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RADIO WORLD

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America's First and Only National Radio Weekly

ol. 10 No. 19 253 Illustrated

Tubeless Amplifier Announced

Grid Biasing Through Resistors

A Simple 4-Valve Circuit

Hookup for Overseas 'Phone Set

The KH-27 RECEIVER *By Kenneth Harkness*

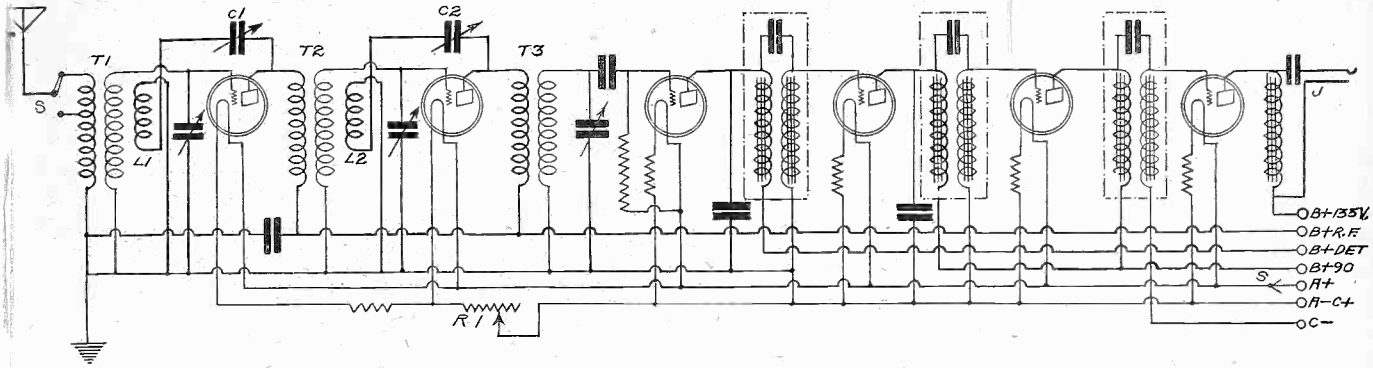


FIG. 1—The wiring diagram of Kenneth Harkness' latest receiver, the KH-27. See article on page 3.

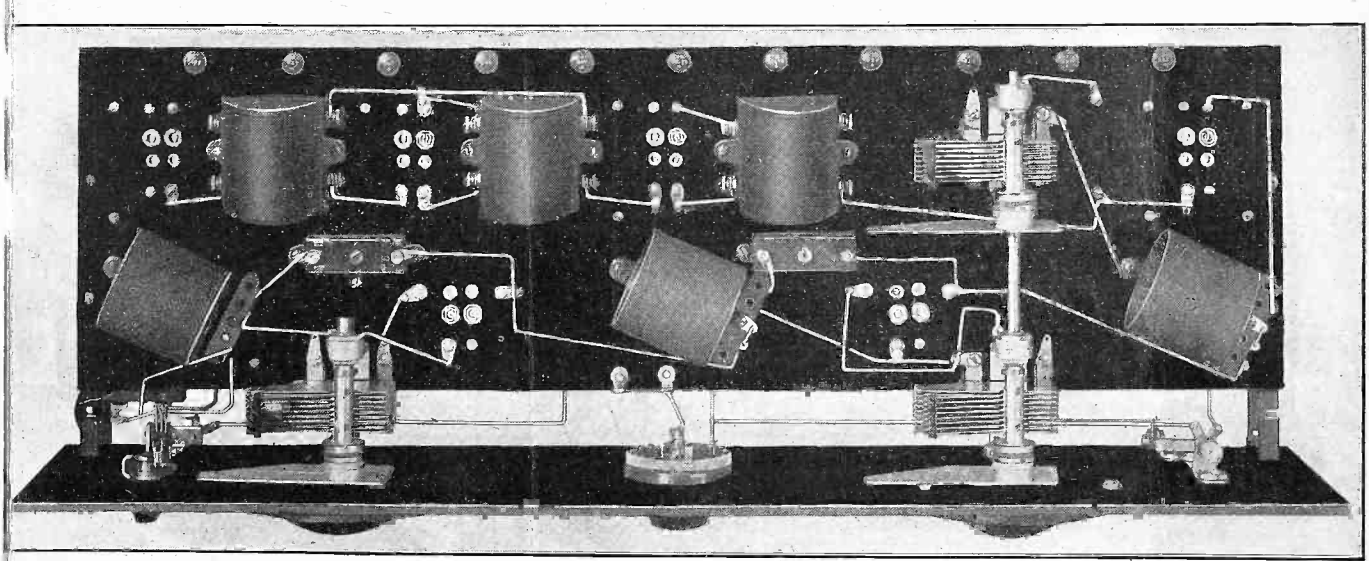


FIG. 2—Top view of the receiver after the wiring has been completed.

HOW TO RID RECEIVERS OF PARASITIC NOISES

LANGMUIR'S GREAT LABORATORY ADVENTURE

Vol. X
No. 19
JANUARY 29, 1927
Whole No. 253
15c Per Copy. $6.00 Per Year

RADIO WORLD
REG. U.S. PAT. OFF.

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

Phones BRYant 8558 and 8559

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

The Harkness KH-27 Receiver
Affords Sensitivity, Simplicity and Pure Tone

By Kenneth Harkness
Consulting Radio Engineer
Designer of the famous Harkness Reflex and the Harkness Counterflex Circuits.

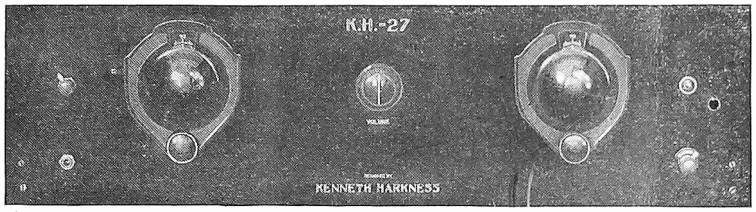


FIG. 3

The front panel view of the receiver. The antenna circuit is tuned by the dial at left. The righthand dial controls two gauged condensers with one motion. The volume control is the rheostat at center.

IT is really astonishing that after six years of broadcasting, after the installation of elaborate and costly radio receivers in thousands of homes, the vast majority of those who listen in nightly have actually no conception of how radio should really sound.

This statement may seem to be rather a wholesale indictment of present day radio receivers. It is not. Fortunately, many sets are capable of faithfully reproducing voice and music. Nevertheless, the vast majority of set owners have never really heard the almost perfect reproduction which modern methods of radio transmission and reception have made possible. They have no conception of the amazing realism with which voice and music can be reproduced.

The set, particularly the audio amplifier, is usually to blame. But even if the receiver is good, the loudspeaker often causes distortion. And if the set and the speaker are both nearly perfect, the tubes, the battery voltages or the battery eliminators may be unsuitable. Few and far between are the installations which harmoniously combine to give true reproduction.

It Is Up to the Listeners

It seems a pity that such a small percentage of radio listeners enjoy the real benefits of radio. Most broadcasting stations have modernized their equipment and have eliminated practically all distortion from their transmissions. Famous artists are appearing before their microphones. The stations are supervising their programs carefully and are weeding out the performers lacking real merit. They are replacing them with the best symphony orchestras, operatic stars of the first magnitude, famous violinists and pianists. The finest talent of the musical world is being offered freely. Unfortunately, most radio listeners are not equipped fully to avail themselves of these gifts of the air. Their receiving equipment distorts the pure transmissions of the broadcasting stations and the output of the average loudspeaker is just a poor imitation of the original.

Radio is no longer a mere "imitation" of voice and music. The days of howling, squealing, distorting reception are past. It is now possible to possess receiving equipment which can reproduce voice and music with almost perfect accuracy and which can create the illusion of reality. When the station announcer talks into the microphone, his voice, reproduced by your receiving equipment, should sound absolutely natural.

As If In Same Room

He should not sound as if he were talking through a megaphone, nor should he appear to be handicapped by the presence of a "hot potato in his mouth". He should actually sound as if he were in the same room with you, talking to you in a natural, unstrained manner. This effect of realism can be achieved with the proper equipment.

Similarly, most music can be reproduced with the same realism. When the strains of a violin issue from the loudspeaker, the sound should bring to your mind's eye the figure of the musician and you should feel his very presence there in your home. A radio receiver should and can be the medium through which actual voice and music come to you through the ether, carrying with them every shade of tone color which makes them distinctive, recognizable.

If the voices produced by your radio receiver are not the actual voices of the performers in the broadcasting studio, if every note of music does not come to you with all its tone shadings, as it would in the concert hall, your receiver is failing you as a medium of reception. There is something wrong with your radio installation. It may be the receiving set, it may be the speaker, the tubes or the batteries. The audio amplifier of your receiving set may alone be responsible. Whichever it is, you are missing the true gift of radio, the thing which makes a radio receiver more desirable than any phonograph—reality.

