. One for each tube. (3)—Yes, the higher voltage being on the last stage; or, ninety on the first and one hundred and thirty-five on the last. Use a four and one-half C battery in the grid circuit of the first tube, and a nine volt C battery in the grid circuit of the last tube. (4)—Yes, the latter data is given with the idea of using these tubes. Use ¼ ampere ballast resistors. (5)—The P post of one transformer is brought to the base of the crystal detector. The B post is brought to the rotary plate connection of C2. (6)—Yes.

* * *

WOULD THE signals be distorted, if I added a two to one ratio audio frequency transformer to the four-tube reflexed receiver shown on page 21 of the Feb. 26 issue of RADIO WORLD? If not, could it be added in the conventional way? I intend using a —01A tube.—Dave Harman, Houston, Tex.

No, the results will be very good. Be sure to use the proper filament control, as well as the B and C supply, it being advised to use the highest voltage allowable for B, e.g., one hundred and thirty-five, with a nine volt C battery. To prevent any possibility of distortion, connect a high variable resistance across the secondary of the first transformer in the first straight stage of audio coupling.

* * *

WHAT DOES QRV mean? (2)—What is the code abbreviation for "I am being interferred with"?—Robert Discon, Chicago, Ill.

(1)—That is the code abbrevation for "Are to you Ready"? (2)—QRM. This is not to be confused with the signal QRN, which means when asking, "Are atmospherics strong?" and when answering, "Atmospherics are strong." This means that you are being bothered with static and other electrical strays.

* * *

I HAVE a four, two and one microfarad fixed condensers. Please show to connect these up in series and in parallel, and also how to find out the capacities of such combinations. (2)—What will the capacity of a one and two microfarad fixed condenser connected in series be? Also in parallel?—Harold Brooks, Woodside, L. Is., N. Y.

The connections of all these combinations is shown in Fig. 527. In the series connections, the reciprocal law is used. How this law applies to this case is shown below.

$$C = \frac{1}{1/4+1/2+1/1} = .571 \text{ mfd.}$$

$$C = \frac{1}{1/2+1/1} = 2/3 \text{ mfd.}$$

For parallel connections, just add up the capacities.

Join RADIO WORLD'S University Club

And Get Free Question and Answer Service for the Coming 52 Weeks
This Service for Yearly Subscribers Only

Have your name entered on our subscription and University lists by special number. Put this number on the outside of the forwarding envelope (not the enclosed return envelope) and also put at the head of your queries. If already a subscriber, send $6 for renewal from close of present subscription and your name will be entered in Radio University. No other premium given with this offer.

[In sending in your queries to the University Department please paragraph them so that the reply can be written under or alongside of each query. Write on one side of sheet only. Always give your university number.]

RADIO WORLD, 145 West 45th Street, New York City.

Enclosed find $6.00 for RADIO WORLD for one year (52 nos.) and also enter my name on the list of members of RADIO WORLD'S University Club, which gives me free information in your Radio University Department for 52 ensuing weeks, and send me my number indicating membership.

Name .....

Street .....

City and State .....

THE RADIO TRADE

R. C. A. Report for 1926 Cites $7,367,100 Profit

According to the annual report of the directors of the Radio Corporation of America, the year ending Dec. 31, 1926, showed a net profit of $7,367,100.

Each of the company's interests was prodigiously successful, e. g., international radio communication, marine radio service, leasing of special transmitters to the American Telephone and Telegraph Co. for San Francisco-London telephone service, merchandising sales of broadcast receivers, broadcasting and tube sales.

The sales in 1926 of the receivers shows a substantial increase over the prior year, not only in units, but in dollar value. The figures are not given. Through improved manufacturing methods and increased quantity production, the prices on standard types of Radiotrons were reduced twice during the year. The successful inauguration of the R. C. A. Authorized Dealer Plan for the distribution of sets was also made in 1926.

The report pleased stockholders.

Impedance Coupler Announced by G. R.

As a result of development work on the problem of high quality amplification, the General Radio Company of Cambridge, Mass., announces the Type 373 Double Impedance Coupler. This unit, mounted in a heavy black metal case with two binding posts on each side and with four screw holes for mounting on board or sub-panel, consists of two impedances, one for the plate circuit and the other for the grid circuit, coupled by a condenser, thus forming a complete coupling unit which may be substituted for a transformer or resistance-coupled unit in the usual audio amplifier. The announcement says:

"To provide an improved amplification curve without the loss of volume and the other recognized drawbacks of the usual resistance or impedance coupled amplifier, is the purpose behind the GR Double Impedance Coupler. The present unit provides ecellent frequency characteristics from the lowest to the highest frequencies required in the faithful rendition of bass notes and harmonics for realistic music and speech. Because of the replacement of the usual grid leak necessary in resistance or impedance coupling by an impedance that combines high impedance to alternating current with low direct current resistance, the tendency to block on strong signals is reduced to absolute minimum.

"The comparatively low resistance of the choke permits of a higher operating voltage than do resistances with equal battery voltage, thus providing more volume without the very high voltages required for satisfactory resistance coupled amplification. The recommended amplifier comprises two stages with GR 373 coupling units, and a last stage with transformer GR 385-L or 285-D, together with power tubes in last and possibly second stage as well.

MAGNER-KELLY INCORPORATES

Wagner-Kelly, Inc., Terrace and Peck Stas., Muskegon, Mich., $15,000; purchase and sale of radio sets and equipment; A. J. Wagner, Thomas B. Kelly, Adama Pyle, Jr. (Incorporated under the laws of Michigan).

Literature Wanted

THE names of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature

Name .....

Address .....

City or town .....

State .....

J. F. Dixon, Jr., Chester, N. J.
F. E. Sunderland, 1461 Broad St. Providence, R. I.
C. Kronen, Confluence, Pa.
Eden G. Lefever, 431 East Philadelphia Ave., Berks County, Boyertown, Pa.
J. Harry Mearns, 1834 Lovering Ave., Bloomington, Del.
M. Smith, 3 Wykagyl Terrace, New Rochelle, N. Y.
Thomas Netland, 302 East Bowman St., South Bend, Inr.
A. L. Bertrand, 70 West Broadway, Derry, N. H.
Roy Belangea, 628 Grand St., Grant St., Danville, Ill.
Henry W. Hill. Box 94, Manchester Depot, Vt.
Charles E. Vange, 3638 McLean Ave., Chicago, Ill.
R. O. Eaton, 2449 Grand Ave., Niagara Falls, N. Y.
Charles Close, 1831 South Ruygold, Philadelphia, Pa.
Ray J. Lummerding, 509 Whitney St., Kaukauna, Wisc.
F. Graff, 705 West Russell St., Philadelphia, Pa.
C. W. Schannon, 1166 Scott St., Milwaukee, Wis.
H. D. Gerry, 809 K. St., Sacramento, Calif.
Phil G. Krippner, 216 South Maple Ave., Green Bay, Wisc.
Edward Pleasant, 8948 Rohns Ave., Detroit, Mich.
W. P. Haworth, 1119 West 8th Ave., Denver, Colo.
Wm. W. Western, 353 West 41st St., Seattle, Wash.
L. Nadelman, 498 Christopher Ave., Brooklyn, N. Y.
A. D. Nesbitt, 1716 Sassafras St., Erie, Pa.
J. M. Carew, 7 N. W. Second St., Miami, Fla.
J. M. Coulter, 2301 Mulberry St., St. Joseph, Mo.
E. W. Davidson, Terre Hill, Pa.
William Richards, 10 Sherman Ave., East Port Chester, Conn.
E. C. Horton, Box 293, Palestine, Tex.
Enrique Foruth, 18, Cuba St., Havana, Cuba.
Jos. H. Brennlisen, 6835 W. 30th Place, Berwyn, Ill.
Radio Heart Co., 724 Blake Ave., Brooklyn, N. Y.
F. T. Bennis, Hopkins, Minn.
Harry Beatty, 3 Vanderveer Const., Trenton, N. J.
William Sutherland 2901 Morcom, Oakland, Calif.
G. Isphording, 4231 Forest Ave., Norwood, O.
R. M. Bailey, 1944 Weber Ave., Box 175, Willowbrook, Calif.
Sylvester Imporota, Box 322, Noble, O.
G. H. Brown, 217 South Elm St., Nevada, Mo.
Sidney Lang, 337 Logan St., Brooklyn, N. Y.
Guy V. Bailey, 1720 36th St., Camden, N. J.
George E. Thompson, 2423 Boulder St., Los Angles, Calif.
J. W. Quinn, 825 Prospect Ave., S. E., Grand Rapids, Mich.
Mathew J. Oskinis, 19 Clifford St., Roxbury, Mass.
A. E. Ladish, 745 23d Ave., Milwaukee, Wis.
Ted Egolf, 957 East 149th St., Cleveland, O.

HOW THE TRANS-OCEAN PHONE WORKS

Described in detail by a famous engineer in the issue of Jan. 22, 1927 and in such a way that even the novice gets an insight into the fundamentals of this type of radio transmission. Follow this up with a description on how to build a set to listen-in on the overseas phone, by Capt. Peter V. O'Rourke, in the issue of Jan. 29, 1927. Send 30c for both of these, or better still send $6 for one years subscription to Radio World and get these copies as a premium. RADIO WORLD 145 W. 45th St., N. Y. C.

WATCH EXPIRATION OF YOUR SUBSCRIPTION!

Subscribers will note that the end of their subscriptions is indicated on the labels on wrappers. If your wrapper shows a date earlier than the current issue, please send payment for renewal. Changes in expiration dates on wrappers appear two weeks after receipt of renewal.
RADIO WORLD, 145 West 45th St., New York City. (Phones: Bryant 0558-0559.)

R. H. Langley, of G. E., Joins Crosley Staff

Cincinnati, O.

Ralph H. Langley, formerly radio engineer in the laboratories of the General Electric Company at Schenectady, N. Y., has been appointed assistant to the president of the Crosley Corporation in Cincinnati, it was announced.

Langley has been affiliated with the General Electric Company as a research engineer since 1920, and previous to that time was connected with the Marconi Company. He is said to have aided in the development on the first transmission apparatus for use in airplanes. Langley is a graduate of Columbia University and holds a degree in electrical engineering. His work in developing the superhetrodyne has given him a fund of knowledge which will enable him to incorporate some new improvements in the receiving sets at the Crosley plant.

All Space Sold for Chicago Trade Show

G. Clayton Irwin, Jr., managing director of the Radio Manufacturers' Association Trade Show, to be held in Chicago the week of June 13, announces the complete sale of all booth space at the show.

"Efforts are being made to secure more exhibit space," Mr. Irwin said, "and a special waiting list of manufacturers who are anxious to exhibit has been started."

NEW CORPORATIONS

United Broadcasting Corp., N. Y. City, N. Y., $10,000; S. N. and W. Baruch, S. Sinsheimer. (Attorneys, Todd and St. John, 258 Broadway, N. Y. City).

Akers Radio Manufacturing Co., 4137 the paseo, Kansas City, Mo., to manufacture, buy, sell, and deal in radios and equipment. Gerald Akers, Nellie B. Akers, E. J. Curtin. (Incorporated under the laws of Missouri.

Virginia Paint and Radio Corporation, Newport News, Va., $500 to $50,000; T. A. Fowler, W. T. Bull, A. Rosenbaum, Allen D. Jones all of Newport News, Va. (Attorney Allan D. Jones, Newport News, Va.)

Chapin Motors, Inc., Winsted, Conn., engage in automobile and radio business; 200 shares preferred stock, par value of $100 and 300 shares common, no par; George H. Chapin, Frank Mandin, Edith H. Merchant. (Incorporated under the laws of Connecticut).

Radio Merchandise, N. Y., $25,000, C. K. Grab, N. Rosefsky. M. Max (Attorneys, Williams & Williams, 1440 Broadway, N. Y. City, N. Y.)

Italian Radio Association, N. Y. City, N. Y., broadcasting, $150,000; C. Giglo, O. J. and E. Amaducci. (Attorneys, Marro & Fortinash, 60 Spring St., N. Y. City, N. Y.)

European Radio Phonograph Electric Corp., N. Y. City., $5,000; J. and M. Alonzo, J. Cardona. (Attorneys, Calinella & Calinella, 277 Broadway, N. Y. City, N. Y.)

Radio Sales Company, Inc., Houston, Tex., $5,000; H. L. Williams, H. O. Quebe, I. L. Fereday. (Incorporated under the laws of Texas).

Ramapo Electric and Radio Co., Ramapo, N. Y., $20,000; G. Dubrow, M. E. Foley, R. L. Stelley. (Attorney, L. A. Hershfield, Spring Valley, N. Y.)

Aerial Tied to Tower 90 Feet From Ground

Lebanan, Pa.

A forty-foot tower, which will be used for purposes of radio reception has been erected on the roof of the new Goodman Electric Company Building, at Fifth and Cumberland streets. N. B. R. Goodman is the manager of the company.

This tower is 90 feet from the ground, and is 8 feet higher than the pole which was erected in the rear of Mr. Goodman's yard some time ago.

The station at the new Goodman building, therefore, is the largest radio receiving station in the city of Lebanon.