Reality Defined

What *is* reality? What makes one radio receiver sound better than another? How is the effect of reality obtained? To answer these questions we must understand the nature of sound. We must realize that one musical sound is distinguished from another not only by its pitch and volume but by its tone quality or tone color. It is this tone quality which makes a note struck on a piano sound unlike the same note played on any other instrument. The pitch, or fundamental frequency, is the same in all cases but the difference in tone *quality* makes them distinguishable from one another.

This difference in tone quality can be analyzed. Research has shown that most musical sounds are actually composed of numerous partial tones. The predominating tone, by which we recognize the pitch, is known as the fundamental; the others are overtones. The fundamental tone is the tone with the lowest frequency or pitch. The various overtones have much higher frequencies. The *quality* of any musical sound depends upon the number and relative strength of the various partial tones which combine to form the sound.

Accurate Reproduction

To achieve realistic reproduction of musical sounds, therefore, it is necessary accurately to reproduce not only the fundamental tone but all the overtones, without distorting *any* of the tones. If any of the tones are lost or distorted, the effect of realism is destroyed. The reproduction may be a fair imitation but it is not an exact duplication of the original sound and the essential tone quality is lost.

When John McCormack sings into the microphone his voice is distinguished by its quality, the warmth and color with which it is endowed. All the tones and overtones which combine to form this quality are faithfully transmitted by the broadcasting station. But if your receiver does not embrace all of this, if it fails accurately to reproduce each and every tone, from the highest overtone to the lowest fundamental, you might just as well be listening to an amateur singer whose performance is technically correct but without that quality which makes for greatness.

It is the purpose of this series of articles to describe a radio installation which preserves and accurately reproduces all the tones and overtones of musical sounds, as broadcast, and thereby creates the illusion of reality. The receiving set, of course, is the most important part of this installation and its construction will be described in detail. The best loudspeaker, tubes and battery voltages to use with this receiver will also be enumerated.

Set's Qualities Discussed

The receiving set is known as the KH-27 and was designed by me after months of experimentation, to reproduce musical sounds accurately and at the same time meet all the other standard requirements of a modern radio receiver. In other words, the set has sufficient amplifying properties to make possible the satisfactory reception of broadcasting stations within a wide radius; the set is selective enough to permit the reception of a desired station without experiencing interference from other stations on adjoining wavelengths; it can be operated by anyone, with ease, but above all, it employs

Neutralization Simplified
By Author's Modification of Rice Method

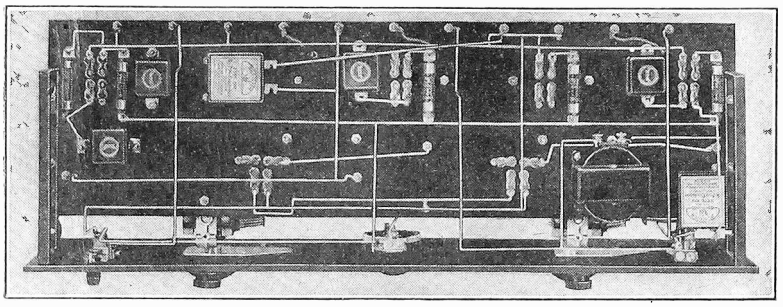


FIG. 4
The wiring is done underneath the subpanel, for the most part.

(*Continued from page 3*)

a system of audio amplification which gives practically uniform amplication of all audio frequencies and which can accommodate the comparatively large amount of power, or volume, necessary to obtain realistic reproduction without distortion.

The KH-27 receiver uses six tubes, two as radio frequency amplifiers, one as detector and three as audio frequency amplifiers. The electrical circuit is given in Fig. 1. Photographs of the set appear in this issue. The view of the front panel shows the operating controls. Stations are tuned in by means of the two vernier dials. The second dial simultaneously controls two condensers, joined by a common shaft. Volume is adjusted by the rheostat in the centre. This volume control is not regenerative. That is to say, you cannot make the set oscillate by varying the rheostat. Each radio frequency amplifying stage is completely neutralized. The system of neutralization is an adaptation of the Rice method developed by me and is unusually effective and easy to adjust.

Uses Large Neutralizer

The most unusual feature of the neutralizing system is the large capacity of the neutralizing condensers. The miximum capacity of each condenser is .0001 mfd. This considerably simplifies the process of neutralization. Furthermore, unlike the original Rice method, the rotors of the tuning condensers can be directly connected to ground, thereby eliminating body capacity effects.

The radio frequency transformers were designed especially for the KH-27. The primaries are large, insuring ample amplification and the prevention of sideband distortion. Transformers T1 and T2 include the neutralizing coils, which are placed inside the secondaries.

A most important part of the KH-27 is the audio frequency amplifier, which is largely responsible for the remarkably realistic reproduction of the receiver. This amplifier employs a new, patented system of inter-stage coupling, known as "Twinchoke" double impedance coupling. A three-stage Twinchoke audio amplifier was described by this writer in the January 1 and 8 issues of RADIO WORLD. To make the present series of articles clear, however, it will be necessary to review some of the facts already known to readers of the previous articles.

The Twinchoke system is the invention of E. E. Hiler, who has been granted a basic patent covering the design of the necessary coupling units. The amplifier is similar, in most respects, to the familiar "impedance-coupled" amplifier. However, the high resistance grid leaks used in the standard impedance-coupled amplifier are not employed in this new system. Audio choke coils, or impedances, are used instead.

Each Twinchoke double impedance coupling unit consists of two identical choke coils, one acting as the plate impedance and the other as the grid impedance. The two chokes are coupled by a 0.5 mfd. condenser connected from the end of one choke to the corresponding end of the other. There is no magnetic coupling between the chokes, no transformer action. The two chokes and the coupling condenser are all enclosed in a metal case to form a complete unit with primary and secondary terminals. Each coupler is connected in the circuit in the same manner as a transformer, as shown in the wiring diagram of Fig. 1, on front cover.

The advantages of this method of interstage coupling are numerous. In the first place, the amplification of all audio frequencies, from 30 to 10,000 cycles, is practically uniform. To fully realize what this means, compare it with the frequency range of the piano. The lowest note on the piano has a pitch or frequency of 27.2 and the highest note a pitch of 4138.4 cycles. Again, the pitch for the human singing voice is from 60 for a low bass to about 1,300 for a high soprano. The pitch of the highest note ordinarily used in music is 4,138 but overtones with frequencies up to 10,000 cycles enter into the composition of musical sounds and speech. The Twinchoke amplifier, then, covers the entire range of speech and music and gives uniform amplification at all frequencies which is the prime requisite of an amplifier.

Handles Much Power

Furthermore, unlike some other audio amplifiers, the Twinchoke amplifier will handle as much power or volume as the tubes will permit without distorting signals in any way. The ordinary amplifier has a very definite volume limit which cannot be exceeded without distortion being introduced. This limit is considerably lower than the "overload" limit of the tubes. When the volume exceeds a certain low value the leakage through the high resistance grid leaks is not rapid enough to relieve the potential charges impressed on the grids of the tubes. Rectifying distortion and "tube blocking" results. The choke coil grid leaks of the Twinchoke amplifier completely eliminates this inherent weakness. These grid chokes have a DC resistance of less than 2,000 ohms and the coupling condenser can discharge instantaneously. Consequently, the grids cannot accumulate excess charges, rectifying distortion and tube blocking are eliminated and the amplifier can handle as much volume as the tubes will permit.

Moreover, the Twinchoke amplifier goes a step farther. It actually quadruples the power output of each tube. In other words, this amplifier can handle *four times as much power as a transformer-coupled amplifier.* If the "overload" limit of a transformer-coupled amplifier (which, of course, can handle much more power than standard resistance or impedance-coupled amplifiers). is reached by a given volume of output, it would take four times as much volume to reach the overload limit of a Twinchoke amplifier, using the same tubes and battery voltages. Sufficient power output can be obtained with ordinary receiving tubes and B batteries to give reproduction which other types of amplifiers can achieve only by the use of extremely high voltages and higher power tubes.

This important and distinctive feature of the Twinchoke amplifier can be easily proved and demonstrated in practice. The explanation is based on the assumption that grid currents may be produced without causing appreciable distortion as there is no magnetic coupling between the various stages of the amplifier. In a transformer coupled amplifier it is necessary to adjust the potential of the grid of each tube to prevent the generation of grid currents. Otherwise, considerable distortion takes place.

[*Part II, the assembly and wiring, next* week.]