Horse Show Hour Is Put on the Air

Los Angeles.

KNX has been going in for some special novelties recently. One of the latest was to have an hour on the air direct from the Horse Show. Another was the opening of a theatre, and a third was some special experimental work.

KOST FEATURED AT WOR

Henry N. Kost, tenor, widely known to patrons of vaudeville as "Cody, the Singing Cartoonist", was featured on the WOR program recently. Kost is one of the most versatile artists now appearing before the microphone. He is a nationally known cartoonist who specializes in depicting the foibles of celebrites and his radio offering consisted of popular songs and patter.

NEW PARTS

The following request manufacturers to write them of new items:

F. F. Anderson, 512 North Monticello Ave., Chicago, Ill.

Al. Donnell, 88 Sylvan St., Rutherford, N. J.

H. J. Speidel, R. R. 16 Mt. Healtthy, O.

Carl Upschulte, 1215 St. Mary's Boulevard, Pefferson, Mo.

George Williams, 18 Depot St., Peckville, Pa.

Chickoray Radio Co., 2028 Beachwood Drive, Hollywood, Calif.

Daniel Greens, 63 Southern Boulevard, N. Y. City.

William Freker, 549 Procetory Place, Pittsburgh, Pa.

Herman R. Wallin, 693 Watkins St., Brooklyn, N. Y.

THE 5-TUBE DIAMOND

Fully described by Herman Bernard in a booklet, with diagrams, including blueprint, and sent on receipt of 50 cents. The Diamond is automatically adaptable to phonograph pickup. RADIO WORLD, 145 West 45th St., N. Y. City.

Fight Broadcasts Are Called Popular

Los Angeles.

The return of the fights as a regular Friday evening feature over KNX, has met with instant approval from listeners. The main event of the American Legion Stadium weekly card is put on the air. Curtis Benton, scenario writer, gives a blow by blow account of the battle round by round. KNX has arranged a flexible program preceding the fight, so it is possible to start at the first round. Many times knockouts in the preliminaries bring the starting time of the big bout very early. By doing this fans are assured of the entire bout.

Funds Being Raised For Socialist Station

Leaders in the Socialist party have announced that they plan to erect a high power radio station in honor of the memory of Eugene V. Debs. Propaganda is their avowed object. Funds are now being raised to make the project possible, and it is stated that $250,000 will be necessary.

"Oh, mother, pray, do tell me this—
What do they mean—'profane,' 'emphatic'?"
"My darling child, you'll understand
When Dad is tuning out the static!"

—A. Marconi

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD: 1926:

June 19—Selectivity's Amazing Coil, by J. E. Anderson. The Light 5-Tube Portable Set, by Herman Bernard.

July 3—Set with a 1-Turn Primary, by Herman Bernard. Part 2 of the Victoreen Portable, by H. Bernard. Trouble Shooting Article for The Light 5-Tube Portable.

July 10—A Rub in Single Control, by Herman Bernard. A DX Double Regenerator, by Capt. P. V. O'Rourke. A 2-Tube Dry Cell Receiver, by Samuel Schmaltz.

July 31—What's Best in an AF Amplifier, by Herman Bernard. A 6-Tube Reversed Feedback Set, by K. B. Humphrey.

Aug. 14—The Improved Browning-Drake, by Herman Bernard (Part 1). Storage Batteries, by John A. White.

Aug. 21—A New Stabilized Circuit, by E. H. Loftin and S. Y. White (Part 1). The Browning-Drake by Herman Bernard (Part 2).

Aug. 28—The Constant Coupling, by E. H. Loftin and S. Y. White (Part 2). The Browning-Drake, by Herman Bernard (Part 3).

Sept. 4—The Four Rectifier Types, by K. B. Humphrey. A Simple Battery Charger, by J. E. Anderson.

Sept. 11—The Beacon (3-tubes), by James H. Carroll. The 1927 Model Victoreen, by Herman Bernard.

Sept. 18—The 1927 Victoreen, by Arthur H. Lynch. Eliminator in a Cash Box, by Paul R. Fernald.

Sept. 25—The Lynch Lamp Socket Amplifier, by Arthur H. Lynch. Wiring up the Victoreen, by Herman Bernard.

Oct. 2—The Victoreen (Continued), by Herman Bernard. New Equamatic System, by Capt. P. V. O'Rourke.

Oct. 9—A Practical "A" Eliminator, by Arthur H. Lynch. Building the Equamatic, by Capt. P. V. O'Rourke.

Oct. 16—The Bernard, by Herman Bernard. How to Box an "A" Supply, by Herbert E. Hayden.

Oct. 23—The 5-tube P. C. Samson, by Capt. P. V. O'Rourke. Getting DX on the Bernard, by Lewis Winner.

Oct. 30—The Singletrol Receiver, by Herbert E. Hayden. How to Get Rid of Squeals, by Herman Bernard.

Nov. 6—Reduction of Interference, by A. N. Goldsmith. Variations of Impedances, by J. E. Anderson.

Nov. 13—The 4-tube Hi-Power Set, by Herbert E. Hayden. A Study of Eliminators, by Herman Bernard.

Nov. 20—Vital Pointers About Tubes, by Capt. P. V. O'Rourke. The 4-tube Diamond of the air, by Herman Bernard.

Nov. 27—The Antennaless Receiver, by Dr. Louis B. Blan (Part 1). Short Waves Yield Secrets, by M. L. Prescott.

Dec. 4—The Regenerative 5-Tube Set, by Capt. P. V. O'Rourke. The 8-tube Lincoln Super, by Sidney Stack. The Antennaless Receiver, by Dr. Louis B. Blan (Part 2). Winner's DC Eliminator, by Lewis Winner.

Dec. 11—The Universal Victoreen, by Ralph G. Hurd. Some Common Fallacies, by J. E. Anderson.

Dec. 18—Selectivity on One Tube, by Edgar Speare. Eliminating Interference, by J. E. Anderson. The Victoreen Universal, by Ralph G. Hurd (Concluding Part).

Dec. 25—A New Coupling Device, by J. E. Anderson. Functions of Eliminators, by Herman Bernard.

Jan. 1, 1927—The 2 Tube DeLuxe Receiver, by Arthur H. Lynch. The Twin-Choke Amplifier, by Kenneth Harkness.

Jan. 8—Tuning Out Powerful Locals, by J. E. Anderson. A Choice Superheterodyne, by Brunsten Brunn. The 2-Tube De-Luxe Receiver, by Arthur H. Lynch (Part 2).

Jan. 15—The DeLuxe Receiver, by Arthur H. Lynch (Part 3). The Simple Meter Test Circuit by Herbert E. Hayden. The Superheterodyne Modulator Analyzed, by J. E. Anderson.

Jan. 22—The Atlantic Radiophone feat, by Lewis Rand. An Insight Into Resistors, by J. E. Anderson. A Circuit for Great Power, by Sidney Stack.

Jan. 29—The Harkness KH-27 Receiver (Part 1), by Kenneth Harkness. Use of Biasing Resistors, by J. E. Anderson.

Feb. 5—5-Tube, 1 Dial Set, by Capt. P. V. O'Rourke. The Harkness KH-27 (Part 2), by Kenneth Harkness. What Produces Tone Quality, by J. E. Anderson.

Feb. 12—Phone Talk Put On Speaker, by Herbert E. Hayden. All Batteries Eliminated, by Herman Bernard. The Harkness KH-27 Receiver, by Kenneth Harkness (Part 3) conclusion.

Any copy, 15c. Any 7 copies, $1.00. All these 31 copies for $3.25, or start subscription with any issue. RADIO WORLD, 145 West 45th Street, New York City.

New Meter Reads Ten Billionth of One Ampere

An instrument that indicates a change in current as small as a tenth of a thousandth of a millionth part of an ampere has been developed in the standardizing laboratory of the West Lynn works of the General Electric Company as a part of the equipment which replaces the human eye in making tests on incandescent lamps, currents in insulators, radio tubes, etc. The instrument, known as a thermionic microammeter, has a full-scale reading of a tenth of a millionth of an ampere, with subdivisions of one five-hundredth of this amount. It is the most sensitive instrument of such a long scale length working on jewel bearings that has ever been built.

The usual 40-watt Mazda lamp, which consumes less than one-half cent's worth of electricity an hour, uses 200,000,000,000 times as much current as the amount represented by one subdivision on the scale of this instrument.

Combined With Cell

The lamp divisions of the General Electric Company at Harrison, N. J., and Cleveland have combined this microammeter with the photoelectric cell in the development of photometric apparatus which is far more susceptible to variations in intensity of light than is the human eye. The light output of lamps in the past has been measured by visually contrasting the amount of light given by the lamp in question with a known amount of light given by a standard lamp. Such a method is far less accurate than the new method, in which the human eye has been replaced by the electrical eye—the photoelectric cell—and the individual is required only to make scale readings of lumens or candlepower in the same manner as he would read volts or amperes on an ordinary laboratory standard instrument.

The photoelectric cell is a vacuum tube which is extremely sensitive to any changes of intensity of light falling upon it, due to the fact that its internal resistance varies with the intensity of the light reaching it. This property of the cell has been utilized in many ways, such as in transmitting photographs by radio, in making talking motion pictures, in an improved method for manufacuring phonograph records, and in different methods for accurately matching colors.

Inside Glistens

Except for a small circular area, the inside of the bulb of the cell glistens with metallic potassium. Depending upon the amount of light striking it, this method permits a varying amount of current to pass through the cell. The more light, the more current; each little increase in the amount of light striking the window of the cell is almost immediately responsible for an infinitesimal increase in the amount of current passing through the circuit of the cell.

For use in photometry, the photoelectric cell is located on the exterior of a spherical photometer, or Ulbricht sphere, with its window adjacent to the small window in the surface of the photometer. The photoelectric cell and the microamtric cell is located on the exterior of a an ordinary radio B battery, of 45, 90 or 135 volts. In this manner the amount of light given off by the lamp under test lowers the resistance of the cell, causing a current to flow through the photoelectric cell and microammeter circuit and, in turn, produces a deflection on the microammeter scale.

Late Frolics Wane

Los Angeles.

Although many stations have given up the late frolics that were so much in vogue a few short months ago, KNX continues to have an excellent one every Saturday evening. The station seldom closes until 2 o'clock Sunday morning.

France Takes Control of Whole Radio Net

Strict Supervision Voted of All Receivers and Transmitters, But Government Will Not Undertake To Do Broadcasting

All radio stations in France are now put under the general administration of the Post Telegraph and Telephone Service and the Ministry of the Interior by the provisions of new radio regulations promulgated in France. No radio for sending or receiving may be established or used except under the regulations prescribed, says an announcement just issued. The full text of a report to the U. S. Department of Commerce follows:

Private stations which receive communications other than private correspondence can be authorized after accepting a special agreement with the Post Telegraph and Telephone administration, the details of which are to be determined by decree, and after the payment of an "art tax" at rates to be determined. Places which charge an admission are in addition subject to an annual tax which is also to be determined by decree.

Power to Authorize

Private sending stations or receiving and sending stations may be established only by special authorization of the Ministers of War, Marine, Interior, and the Posts Telegraph and Telephone Service with the consent of an interministerial committee.

Three national and 18 regional establishments will be set up either under direct Government operation or by special concessionaries. The programs will be under the charge of special groups approved by Government authorities.