LIST OF PARTS

One KH-27 front panel, drilled and engraved, 7 x 26 inches.
One KH-27 subpanel, 7 x 25 inches, completely drilled, with six stockets attached.
One pair I. C. A. bakelite mounting brackets.
One condenser ¼ inch shaft, 9 inches long.
Three KH-27 coils, T1, T2 and T3.
Three KH Twinchoke Double Impedance Couplers.
One KH output filter choke coil.
Three Hammarlund 17-plate Midline condensers.
One Yaxley rheostat, 10 ohms.
One Yaxley fixed resistance, 2 ohms.
One Yaxley battery switch, midget.
One Yaxley pilot light bracket.
One Yaxley Midget aerial switch.
One Micamold grid condenser, .00025 mfd.
One Micamold fixed condenser, .001 mfd.
Two Micamold fixed condensers, .002 mfd.
One Micamold grid leak, 2 or 3 megohms.
Two Tobe type 201 condensers, 1 mfd. each.
Two X-L Variodensers, type G1.
Four Amperites (three Type 1A and one type 112).
Two Kurz-Kasch Vernier Dials.
One set Eby binding posts for the KH-27.
One 6-volt lamp for pilot light.
Four dozen 6/32 nuts and bolts, ½ and ¾ inches long.
Soldering lugs and bus bar.

ACCESSORIES

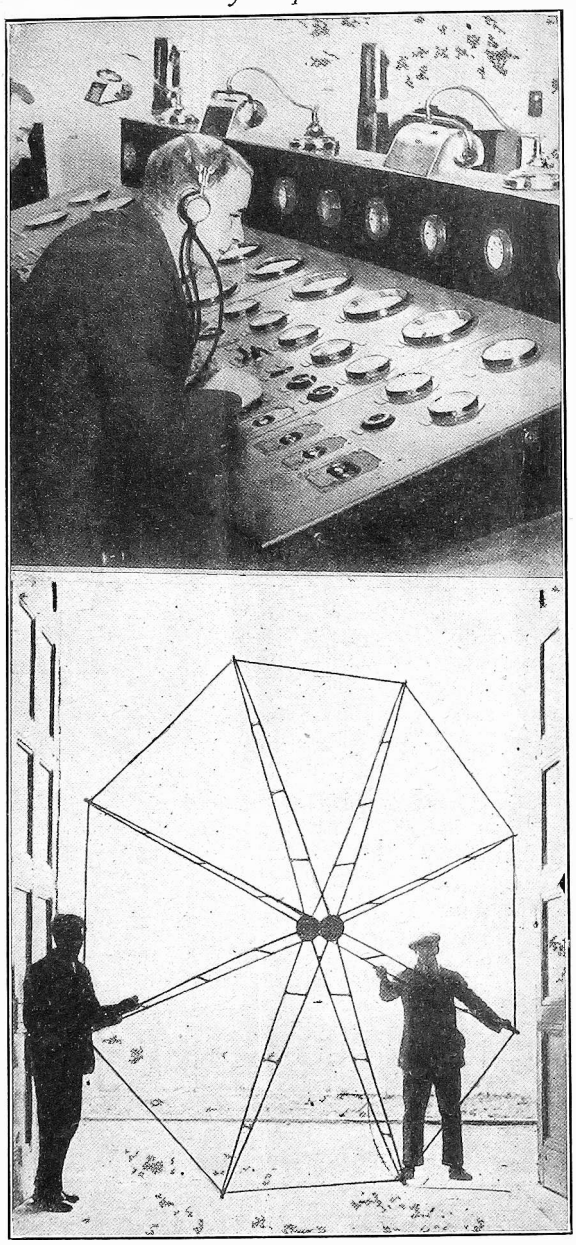
Four CeCo type A tubes; one CeCo type H; one CeCo type J; three 45-volt Eveready B batteries; one 22½ to 40½-volt Eveready C battery; one 6-volt storage A battery and charger; one Birnbach nine-conductor battery cable; one Western-Electric cone speaker; one Blandin cabinet.

Pick Up the Overseas 'Phone
With Set That Duplicates Carrier

By Capt. Peter V. O'Rourke

A GREAT deal of interest is displayed in the reception of trans-Atlantic telephony. The question of circuits offers an obstacle to many. If the telephony were carried on with ordinary radio, in which both side bands and the carrier are present, there would be no difficulty. All that would be required would be an ordinary receiver in which the tuning circuits are adjusted to the carrier frequency of the signal to be received. This happens to be 5,000 meters or 60 kilocycles. But since only one side band without the carrier is used the problem is not quite so simple. It is necessary to supply the missing carrier.

The carrier may be re-supplied by any one of the many oscillating circuits, provided that its frequency is adjusted to have exactly the same value as the original frequency, that is 60 kilocycles. For this purpose an intermediate frequency transformer may be used, provided that its peak occurs at a higher value than the 60 kilocycle frequency. It must be higher so that a condenser may be connected across the secondary to adjust the frequency exactly. Of course if the circuit will oscillate at exactly 60 kilocycles without the condenser then the condenser is not required. But the accuracy of the adjustment must be within a few cycles, otherwise the reproduced speech will not be understandable, or at least it will be badly distorted.



(Herbert Photos)

FIGS. 1 AND 2

Top photo shows the control board at the Rugby, England, station, the European terminus of the trans-Atlantic radio telephone. This elaborate and conveniently arranged control board contains most of the mechanism for handling the overseas conversations. Bottom photo shows one of the twelve-foot antenna spreaders used at the Rugby station for picking up the signals from America.

The tuning, however, is not so very difficult, since the reception is on a high wavelength.

One receiver which may be used is shown in Fig. 4 L_1 and L_2 are the two windings of an untuned intermediate frequency transformer which has a peak at or near 60 kc, but this transformer must not have a sharp characteristic. Its purpose is to pick up a frequency band from 60 to 70 kilocycles without favoring any-one of the frequencies to any marked extent. There are many suitable coils which may be used for this purpose that may be obtained in radio stores.

The oscillating coil L_2L_3 should be an intermediate transformer with much sharper characteristics so that it will cause oscillations in the circuit and also hold the frequency after adjustment to the right value. There are several transformers on the market which have peaks near or above 60 kilocycles and these may be used, provided they are not wound with too fine wire. A transformer may be wound which will perform satisfactorily. Starting with a winding form 1½ inch in diameter and the same length, the primary or plate coil should contain about 500 turns of No. 34 copper wire, perferably single cotton covered. It is not absolutely necessary, however, to hold strictly to this size of wire and this insulation. Small variations in either direction may occur without great change taking place in the inductance value of the coil. The secondary may be wound directly over the primary, with a few layers of paper between them, and this winding should have about the same number of turns.

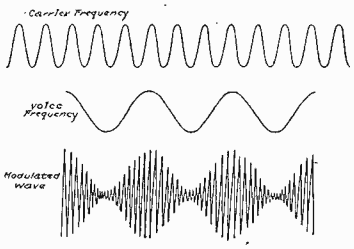


FIG. 3

The carrier frequency is a radio wave. The voice frequency is an audio wave. The result of mixing the two is a modulated radio wave. The trans-oceanic telephone system uses only the upper fringe of the modulated wave, thus suppressing the carrier and one side band.

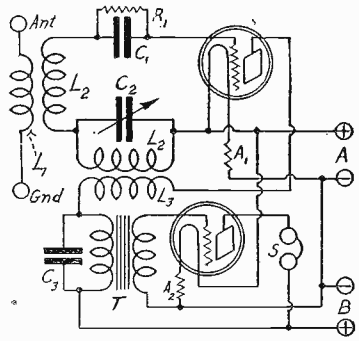


FIG. 4

Circuit diagram of a receiver that will pick up the 5,000 meter transmission of the trans-oceanic system, supplying a frequency exactly equal to that of the suppressed carrier.

A fairly large capacity should be used to tune the coil, as this makes tuning easier and makes it possible to get on the right frequency. Suppose that the capacity is 1,000 mfd. (.001 mfd.) when the frequency is 60 kilocycles. The inductance of the coil should then be very nearly 7 millihenries. This is just about the value of the coil design given above.

Since it was assumed that the condenser has a capacity of 1,000 mfd. it may be obtained by using a variable condenser of this rating. The distributed capacity of the coil and the zero capacity of the circuit will add a little to give some leeway. But a 500 mmfd. condenser is more common. This may be used in connection with a fixed condenser in parallel, of about the same value.

The frequency may be obtained also by using a fixed condenser and adjusting the secondary coil to resonance.

Use of Biasing Resistors To Get Right Grid Voltages from Eliminators

By J. E. Anderson

Consulting Engineer

THE question of voltages in the output of a B eliminator offers difficulties to some persons. They do not know how to select their resistors, how to measure the voltages on the various tubes, nor how to adjust the circuit to get the proper grid bias on the tubes.

Those who have investigated the properties of B battery eliminators have no doubt observed the fact that the output voltages of the device depends on the current which it is delivering. The voltage as measured across the terminals of the instrument decreases as the current it delivers increases, and the rate at which it decreases is usually shown in a curve known as the regulation curve of the eliminator. A good eliminator should have a regulation curve which is very nearly horizontal, that is which gives nearly as high voltage output for large currents as for small. But in all practical eliminators at the present time the decrease in the output voltage is considerable, so that if the regulation curve of any particular device is not as straight and level as the ideal the instrument should not be condemned.