Taxation Feature

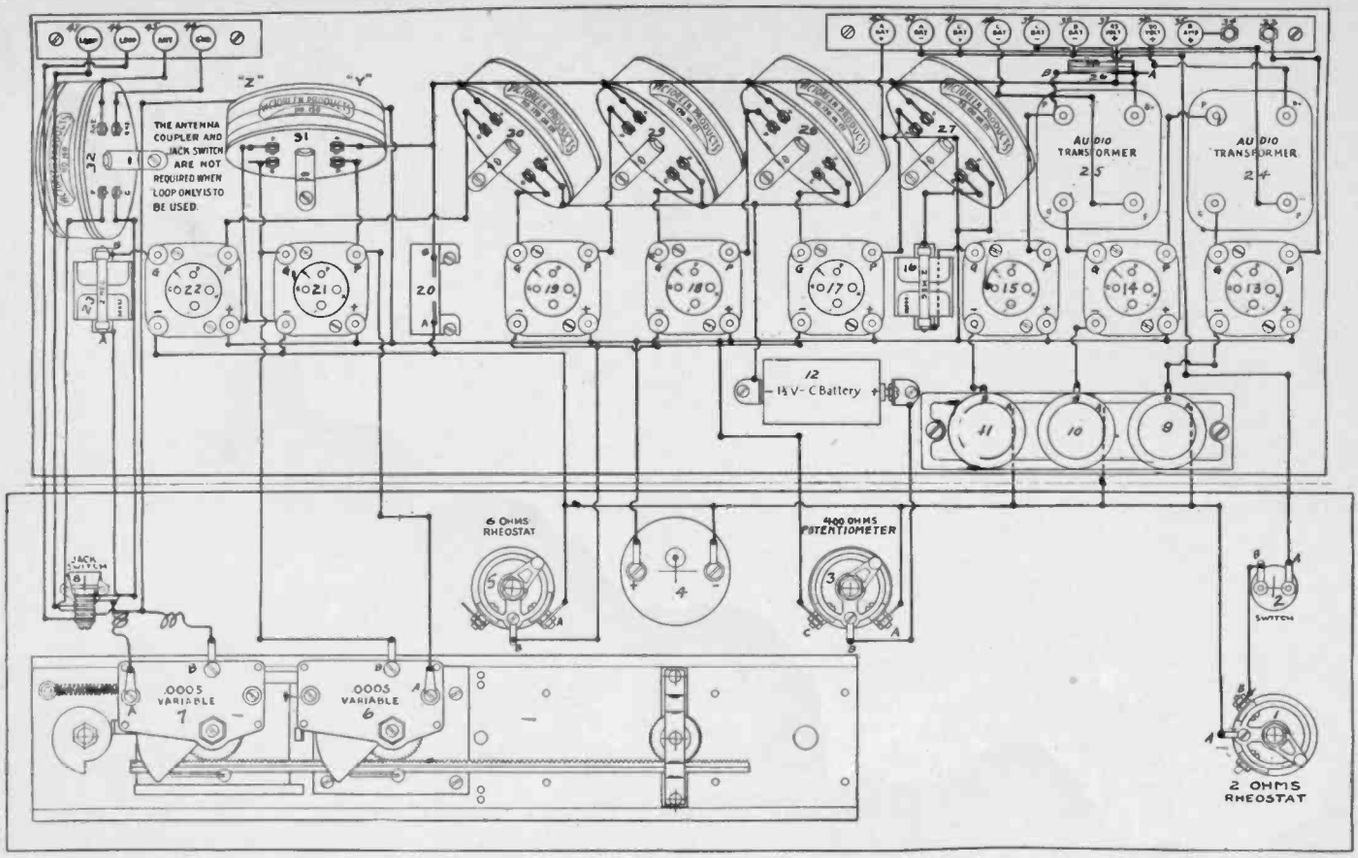
For the present the plan does not contemplate as extended official control and operation as the law makes possible. It is intended that the Posts Telegraph and Telephone service shall secure the cooperation of private groups which will assume the financial burden of operating the large sending stations. Until a year from the present time the Government authorities have the power to enter into contracts with private interests which shall run not longer than January 1, 1933, for the establishment and operation of the proposed stations.

The concessionaire is to pay a tax and the capital invested is to receive a dividend not greater than the interest on the advances of the Bank of France to the State plus 2 per cent. After charging off 10 per cent to amortization and payment of the dividends, the surplus profits are to be divided equally between the Government and the concessionaire. At the end of the contract period the operating authority becomes the owner of the properties subject to paying the nonamortized capital costs within five years.

Notwithstanding the declarations made by the Government that the new regulations do not contemplate nationalization, there is much in the new regulations which is disturbing to those in France who are anxious that the industry shall have free development, it is reported.

Special Permit Needed

Private radio equipment of all sorts is to be operated only by special permission. Its use may be stopped at any time on the vote of a Government commission. Free access to the markets of the world is limited in the case of both public and private sending stations by the requirement that such equipment "must be, as far as possible, of French manufacture."



Picture diagram of the wiring of the Universal Victoreen. Note an original twist to the filament wiring. The master control unit is at lower left.

How to Build THE DIAMOND

5-Tube Model

Herman Bernard, designer of this wonder circuit, has written an illustrated booklet on "How to Build RADIO WORLD'S *Improved Diamond of the Air." Send 50c and get this booklet, including a full-sized wiring blueprint and free nameplate.*

Outstanding Features of Set: (1) Fans, charmed by tone quality, sensitivity and selectivity, report speaker reception of far-distant stations with great volume. (2) A 2-tube earphone set, a 5-tube speaker set, and a separate 3-stage audio-amplifier for immediate use with any tuner, are combined in one. (3) No rheostats are used. (4) The set is inexpensive to construct and maintain. (5) The set works from outdoor aerial or loop; hence no aerial problems present themselves, in city or country.

Send $6 for year's subscription and get booklet, blueprint.

[Newsdealers or radio dealers, order the booklets with blueprints included, in quantity, direct from American News Co. or branches.]

RADIO WORLD
145 West 45th St., New York City

Tubes Need No Matching Here

Tube matching forgotten in a Super-Heterodyne! Hard to believe isn't it—but it's so. This is accomplished by a condenser built across the secondary of the IFT of Victoreen manufacture. The variation in tube capacity in comparison with the shunt condenser is so small as to become negligible. This also holds true with regard to the manner in which the general wiring is carried out. No special attention is necessary for success—only, it's always good policy to make your leads as short as possible—especially the grid leads.

Due to the truly resonant characteristics of the secondary, an aperiodic primary is used. This permits the transformers to be used with either 201-A or 199 tubes. If your Victoreen is to be operated on the large tubes—specify 170s for inter-

FILL OUT AND MAIL NOW

SUBSCRIPTION BLANK

RADIO WORLD

RADIO WORLD 145 *West 45th Street, New York City (Just East of Broadway)*

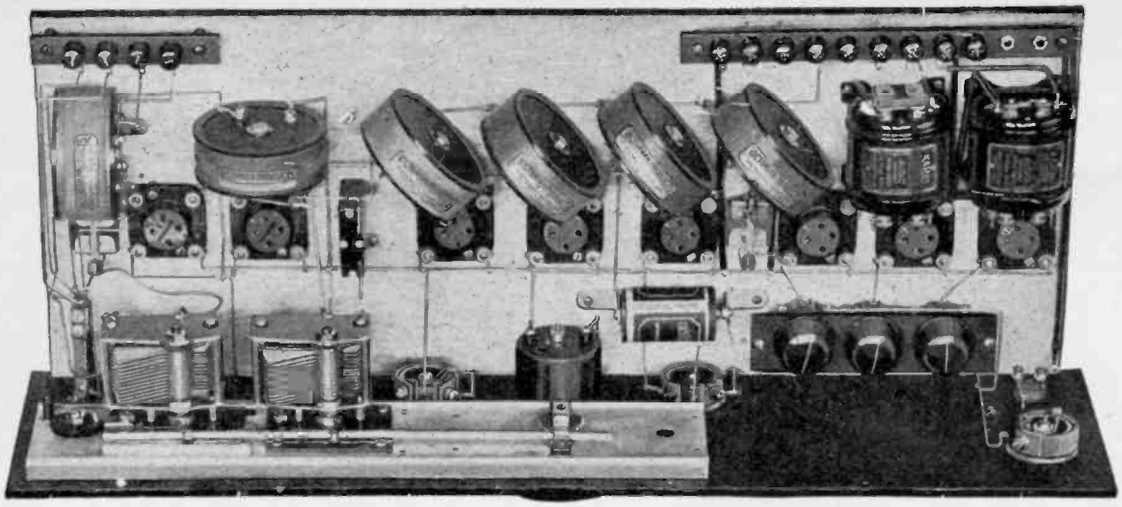
Please send me RADIO WORLD for.....months, for which please find enclosed.....

SUBSCRIPTION RATES:
Single Copy .....$ .15
Three Months..... 1.50
Six Months..... 3.00
One Year, 52 Issues..... 6.00
Add $1.00 a Year for Foreign Postage; 50c for Canadian Postage.

.....

.....

.....



The top view of the Universal Victoreen.

mediates; 171s if you plan to build a dry cell tube affair. All the transformers are tuned to the same wavelength and it is an easy matter to make replacements in case any of the transformers are broken by handling or through other reasons.

The peak of these transformers has been designed that the variation in voice frequency will not cause distortion. Usually Super-Heterodyne transformers are tuned between 1,600 to 10,000 meters. On the latter wavelength iron core transformer alone can be used. This opens up the possibility of distortion. On 1,600 meters the amplification is hindered because of interstate oscillation and this would only be overcome through the "losser" system of potentiometer control.

Peaked at 3,400 Meters

Victoreen transformers have been established at 3,400 meters. This was considered as the best wavelength and is equivalent to 88,000 cycles and offers the least trouble in harmonics.

In the average Super-Heterodyne the potentiometer is used to prevent oscillation by decreasing the sensitivity of the tubes. In the Victoreen, although the potentiometer is used it does not act in this manner, and, on the other hand, is used purely as a control of the grid voltage on the radio frequency tubes. This use makes it appear to him who little understands radio as a volume control and it may be safely used as such.

The Victoreen has been operated on local and long distance stations with the detector B lead on 16 volts and even less. There was no lack of volume. This leads us to another thought. It must be most certainly granted that it ought cost more to own and operate Super-Heterodyne as compared with a five-tube set—and, in this statement which follows, although it may seem difficult to believe—it is the truth. There is less B battery consumption on the Victoreen than there is in the average five-tube and some four-tube sets. The old-time popular three tube sets may be included. The drain is from 8 to 10 milliamps. There is real economy for anyone.

One does not bother about A battery drain these days for everyone owns and uses a battery charger or ought to.

Question of Tubes

If the "bugaboo" which has made Super-Heterodyne ownership costly, has been eliminated what else can keep the radio fan from at last owning a real good super? Don't let eight tubes scare you. You have in your home this very minute tubes which you are not using because they don't seem to be very good on your present set.

COMPLETE DATA on "How to Build a DC A and B Eliminator," were given in the Dec. 4 issue of RADIO WORLD, by Lewis Winner. Lucid photos and diagrams accompanied this excellent article. Either send 15c for this copy, or begin your subscription with this issue. RADIO WORLD, 145 West 45th St., N. Y. City, N. Y.

Open Secondary Has the Higher Potential

If AC is flowing in the primary of a transformer there is an alternating potential difference across the secondary terminals even if the secondary circuit is open. In fact, the P. D. is greater when the secondary is open than when it is closed. As soon as it is closed current flows, and part of the original potential is used up in driving the current through the windings of the secondary, because they contain resistance. The total electromotive force (emf) in the secondary does not change when the circuit is closed. The emf is same as the P. D. when the circuit is open. When the circuit is closed the emf is the amount of work done in carrying a unit of electric quantity around the entire circuit against the electric force.

There is also a difference of potential across the terminals of a battery even when no current is flowing. And as in the case of the transformer, the P. D. is greater when the cell is open than when the circuit is closed. The difference is the fall of potential in the internal resistance of the cell.

If a battery be connected across the terminals of a condenser there will be a current flowing into the condenser for a very short time. It will flow until the potential difference across the condenser is equal to the potential of the battery. When current has ceased to flow, the battery is charged to a potential equal to that of the battery and that charged remains in the condenser when the battery is removed, unless there is a leak in the condenser which lets it escape gradually.

A certain amount of work has been done by the battery in charging the condenser, and this work may be regained in discharging the condenser. If the condenser is discharged through a head set, a click will be heard, and this click is produced by the work which was originally done in charging the condenser. The amount of work required to charge a condenser is measured by one half the product of the square of the voltage multiplied by the capacity of the condenser, that is, $W = \frac{1}{2}V^2C$. Thus if the condenser is charged to 100 volts and the capacity is 4 microfarads, the work or energy stored in the condenser is .02 joules. A joule is a watt-second of energy or work. The energy stored in this condenser is about eleven one millionths of the energy required to operate a 50 watt light for one hour.

The charging of a condenser may be compared with the inflation of an air tank. The pump used is the battery. The pressure of the air is the voltage, or potential difference of the condenser, the size of the tank is the capacity of the condenser. Work is done in charging the gas tank with air up to a certain pressure.

Quotations Laud Value of Reception

"Radio enters the sickroom to cheer the suffering patient. It brings the orchestra to the helpless cripple. It gives the deaf, or some of them, the power to hear. Radio is thus an angel of mercy. It is the spirit of the Red Cross set to music."

"Men bring their experiences from the far corners of the earth and lay them at our hearth."

"The radio wave travels the air and the earth so that he who tunes may listen."

"Radio plays no favorites. It makes its happy entrance to all homes and all places and flies with eager wings alike to the golden dome of a king's palace and to the squalid hut of the hermit in the hollow of the hillside."

Tilson & Tilson Have a New Kit

Tilson & Tilson, 154 Nassau Street, New York City, have taken over the distribution in the East of the "Nine-in-Line" basic kit. This circuit has made a decided hit in Chicago, wonderful reports of its performance being circulated. The growing interest all over the country decided the High Frequency Laboratories, makers of the kit, to branch out to bring something new to the fans who are always seeking something better. The kit is attractively boxed and consists of two air core transformers with maximum amplification at exactly 35.6 kilocycles; three iron core transformers, also at 35.6; one radio frequency choke; one radio frequency transformer and two audio transformers, all matched with laboratory exactitude. A beautiful drilled and engraved front panel, together with subpanel, also drilled ready for mounting, are also available, both made by the Celeron Company, makers of quality panels. Information on the kit and the panels will be cheerfully supplied by Tilson & Tilson upon application to the above address.—J. H. C.

Motorboating Misconstrued to Be Fading

Motorboating is a well known characteristic of well-designed audio frequency amplifiers which are operating under difficulties. The frequency of the put-putting may be almost anything from zero up to audible frequencies. Of course squealing of a receiver is due to the same cause as motorboating, but it rarely happens in well-designed circuits, at least not when reasonably large by-pass condensers are connected across the plate battery or eliminator.