Need of Low Output Resistance

The reason for the variation of output voltage with current drain is the resistance of the rectifying device and of the filter coils. A good instrument should have a rectifier with a very low output resistance and the coils used in the eliminator should be wound with heavy enough wire to keep the total resistance low. In the accompanying drawing the resistance R_o represents the resistance of the eliminator as measured at its output terminals. It includes the resistance of the rectifier as well as that of the filter coils.

The output voltage of the eliminator is the difference between the emf in the output circuit of the eliminator and the voltage drop in the resistance R_o. That is, if the emf is equal to E, the output voltage V of the eliminator is given by V=E—R-I, where I is the curren flowing in the circuit, or is the total current required by the set. E is the maximum voltage that can possibly be obtained from the eliminator and is the voltage across the output terminals when no current is flowing. It is a constant as far as the output side of the eliminator is concerned. It depends only on the type of rectifier and on the input to the device.

Curve Helps Greatly

The resistance R_o is not a constant but depends somewhat on the amount of current that the eliminator delivers. The regulation curve obtained with a constant resistance is shown in Fig. 2, but the regulation curve of an actual filter is crooked and runs something like the lower curve in Fig. 2.

When a circuit is to be adjusted as to plate and grid voltages the first information necessary is the nature of the regulation curve of the eliminator to be used. One must know the output voltage at all current values likely to be met in the particular circuit that is to be adjusted. For example, the receiver may require a total of 20 milliamperes after it has been properly adjusted as to plate and grid voltages., The regulation curve will then answer the question: What will be the output voltage at 30 milliamperes? Suppose that the curve shows that the output voltage is 220 volts when the total current drain is 30 milliamperes. From this available voltage we must get both plate and grid voltages for the various tubes. How can this be done?

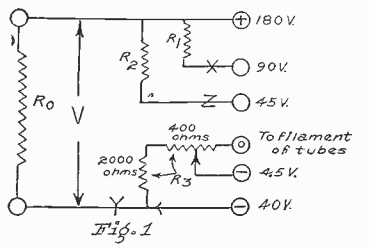


Fig. 1

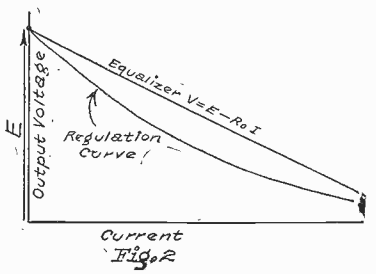


Fig. 2

Suppose that the last tube in the circuit is a CX-301, which uses 180 volts on the plate and with 40 negative volts on the grid. This tube may be taken care of by dividing the available 220 volts in the ratio of 180 and 40 between the plate and grid respectively. How can this be done?

Resistor In Common Lead

As shown in Fig. 1, it may be done by connecting the plate of the tube to the high potential side of the eliminator output and the low potential side of the eliminator (B minus) to the grid return. It then remains to connect the filament of the tube to a point which is 40 volts higher than the negative end.

One way of doing this is to provide a resistance R_3 through which the plate current from all the tubes must flow before it can return to the negative side. The amount of this resistance is determined by the total current that flows through it and the desired voltage across it. In this case the current is 30 milliamperes (20 for the CX-371, 10 for the other tubes) and the voltage, let us say, 40 volts. Applying Ohm's law gives 1,333 ohms as the required resistance. The resistor used should be variable within sufficiently wide limits to allow variation of the grid bias. In this particular case the maximum resistance should be about 2,500 or 3,000 ohms.

In the above example it was assumed that the entire 30 milliamperes flowed through the entire part of the resistance. This may not be the case always, and then it will be necessary to modify the above results. Each section of the resistance should be treated separately by multiplying the resistance of each by the current flowing in it. Then the total voltage drop in may be obtained by adding together the partials.

Obtaining Other Biases

The resistance drop method of obtaining a negative bias may also be used for the other amplifiers in the receiver. Suppose the tubes used in the previous stages require a grid bias of minus 4½ volts. We already know the total current flowing in the resistance and it remains to determine the value of the resistance which will cause a drop of 4½ volts. By Ohm's law, 4½ /.03 equals 150 ohms is the required resistance.

A good way of providing both a 4½ and a 40 volt grid bias at the same time is to connect a 400-ohm potentiometer in series with a 2000-ohm rheostat, both of the heavy duty type. The potentiometer is connected first to the filament and then the rheostat is connected between the potentiometer and the negative end of the line. Then to get the proper grid bias on the last tube the rheostat is adjusted so that the sum of the 400 ohms in the potentiometer and the resistance of the rheostat is 1,333 ohms. The 4½-volts bias for the other amplifier tubes is obtained by sliding the arm of the potentiometer until the voltage between the filament and the arm is 4½ volts. This adjustment does not change the current flowing in the resistance and hence it has no effect on the bias on the last tube. This however, assumes that there is not current flowing in any of the grid circuits. The assumption is justified, because when the bias is just right and when the tubes are not overloaded there is no grid current.

Milliammeter Very Convenient

The choice of the resistance R_1 and R_2 is also a simple matter. The amplifier tubes are to have a plate voltage of 90 volts. Now, the voltage between the filament and the high side of the line is 180 volts. It is necessary to drop 90 volts to bring the voltage on the amplifiers down to 90 volts. To get the correct resistance value of R_1 it is necessary to know how much current flows in this resistance. As a first approximation this may be estimated by adding up the plate currents in all the amplifier tubes which are served by the 90 volt tap. Suppose that there are three tubes and that each tube takes a current of two milliamperes. The three tubes then take six milliamperes. Hence 90/.006 or 15,000 ohms is the required value for R_1. To adjust the voltage more accurately a milliameter should be inserted in the 90 volt lead at the point marked X, and the reading should be used for the current flowing through R_1. In the same way the total current flowing in the output of the eliminator may be measured by inserting a milliammeter at the point marked Y. This reading should be used in determining the total value of R_2. It was assumed that the current here is 30 milliamperes, but the actual current may be different from this.

Add the Separated Currents

It will be observed that the output voltage of the eliminator will depend on the values of the various resistances used in the eliminator. For this reason the correct final adjustment cannot be obtained unless the final currents are known. The characteristics of the various tubes used should be known, as well as the voltage regulation curve of the eliminator. From the curves pertaining to the tubes used, the plate current for the desired plate voltage and the desired grid bias should be looked up. And these currents should be added together to get the total current. For example, it may be that these curves show that each of the three tubes assumed above will take a current of 5 milliamperes when the bias is 4½ and the plate voltage is 90 volts. The total current in the resistor R_1 would then be 15 milliamperes instead of 6 ma. The curve for the power tube may also show that the current in the plate of that tube will be 20 milliamperes for the plate and grid voltages speci-

Tube Completes the Circuit

At Otherwise Open Ends of the B Supply

(Concluded from page 6)

fied. So far, then, the total current will be 35 milliamperes. To this must be added the current in the detector plate, which may be one milliampere. Then the current in the output of the eliminator will be 36 milliampees. If the eliminator will give an output voltage of 220 volts when the current drain is 36 ma., all is well. The resistances may be calculated as illustrated above. But if the output voltage is less than 220 it will either be necessary to employ a lower plate voltage on the tube or else it will be necessary to increase the input voltage on the AC side of the eliminator. This may be done by decreasing the number of turns in the primary of the input transformer, where this is physically convenient.

Can't Use Ordinary Voltmeter

The calculation of the resistance R_2 in the plate circuit of the detector is made in the same ways as the others. When the voltage from filament to the high side of the line is 180 volts and the voltage required on the plate of the detector is 45 volts, the voltage drop in R_2 is 135 volts. The current in the plate of the detector may, for example, be one milliampere. This would require that the resistance of R_2 be 135,000 ohms. The true plate current in the detector should be obtained from the characteristic curves of the tube used as detector, or else it should be measured at the point marked Z when the resistance R_2 has approximately the correct value.

It should be pointed out that the voltage cannot be measured accurately with an ordinary voltmeter. It will not give the correct values at all, and hence the resistances cannot be adjusted by varying them until the voltage reading is the desired value. If the voltmeter is to give an approximately correct indication of the plate voltage, its resistance must be very large in comparison with the resistance across which it is placed. Such voltmeters are expensive, and are not found in any but the most completely equipped laboratories.

Fig. 1 has been used for illustration only and is not to be taken as the correct way of getting the voltage on the various tubes. This refers especially to the 90 volt tap. The other two follow best practice provided that R_2 is used for the detector alone.

Separate the AF Resistors

One resistor should be used for each audio frequency tube in the circuit, and one may be used for all the radio frequency tubes. The reason for separating the audio frequency circuits is the difficulty of by-passing audio frequency currents and preventing coupling between the various tubes. In every case the common resistance between two or more audio frequency tubes should be reduced to a minimum. This minimum is the resistance of the rectifier and the filter. To make this a low minimum the regulation of the eliminator should be good, that is, the curve showing output voltage against current drain should not be too steep, but should remain nearly horizontal.

When separate resistors are used in all the plate circuits of the audio tubes, the value of resistance is determined the same way as in the case of the detector. For example, when the plate and grid voltage is right the plate current may be 5 milliamperes.