If the amplifier is capable of bringing out the very lowest notes, or, rather, oscillations. the motorboating may take the form of a slow but periodic swelling and waning of the signal, not unlike that of slow fading. The amplitude of the slow oscillation may be such as completely to modulate the signal, that is, it may completely cut out the signal in the trough of the wave and double its intensity at the crest.

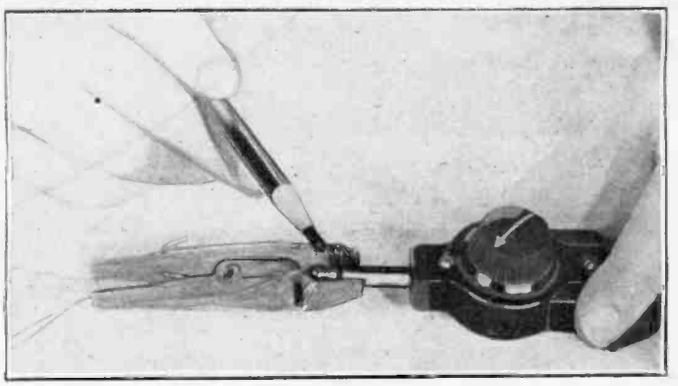
If the oscillation is feeble it is not annoying and can only be noticed if special attention is given it.

A much greater variation in the signal can be tolerated if the fluctuation is very slow than if it is rapid enough to constitute an audible frequency by itself.

Since slow motorboating is almost identical with slow fading is it not logical to assume that some troubles which have been attributed to fading in reality is only oscillation in the audio amplifier? The occurrence and intensity of motorboating in an amplifier depends to a certain extent on the radio frequency amplification in the set and to a very much greater extent on the audio frequency amplification, and it is more severe the greater the amplification. Hence it seems that motorboating would appear oftener when distant stations are being received than when locals are being received, and that is usually the case. This applies to comparatively feeble motorboating only. Violent motorboating takes place all the time, whether the set is tuned or not. Therefore feeble motorboating takes place under somewhat the same conditions as fading and sometimes they may be confused. Usually, however, true fading is not so regular as motorboating, its successive periods not being of equal duration.

HOW TO GET OUTPUT POLARITIES RIGHT

BY RUNNING the wires from a small battery to the input posts of a plug, which is not marked for polarity, and connecting the output shaft of the plug to a wooden clip, connected to any type voltmeter, the correct polarity markings of the input posts are had.



Mary had a little set
Whose wheeze was far from pleasant.
Ma bought it at a fire sale
For Mary's birthday present.
—James Whitcomb Fields

Why not broadcast the doings of our belligerent Congressmen as "straight from the ringside"?

Radio is in its infancy, but who's to wash the bibs?

THEY ALL PRAISE THE BRETWOOD Variable Grid Leak

The Bretwood Grid Leak came with today's mail. It is now exactly 9:00 P.M. and the leak was installed about a half hour ago.
This note is not only an expression of appreciation but also an attestation of the truth of your advertising. During the past half hour I have tuned in stations "ALL OVER THE DIALS" at leisure, and can adjust reception with the leak almost equal to a variable condenser.
I feel constrained to add that while waiting for reply and then receipt of leak from you, there has been on the set a fixed leak and condenser of well known and thoroughly reliable make, and fairly good reception has been enjoyed but during this half-hour-only test thus far the results are inexpressibly beyond expectation.
Have been a radio fan only about four years, but I feel I have sufficient knowledge and experience to recognize a good thing upon fair trial. Your promptness and desire to satisfy your trade, in this case has won for you another "BRETWOOD BOOSTER." Thank you.

The Rev. WALTER G. BARLOW,
Bishopville, Md.

Very many thanks foryourkind letter of the 21st ult. and for the grid leak, which works perfectly. I have tried four different makes of grid leaks. The Bretwood "has 'em beat."

M. SAWYER,
Box 238, Los Gatos, Calif.

Received your grid leak and wish to say that none can compare with it when it comes to clearing up reception.

JOHN A. BLACKBURN,
5328 Warren Ave., Norwood, Ohio.

Enclosed find P. O. money-order for $3.00. Please send me two of your Variable Grid Leaks. I am using one and it works fine. Please mail them as soon as possible.

W. H. PERRY,
119 Congress St., Buffalo, N. Y.

Received your grid leak and many thanks. It is the best $1.50 that I have spent for radio equipment.

ED. JENKINS,
703 E. Main St., Louisville, Ky.

Enclosed herewith find check for $1.50 for one Bretwood Grid Leak. I am using your leak and find it far superior to any others. This is my third Bretwood.

J. C. WHITE,
422 W. Wooster St., Bowling Green, Ohio.

Will you please send me by return mail two Bretwood Variable Grid Leaks. I enclose herewith check for $3.25, the 25c being for a special handling stamp, as these leaks are needed at once.
The leaks are the only satisfactory instrument on the market. I find them absolutely essential in the construction and operation of sensitive experimental receivers.

ED. J. WHITTIER,
The American Appraisal Co.,
Milwaukee, Wis.

I want to thank you for your leak, it makes the set 100% better. I was going to have a Diamond of the Air built, but since I have added your leak to my set I am now down in the dining room of the first floor and the set is on the second floor. I can hear the set just as plainly as if I were up there. I can hear every player in any band or music which is on air. The first night I gave the leak a very good test, and I got four stations in Chicago, one in Detroit, one in Canada, one in Atlanta, Ga., and several others without any noise. All were good and clear. It is going to make me spend more money, as I will have to get a good loud speaker. The horn I have now is a Manhattan Jr.. and is good and clear, but as soon as your leak is installed the howling present when using three tubes is immediately stopped.

LEON E. COLE,
5816 Tilbert St., Philadelphia, Pa.

Grid Leak received and tested out, and find it is the only variable leak I ever used that is really variable. Enclosed find $1.50, for which please send me another one.

F. E. STAYTON,
Box 240, Ardmore, Okla.

Thank you for introducing me to the Bretwood Variable Grid Leak! I have installed one in my Three-Circuit Tuner, according to your instructions, and find that it does all you said it would—and more. I am now recommending the Bretwood to all my friends, and those who have used this wonder grid leak have nothing but high praise for it. The fact that it can be adapted for any hookup makes it invaluable to the experimenter.
Although I have only used the Bretwood leak for three weeks I have pulled in several of the weaker stations which were inaudible before, and the microphonic noises which were decidedly pronounced before have entirely disappeared.
Please accept my best wishes for your continued success and also for the Bretwood Grid Leak.

S. R. HUBBS,
180 Quincy St., Brooklyn, N. Y.

Let me say that the Bretwood Grid Leak improves the set 100%.

J. E. McGINNISS,
27 Lenox Rd., Brooklyn, N. Y.

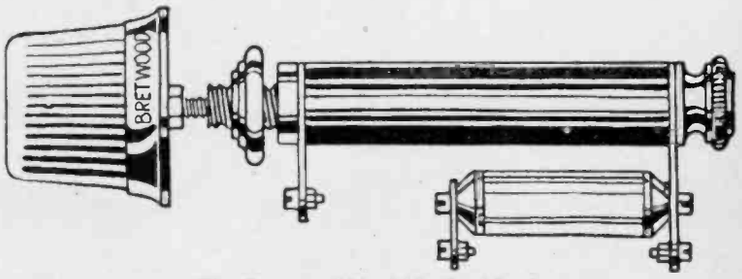
I wish to take this occasion to thank you for your courtesy in furnishing me with your very excellent Grid Leaks. I have installed one with your Condenser on my own personal radio set, and am delighted with the results.

R. W. DeMOTT,
Experimenter Pub. Co.
53 Park Place, N. Y. C.

I have received the Grid Leak you sent me and it is perfect. It is surely wonderful the way it works. Please send me another by return mail for a friend.

J. F. COOPER,
1029 Courtlandt St.
Cincinnati, Ohio.

WITH so much interference these days, why not improve your detector tube action and gain selectivity? Simply install a Bretwood Variable Grid Leak. Price $1.50.



The Bretwood Variable Grid Leak
Precision Range, 0 to 10 Megohms

Brings in More Distant Stations—Affords Greater Volume—Improves Tone Quality Fits Any Set, Panel or Baseboard.

Price, $1.50

"IT DOES THE TRICK"

The North American Bretwood Co.

Telephone, BRYant 0559

145 West 45th Street, N. Y. City

Sole Distributors for United States

North American Bretwood Co., 145 West 45th St., N. Y. City.

Gentlemen: Enclosed find $1.50. Send me at once one Bretwood Variable Grid Leak on 5-day money-back guarantee. (Or $2.00 for leak with grid condenser attached.)

NAME .....

ADDRESS .....

CITY..... STATE.....

Inquiries Solicited from the Trade

BST 5

Tested, Approved and Received Certificate of Merit from Radio News and Radio World

$40.00

Gets 115 Stations With B. S. T.-5

Have been using one of your B. S. T.-5 sets about three months and I certainly am pleased with the results. I am using a 90 ft. aerial, B eliminator, storage battery and a cone speaker and have logged 115 stations from WOK, 217.3, to KSD, 545.1, all on loud speaker loud enough to be heard all over my house with a clear tone. My neighbors say they have heard it several times in their house with all windows closed and enjoyed it.

W. R. WESTCOTT, 128 Biddle St., Kane, Pa.

B. S. T. Has the "Punch"

I am more than pleased with your B. S. T., for it sure has the punch to go get the stations. At present it is going "strong"—taking care of two speakers. A Western Electric in my home and one in my mother's home next door and both have real volume.

JOHN H. BARTON,
277 Delaware St., New Brunswick, N. J.

I take great pleasure in telling you that my B. S. T. 5-tube set is working splendidly in every way, and the cabinet itself is beautiful, and admired by all my friends.

THOMAS HARTLE,
155 Perry St., Paterson, N. J.

IMMEDIATE DELIVERY

New model cabinet Du Pont Duco finish; base 21" long by 8" wide, height 9½", top 21" by 6". Five-ply walnut veneer

DIRECT FROM FACTORY TO YOU SAVES HALF AND IS GUARANTEED

This highly sensitive, powerful and selective BST-5 radio receiver has all up-to-the minute improvements. Heavy aluminum automobile type chassis, shielded against stray currents and distortion. Flexible grip, Universal type sockets, eliminating microphonic noises. Has provision for battery eliminator and any power tube. Fahnestock clips on sub-panel for adjusting C battery, has voltages for power tube. Efficient on either long or short aerial, including indoor aerial. This BST-5 sets a new standard for true tone values and selectivity. This BST-5 gives greater volume than many six-tube sets and consumes less current.

Shipment made same day we receive your cheque or P. O. Money Order for $40.

RADIO WORLD Guarantees the Responsibility of This Advertiser

B. S. T. CONE SPEAKER

Guaranteed to give Satisfaction in Tone, Volume and Appearance Adjustable to Volume Desired

18 inches in diameter edged in Gold Braid, Art Metal Base can be placed on highly polished surface without danger of scratching.

Immediate Delivery

$7.50

Shipped Direct from Factory

Satisfaction Guaranteed or Money Back

GUARANTY RADIO GOODS CO. 145 West 45th St., New York

For greatest economy all loud speaker sets require the new Eveready Layerbilt "B" Batteries

IT WILL pay you, in convenience and reliability as well as in dollars and cents saved, to use this remarkable battery.

The reason for the Eveready Layerbilt's surprising performance lies in its exclusive, patented construction. No other battery is like it. It is built in flat layers of current-producing elements, making practically a solid block. The layers make connection with each other automatically, and occupy all available space inside the battery case. Layer-building packs more active materials in a given area, and makes those materials produce more electricity.

Every loud-speaker set should use Heavy-Duty batteries, for they alone offer economy on modern receivers. When you buy new "B" batteries, be sure to get the Heavy-Duty size, and remember that the Eveready Layerbilt has proved to be the longest lasting, most economical of all Heavy-Duty batteries.

Our laboratories are continually testing batteries, and in all our tests we have yet to find a battery that is equal to the new improved and radically different Eveready Layerbilt "B" Battery No. 486. The development and perfecting of this remarkable battery is an outstanding battery-building achievement. It is the result of many years' experience plus the facilities and resources of the pioneer manufacturers of all dry cell batteries.

NATIONAL CARBON CO., INC.
New York San Francisco
Unit of Union Carbide and Carbon Corporation

Tuesday night is Eveready Hour Night —9 P. M., Eastern Standard Time, through the following stations:

WEAF—*New York*
WJAR—*Providence*
WEEI—*Boston*
WTAG—*Worcester*
WFI—*Philadelphia*
WGR—*Buffalo*
WCAE—*Pittsburgh*
WSAI—*Cincinnati*
WTAM—*Cleveland*
WWJ—*Detroit*
WGN—*Chicago*
WOC—*Davenport*
WCCO—*Minneapolis, St. Paul*
KSD—*St. Louis*
WRC—*Washington*
WGY—*Schenectady*