Circuit Through Space Charge

The selection of resistors for the plate circuits and the grid bias drop in connection with B eliminators may be understood more easily when it is recalled that the plate to filament space forms a conductive path which offers a certain amount of resistance to the current flowing. When the filament is heated and when a positive voltage is applied to the plate the electrons emitted by the filament are attracted to the plate and they form a convection stream of electrons from filament to the plate. This stream of electrons constitutes an electric current (DC) from the plate to the filament. This current encounters a certain amount of resistance in its passage from the plate to the filament due mostly to the repulsion effect of the electrons upon each other. The effective voltage applied to the plate at any time is the voltage drop across this internal resistance, not the AC resistance, but the DC resistance.

When more than one tube are connected to the same source of voltage each tube will take a current, and the currents from all the tubes used are joined in the source so that the current in the eliminator is the sum of all the separate plate currents. The filter coils must be able to carry all this current without heating or without causing an undue drop in the voltage.

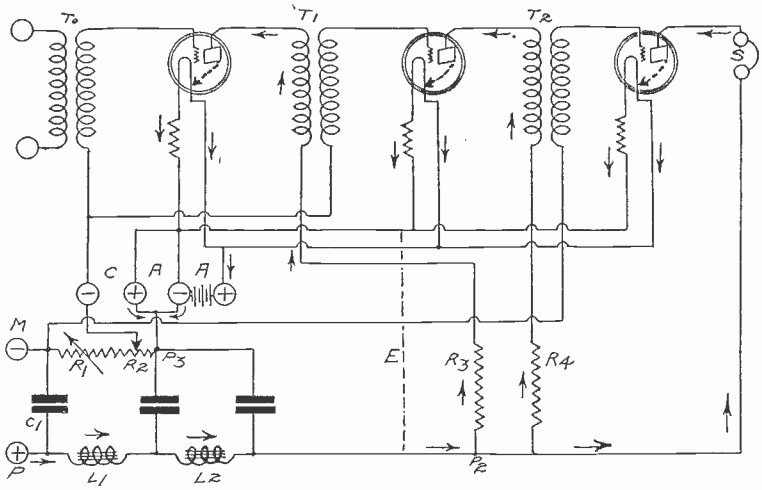


FIG. 3.

Use of a B Eliminator

The operation of a receiver with a B eliminator may be explained with the aid of Fig. 3. Starting at P (lower left corner), the positive terminal of the output of the rectifier, the current flows in the direction of the arrows through the choke vils L_1 and L_2. At the point P_2 it divides and goes in three directions to the plates of the three tubes in the illustrative circuit. In the plate circuits of the first two tubes resistors R_3 and R_4 (lower center) are placed. The object of these is to drop the voltage of the output of the eliminator to a value suitable for the plates of the tubes. To calculate the values of these resistors it is necessary to know the voltage E when all the tubes in the circuit are working normally, the voltage desired on the plates of the tubes served and also the current flowing in each resistance. The last tube usually requires no resistance, as the voltage of the filter is adjusted in the process of manufacturing.

The course of the plate currents is shown by arrows throughout. From plate to filament the arrows are dotted to show that the current is not ordinary conduction but electronic convection through space. Since the entire filament contributes electrons, the plate current is divided between the halves of the filament, as shown by the arrows.

Division of the Current

One part passes down the negative leg and the other down the positive and this has to pass through the A battery before it can return to the negative side of the filter. It will be noted that the current which flows through the A battery flows against the normal filament current. One would expect from this fact that when the plate current is appreciable that the filament would be less brilliant when a certain heating current flows in the A battery. This agrees with experience, because when the plate current is turned on the filament becomes less bright.

The method of obtaining a grid bias is also shown in Fig. 3. It is obtained from the resistors R_1 and R_3 (lower left). It will be observed that the current from all the tubes passes through these resistors. Hence, when calculating the reristance value of them the total current supplied by the filter must be used. Resistor R_3 is a potentiometer of about 400 ohms and R_1 is a rheostat of about 2,000 ohms. The two are connected in series. The grid bias for the first two tubes is obtained by connecting the grid return leads to the sliding arm as shown.

The grid bias for the last tube is obtained by connecting the grid return of that tube to the most negative point on the filter, or to the point M. The amount of bias for the last tube is varied by varying the resistance of the rheostat R_1. This connection assumes, of course, that the required grid bias on the last tube is greater than that for the other tubes. The grid bias obtained for any tube is the voltage drop between the point P_3 and the point to which the grid return is connected. Or it is the product of the current flowing through the resistors by the resistance between the point P_3 and the point where the grid return is connected. In the case of the last tube the total resistance is the sum of R_1 and R_2. In adjusting the grid bias it is best to adjust that of the last tube first, as this is the most important, and also because it causes a change in the necessary adjustment of the others. After this adjustment has been otbained the bias for the other tubes may be obtained simply by turning the potentiometer arm.

An Easy-to-Build Four-Tuber

How to Wind the Coils for Regenerative Set

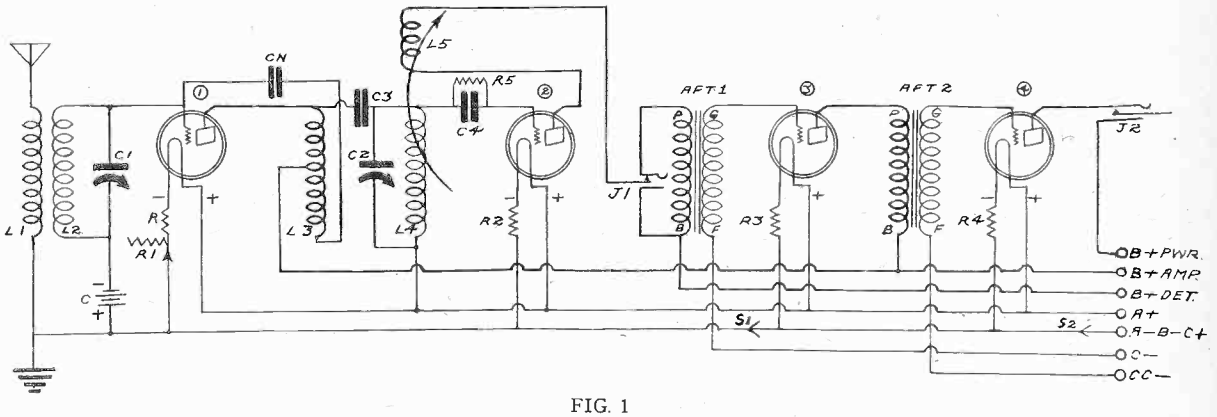


FIG. 1

The circuit diagram of the four-tube set. Another receiver may be plugged into the audio amplifier.

By Ludlow Greer

AN easy tuning, distance getting, selective, voluminous and quality receiver is diagrammatically represented in Fig. 1. It employs a stage of tuned, neutralized radio frequency amplification, capacitatively coupled to a regenerative detector, these followed by two stages of transformer coupled audio frequency amplification.

After the signal has been amplified in a distortionless manner by the radio frequency tube, the energy is fed into the regenerative tube via the condenser C3, which has a fixed capacity of .0005 mfd. CN, the neutralizing variable condenser, has a maximum capacity of .00015 mfd.

The first coil to wind is the radio frequency transformer. The primary L1 consists of ten turns, while the secondary winding L2 consists of forty-seven turns. Both these windings are placed on a single three-inch diameter form. All wire is No. 22 double cotton covered. About a quarter of an inch should be left between these two windings, all of which are in the same directions. Be sure to keep trace of the beginning of both windings, either by bringing the leads to binding posts, clips or just in a flexible fashion to pieces of paper, with the proper markings. The next coil to wind is the plate coil L3. This consists of forty turns, being wound on a three-inch diameter tubing with No. 22 double cotton covered wire.

Tab That Goes to B Plus

At the twentieth turn on this winding either scrape some insulation off and solder on a piece of flexible wire, or during the winding process, bring a small loop out, when this number of turns has been reached. There are still two more windings to make. One is the grid coil L4 and the other is the tickler L5. The grid coil consists of forty-seven turns, the same number as on the secondary winding of the radio frequency coil, and is wound on a separate three-inch diameter tubing with number twenty-two double cotton covered wire. Watch the beginning and end of the windings here, also. The final coil to be wound is the tickler, which consists of thirty-five turns of number twenty-six single silk covered wire, wound on a two and a half-inch diameter tubing and placed on a rotor shaft so the tickler turns inside the secondary coil L4.

Across the secondary winding L2 and the grid winding L4, variable condensers having a maximum capacity of .0005 mfd., C1 and C2 respectively, are shunted. The grid condenser C4 is of the standard .00025 mfd. type, although, it was found when experimenting that some tubes (hard type) worked better with a .0001 mfd. fixed type. The grid leak R5 should have a resistance of 2 megohms at least.

Use of Amperites

The filament temperature of the detector and two audio tubes is controlled by automatic filament ballasts, R2, R3 and R4. The filament temperature of the radio frequency amplifier tube is controlled partially by an automatic control, R, and partially by a rheostat R1. The rheostat takes care of volume control. Using the 301A tubes in the radio, detector and first audio stages, these ballasts are 1A Amperites. The rheostat has a resistance of 10 ohms. R4 is a one-half ampere ballast resistor, such as the 112 Amperite and is used to control the filament temperature of a power tube, e. g., CX-371.

The filament circuit of the audio stages may be disconnected with the aid of S1 so that you may listen to the detector output, via the single closed circuit jack J1. When you wish to listen to the output from the last stage of audio, both switches S1 and S2 are closed.

The C battery in the radio frequency stage consists of a series of three one and one-half volt flashlight batteries, which gives you a total of four and one-half volts. For best results, it will be necessary to experiment with the voltages. The B voltage for the radio frequency and first audio tubes, B+ Amp., should be sixty-seven and one-half volts. The B voltage for the detector, B+ Det. tube, should be forty-five volts. The B voltage for the first amplifier tube may be ninety volts. The B voltage for the last amplifier tube should be one hundred and thirty-five. A four and one-half volt C battery, C—, is used in the grid circuit of the first audio tube. A nine volt C battery, CC—, is used in the grid circuit of the last audio tube.

When Is Shielding Necessary?

Often complaints are made about "static," when there is no static at all. The first thing to do is to find out whether the disturbing noises originate within the set, or from an outside source. The usual method followed is to disconnect the aerial and to assume that if the noise continues, it is the fault of the set or accessories. This is not always the case. One of the radio frequency stages, or the detector, may be picking up the interference from an outside source, a coil acting as a miniature antenna. To determine whether this is what is happening, vary the tuning controls of the set. If the volume with which the interference is received can be varied by manipulating these controls, it is an indication that shielding is needed.

The simplest complete shield that will prove effective can be made from tin foil, copper foil or similar non-magnetic metal. It will be necessary, in most cases, to dismount the apparatus from the panel, though, at times, thin strips of shielding material can be slipped into place between the panel and variable condensers, etc. Great care must be taken to avoid short-circuits between the shield and the various parts used in the set, unless the parts which it is likely to touch are grounded. Besides covering the panel with a shielding material, which may be schellaced on, the entire inside of the cabinet must be lined with metal in the same manner. This includes both top and bottom, which are sometimes neglected, as well as all sides. The shield inside the top must be attached to the remainder of the shield by a good electrical connection, such as a piece of phone cord, with the tinsel covered cords soldered or screwed fast. Every part of the shield must make good electrical contact with every other part, and the shield is then either grounded or connected to the negative A battery lead.

It is a known fact that the shield introduces a loss into the set if it is allowed to get into the field of the RF transformers. It is well, therefore, so to place the coils that they will be kept at least two inches from the nearest part of shielding and preferably four inches from each other, if their axes are parallel and the angular placement of the Neutrodyne is not employed. When a shield is built into a set at the beginning, it may be used as one of the A battery leads, as in the Radiola III. This eliminates the use of one long lead and insures a well connected shield.

Battery leads may be six feet long without serving as miniature aerials and tending to pick up unwanted signals and interference. If over that length, they are a frequent cause of trouble. Both A and B batteries should be kept as near the set as practicable. If for any reason they must be placed a greater distance away, they should, by all means, be bypassed.

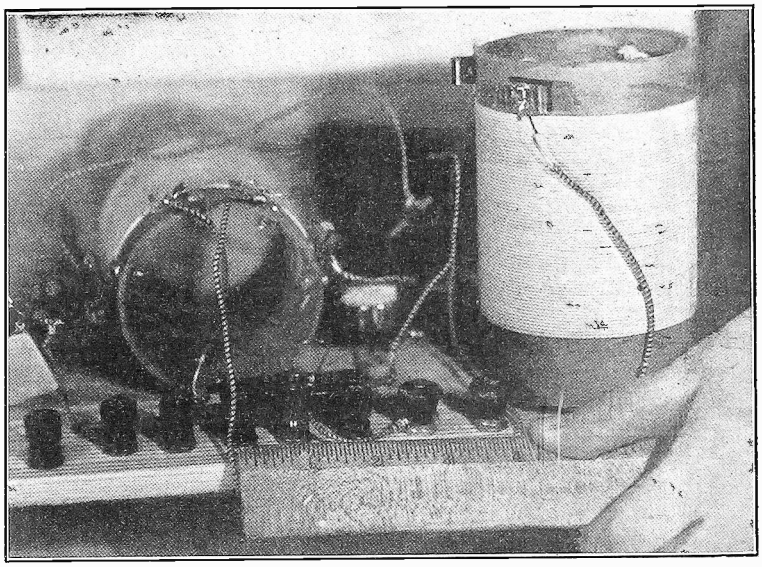
Coil Placement a Science

Correct Angle Enables Squelching Oscillation

By Herbert E. Hayden

THE success or failure of a radio receiver often depends on the position of one tuning coil with respect to another. The farther the two coils are placed from each other the less is both the capacity and the magnetic coupling between them. Also when the two coils are placed approximately at right angles the magnetic coupling is less than when the two coils are parallel. The capacity or electrostatic coupling does not depend to any great extent on the relative angular positions of the coils, but this coupling has an effect on the effective right angle arrangement.

It is always possible at one frequency to place the two coils so that the sum of the capacity and the magnetic coupling is zero. But this does not mean that a position can be found where the total coupling is zero. There is nearly always a residual coupling which is due to resistance common to the two coils. But when the coils have been placed so that the sum of the magnetic and the capacity coupling is zero the residual coupling is usually very small, and therefore the minimum coupling between the two coils is also very small.



(Hayden)

IF COILS are properly placed in respect to each other they may be put even 4-inches apart. However, it is safer to rely on a 6-inch difference, if space permits.

Not Exactly Right Angles

The two coils are usually not quite at right angles when the coupling is zero, because the capacity coupling distorts the symmetrical arrangement. It is usually necessary to tilt one of the coils with respect to the other, or to raise or lower it. When first placing the coils the axes of the two should be at right angles and the plane in which the axis of one lies and to which the axis of the other is perpendicular should pass through the middle of the second coil. In other words, the geometric centers of the two coils should lie in one plane to which one axis is perpendicular and in which the other axis lies. This holds for either of the coils with respect to the other, so that in reality it is necessary to line up two planes at right angles to each other.

When this arrangement has been effected the zero coupling position will be found by moving or tilting very slightly one coil with respect to the other.

How to Make Test

An experimental way of finding the position of zero coupling is as follows. Connect the antenna and ground, or the output of an oscillator, to the first coil. Connect the other to the grid circuit of an amplifier-detector circuit. Listen in with a headset. Then arrange the two coils until the signal that gets through is the least. It will be found that the position is quite critical, particularly when the two coils are too close together. This adjustment is very important when building a RF set which is to be squeal-proof on the lower waves. The adjustment should be made in every Neutrodyne, because without it the circuit will not neutralize.

U. S. Takes Inventory of Advance In 1926

Quartz Plates for Constant Frequency, Trans-Ocean 'Phone, Sending of Pictures Across Atlantic and Receiver Improvements Cited in Survey by Commerce Dept.

The Department of Commerce announced that the issue of December 31 of the monthly Radio Service Bulletin No. 117 is now available, with a full list of all the 671 broadcasting stations licensed up to that date. The Bulletin also contains a summary of the chief events in the development of radio, "Peaks in the Waves of Wireless Progress," from 1827 when Savary found that a steel needle could be magnetized by the discharge from a Leyden jar, down to 1926. The full text of the statement follows:

1926. During this year directional or beam transmission developed to a point where it may now be considered as practical for commercial usage.

The use of quartz plates for maintaining constant frequency or radio transmitters advanced considerably during the year.

New York and London 'Phone

Successful radiotelephone experiments were conducted between New York and London. This service will be used commercially in the near future.

With the development of transmitting pictures by radio it is now practical to transmit weather maps to vessels at sea.

Considerable progress was made in the perfection of receiving sets. The single-dial receiver came into greater use for reception of programs from broadcasting stations.

A committee representing the departments of the United States Government directly concerned studied our radio problems and prepared proposals for consideration by the International Radiotelegraph Conference which is contemplated being held in Washington during 1927.

Pictures Sent By Radio

Commercial pictoradiogram services are now in operation between New York and London and between San Francisco and Hawaii.

The use of the radiocompass (direction finder) on shipboard increased materially. At the close of the year about 30 merchant vessels of this country were so equipped. A very large number of naval vessels are also equipped with this apparatus.

On July 8 the Attorney General of the United States rendered a decision to the effect that the Secretary of Commerce has no jurisdiction as to the wave length, with the exception of the band between 600 and 1,600 meters reserved for Government stations, or the power used by commercial stations, including broadcasting stations.

Increase in Stations

Since July the number of broadcasting stations increased 155, making the total number licensed on December 31, 671. A large number of the stations in this class increased their power and changed their wavelengths during this period.

The joint resolution of Congress approved December 8 requires the applicant for a radio-station license to waive any right or any claims of right against the United States to any wave length or to the use of the ether in radio transmission because of previous license to use the same or because of the use thereof.

Radiotelephone was used for the first time in directing the filming of a naval scene, off the coast of California, for a photoplay.

Radio Service Bulletin No. 117 may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents a copy.

Langmuir's Great Adventure Came When He Was Alone with Tube in 'Lab'

Emission Increased 10,000 Times with One Filament and Not with Another, and So Thoriated Tungsten Came Into Use

By Dr. Alfred N. Goldsmith

Chief Broadcast Engineer, Radio Corporation of America.

IT is said that every bridge exists in the mind of the civil engineer before it is flung across the river. Likewise, a skyscraper exists in the mind of its architect long before the site is cleared and the caissons are driven down to bedrock. Again, every great painting or statue is conceived in its ideal perfection by the artist's fertile mind long before it is realized in material form. And so it is with radio: an achievement in practical form never comes until long after patient and inspired scientists and research engineers have dreamt of new physical principles and methods, followed by tireless experimenting until, despite all discouragements, they have achieved the chosen goal of a newer and a better way of accomplishing that which is most needed in the progress of radio.

Now at least three conditions must be met in order that a suitable product shall reach the ultimate consumer.

First, there must be available the undivided services of learned men, with long experience and marked capacity for research, thoroughly acquainted with the problems, and with the determination, knowledge and inspiration to develop new things and methods.

But even the great scientists cannot make bricks without straw. They require elaborate facilities in the way of apparatus and assistants. so that the second point is the *material,* as the French would say, quite as much as the *personnel.*

The Production Problem

Thirdly, there is need for the co-ordination of all research and developmental efforts with those of production which must follow for a successful consummation of the process. In this connection, be it noted that so vast is the scope of modern science that no one man can do more than to polish one facet of the diamond of scientific knowledge. Left to themselves, many qualified scientists might find their labors lost either through needless and exasperating duplication of efforts on the same problem, or through the failure so to co-ordinate their activities so as to cover every portion of the field, and to explore every nook and cranny of the unsolved problems.

It is just here that the great industrial organizations come into their own in the field of applied science. It is in this connection that these great organizations can render a real service to society. These huge organizations, because of the very magnitude of their operations, can afford to provide elaborate facilities, can place problems before leading scientists, can assign each task to the right man, can co-ordinate efforts so that all parts of a given problem will be covered with the simultaneous and co-ordinated efforts of specialists.

What is still more significant, these great industrial organizations can afford to continue year after year, despite discouragements, setbacks and long and costly delays, until the final outcome, be it successful or otherwise. Smaller organizations, obviously, cannot afford to stand the gruelling tests of patience, with its terrific cost, which is part and parcel of pioneer development.

A Different Field

Now in no other portion of the field of radio are research and development so important as in the case of the vacuum tube. Consider, for example, the work of Dr. Irving Langmuir, known throughout the world for his scientific achievements. You are not likely to find Dr. Langmuir, in his Schenectady research laboratory, placing vacuum tubes in a receiving set, nor again studying the characteristics of tubes with an array of meters. To others must go those practical tasks—tasks far down the long line of research and development. It is more probable that you will find Dr. Langmuir studying a new piece of apparatus for investigating the behavior of the invisible electron, the atom or the even larger molecule, or again of films of oil floating on the surface of water, or still again the physical behavior of elaborate chemical compounds, or once more the nature of light emitted by some glowing vapor. These and many other apparently academic subjects—academic today, practical tomorrow—are most likely to call for the attention and interest of this great scientist. Yet in time these seemingly abstract studies become important features of your vacuum tubes or radiotrons, and provide for still better radio results.

Turning from the general to the specific, there is the dry-battery tube. The filament of this tube, as well as that of the leading storage battery tubes, is based upon what might logically be termed an electric sponge.

Instead of chemically pure metallic tungsten, with its high operating temperature, relatively limited life, and high cost of operation, there has been produced thoriated tungsten in which tiny fragments of the rare element thorium are are scattered throughout the tungsten while it is in powdered form and before it has been swaged and sintered and drawn out into filament wire one-half a thousandth of an inch in diameter.

Now, thorium has the peculiar property when heated of pouring forth a flood of electrical particles or electrons. It is, however, mechanically unsuited for filament use by itself. It would melt too easily, for one thing. However, by placing the thorium in diffused form in the tungsten, a filament of better mechanical and thermal properties is obtained, while still retaining the electronic proclivities of thorium.

The thorium in the thoriated tungsten filament forms a layer of really unimaginable thinness on the filament. This layer or film is very quickly driven off but the heat just as quickly boils out fresh thorium to the surface, there to form a fresh coating. And so it goes. The action is much like that of a sponge soaked with water which, reaching the surface, evaporates by the heat of the sun, yet the sponge all the while is being squeezed just enough to keep the surface constantly moistened with a fresh supply of water.

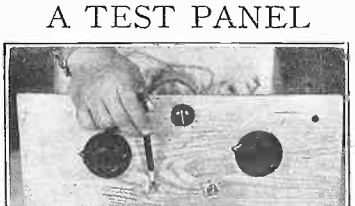
The Great Scientific Adventure

There is much that the present-day vacuum tube owes to Dr. Langmuir, as well as to other scientists and research engineers who work in research laboratories devoted to vacuum tube development. It was Dr. Langmuir, who, in the course of his investigations of the so-called "Edison effect" in incandescent lamps, found that as the vacuum was made higher and higher, the available electronic emission from the hot filament became steadily greater until finally, when a vacuum tube was immersed in liquid air giving an extremely high vacuum, the emission was 10,000 times its original value. This was an astonishing result, but, when the experiments were repeated with another lot of filament wire, no such increase in emission developed. An investigation of the two lots of wire revealed the fact that the second lot was chemically pure tungsten, while the first contained thorium.

So it was that the thoriated tungsten filament came into being. Much remained to be done, however, in the way of developing just the right proportions of ingredients, as well as a process for making the delicate filament. Also, out of these discoveries came special pumping equipment, including the Langmuir mercury pump for producing the high vacua. As a further development of the high vacua research, suitable so-called "getters" were evolved whereby to sweep out the last vestiges of gas remaining in the vacuum tubes after the allotted time for pumping in quantity production.

In conclusion, it is evident that the really good vacuum tube has a pedigree that extends back to the research laboratory. It has been fathered by scientists of note. Its infancy has been spent in the laboratory; its childhood has been passed in the testing laboratory, at the hands of none-too-kind skeptics; its youth has been devoted to production in the largest tube factories in the world; and in its prime of life it renders service that is a credit to its sponsors.

A TEST PANEL



(Hayden)

FANS with limited means do not have to stop their experimental work just because they cannot afford to buy panels for mounting their instruments. A wooden board will serve just about as well as the more costly insulating paneling. If the board is too thick to take the instruments, recesses may easily be chiseled in the wood to make the instruments fit.

Tubeless Receiver Claimed By Professor, Using Bismuth and Copper

Offer of $100,000 by Westinghouse Is Reported, But Goldsmith Denies It and Deprecates the Device and Professor's Claims

By Robert Bangs

RECENTLY it was announced at Mercer University, Macon, Ga., that the Westinghouse Electric and Manufacturing Co. had offered Dr. Palmer H. Craig, head of the physics department of the university, $100,000 for a new device which is supposed to replace vacuum tubes as amplifiers and detectors.

The device is called an "electro-magnetic detector and amplifier" and consists of a series of bismuth plates stacked in a pile and interlaced with copper wires. The bismuth plates are protected by a coating of sulphur because bismuth, a very brittle substance, is likely to crumble.

Long Sought After

Many attempts have been made by various investigators to make use in this manner of this property of bismuth and of similar properties of allied metals but so far there has been no claim of success, until Dr. Craig came along. The most common attempted application is to the rectification of AC for filament and plate voltage supply. Lack of efficiency and of dependability have been the main causes of failure. Another limitation is the supply of suitable metals in commercial quantity.

One of the metals which displays similar properties is molybdenum. This has been used by scientists of the Bureau of Standards for converting light energy from the sun into electric energy.

From Earth to Sun!

A certain amount of success has been achieved and it seems possible that power may soon be derived directly from the sun in this manner. Here, also, lack of efficiency and of adequate supply of the metal are limitations. There is plenty of molybdenum to be had in different parts of the world, but not all molybdenum is suitable for the purpose. There seems to be an active component in the metal which is responsible for the peculiar property, and it is now the aim of the scientists to isolate this substance.

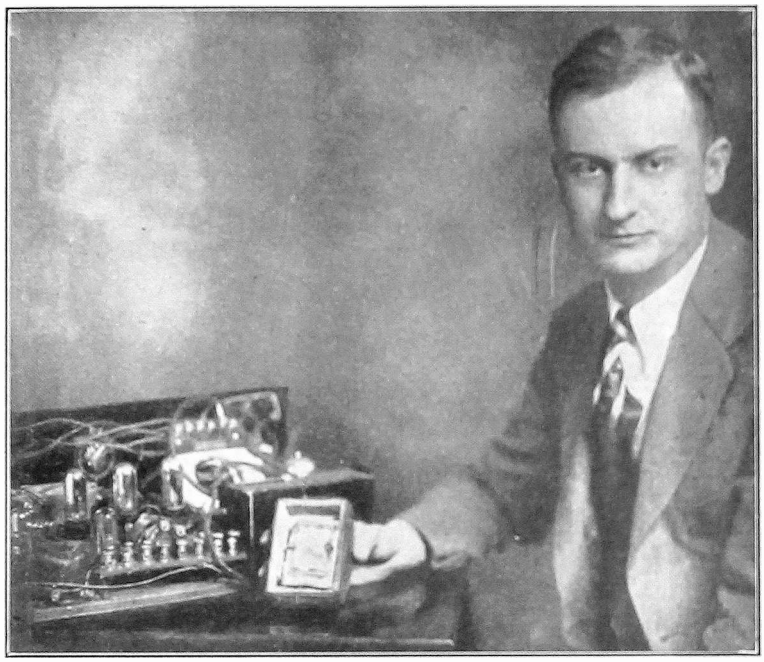
Apropos the offer to Dr. Craig, Dr. Alfred N. Goldsmith, of the Radio Corporation of America, denied that any such offer has been made for Dr. Craig's device. Dr. Goldsmith, chief broadcast engineer of the corporation, deprecates the idea that the peculiar property of bismuth can be used for the purpose claimed by Dr. Craig.

He Is Not Yet Thirty

Dr. Craig emphasizes the point that the device will displace batteries as well as vacuum tubes in radio sets.

Dr. Craig, who is not yet 30, developed the invention, upon which he immediately applied for a patent, for his thesis at the University of Cincinnati where he received his degree of Doctor of Philosophy last June.

When asked to show the invention, Dr. Craig drew out a small block of substance resembling sulphur. It was an inch thick, about three inches long and two inches wide. Protruding from the top were tiny wires. It was encased except for the top.



(Underwood & Underwood)

DR. PALMER H. CRAIG and the device that he says enables good reception without any tubes.

He styled the device "an application of bismuth plates as detectors and amplifiers," which would be used in place of present batteries and vacuum tubes in a radio.

What He Found Out

In his research for his Ph. D. degree at the University of Cincinnati, Dr. Craig found that the bismuth plates might be so used and the actual invention is described in part in his doctor's thesis.

The inventor today spoke of the device as "a series of about ten thin bismuth plates, piled one on the other, with wires running between them and finally on out to the actual radio set."

Because of the delicate nature of the bismuth plates, Dr. Craig has protected them with a covering of sulphur. According to the inventor, the bismuth plates will generate the energy to operate the radio and serve as a detector and amplifier.

Describes Process

The process is described in the scientist's thesis as follows:

"The author is at present using this additive principle in an application of the Hall effect to rectification of alternating current, with a method similar to that described by Descoudres.

"The additive principle used in this connection produces a Hall potential of several volts in low fields with thin bismuth films, and thus gives the Hall effect a practical importance as a rectifier, especially in radio and similar applications."

Estimate 900,000 Canadian Fans

It is estimated that there are about 300,000 radio receiving sets in use in Canada, which would indicate that about 900,000 are enabled to listen to broadcast programs, assuming that on an average three persons are served by each set, according to a report to the Department of Commerce from Ottawa.

Between April 1 and November 30, 1926, the Radio Branch of the Department of Marine and Fisheries issued 146,186 licenses to owners of radio receiving sets.

This total represents an increase of 11,700 in comparison with the number of licenses issued during the corresponding eight months of 1925, when the total was 134,486.

Canadian manufacturers of radio apparatus are said to effect a domestic consumption of their product of about 1,000,000 sets within the next few years.

It is feared in Canada, however, that the popularity of radio will be affected adversely unless arrangements can be made to prevent interference caused by several stations broadcasting on the same wave length. Eastern Canada now has only four exclusive wavelengths and Western Canada only two. There are 48 broadcasting stations in the Dominion.

Weather's Effect On Signals Found Small

Pickard Discovers Barometic Pressure May Have Some Influence —Study of Solar Force Called Important in Field on Radio Science

By Greenleaf W. Pickard

From a paper delivered at the Institute of Radio Engineers

One of the outstanding problems today is the nature and cause of those atmospheric changes which produce such diversified effects as weather, magnetic storms and disturbances of radio reception.

The problem is meteorological. If this earth had no atmosphere there could be no weather and on an airless planet there could be no long distance radio communication.

The only known important force which acts upon the atmosphere is the complex radiation and emission from the sun. Changes in this force are caused in two ways; first by the movements of the earth with respect to the sun, and second by actual variations in solar radiation. If the sun maintained a constant radiation we should only have to consider the earth's rotation on its axis, which gives us night and day, and its movement in an orbit around the sun, which by the changing angle of the solar rays gives us the seasons. If these movements were the only factors involved, weather, terrestrial magnetism and radio reception would follow the calendar to a far greater extent than our measurements indicate.

Does Not Go by Rote

But in the scheme of things as they are, we find that weather does not go according to the calendar, nor does radio reception. The visual evidence of sunspots, faculae and prominences tells us that the sun is periodically disturbed, and measurements of the light and heat received by the earth have shown that this varies in general correspondence with visible changes on the sun's disk.

Definite relations have been established between solar changes and weather, which have already been usefully applied to weather forecasting.

Less definite today is our knowledge of the short wave and corpuscular radiation from the sun, which cause ionization and electrical currents in the atmosphere and even chemical changes.

Made Many Tests

Our only direct indices of these radiations are such things as disturbances of terrestrial magnetism, atmospheric electricity and radio reception, although over long periods they are highly related to sunspots and other visible changes of the sun's surface. And as radio research has not yet become a pure science, we do not have such systematic records to study as those gathered through the years by astronmical and magnetic observatories.

Several times in the past twenty years I have attempted systematic measurements of reception from distant stations in the hope of finding some correlation with other elements. With the advent of broadcasting I began a more systematic measurement of field intensities from distant stations, at first (in 1922) by audibility meter, and later (in 1923) by continuous photographic recording. I again began to notice coincidences between magnetic storms and depressed reception despite the fact that the first years of broadcasting fell in a happy period of minimum solar activity and a magnetically quiescent earth.

Effect on Chicago Station

I have made a preliminary analysis of reception from WBBM, Chicago, with respect to meteorological elements and particularly with respect to barometric gradients.

So far the result has been negative. The field at Newton Centre, Mass., when solar and magnetic periods are removed, does not seem to depend in any way upon the relation of the line joining Newton and Chicago to the isobars of the weather map.

But there seems to be a slight relation, which I have not yet fully investigated, between barometric activity and reception. Apparently days with great fluctuations of air pressure tend also to be days of low reception. The relation here is probably indirect; that is, barometric activity may be linked with solar disturbances, which are in turn associated with reception.

It is perhaps unlikely that any high correlation between reception and weather elements will be found.

Weather Is Local

Solar disturbances and magnetic storms are world-wide events, whereas weather is rather a local matter. Analyses of weather elements over the whole earth indicate that here are areas of positive correlation with sunspots and also areas of negative correlation.

Although I have not yet collected and analyzed reception data from any such collection of receiving points as would fairly represent the earth as a whole, I have found that a bad night for reception in Newton Centre is in general a bad night anywhere in the United States. And I have also found that European reception of distant broadcasting stations agrees remarkably well with my measurements of WBBM.

But the secrets of this universe yield rather to observation than to pure speculation. When we have a sufficiency of the right kind of data we can frame stable explanations; until then we are groping in the dark. The relation of earth and sun is a dominant one to mankind, and the study of radio transmission phenomena may well throw new light upon this little-understood subject.

Using Same Wave for Chain Stations is Held Difficult

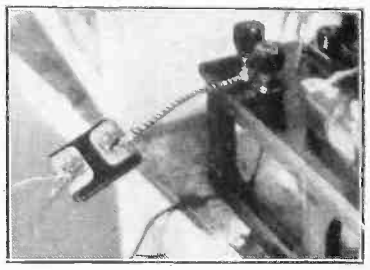
Washington.

Use of the same wavelength by a number of stations for chain broadcasting is not practical at present, according to Dr. J. H. Dellinger, chief of the Radio Laboratory of the Bureau of Standards.

Complaints that a number of stations linked together prevent the average listener from getting anything but the program sent out on the chain have resulted in demands that all such stations be required to operate on the same wave. The subject was given considerable attention at the recent meeting of the Institute of Radio Engineers in New York.

"I notice," says Dr. Dellinger, "that those who have studied the problem have carefully avoided drawing conclusions as to the practicability of operating chain stations on a single frequency. Their investigations make it plain, however, that the 'flutter' effect will be sufficiently serious to make reception definitely worse by the average listener than under the system where each station has a different frequency."

Series Condenser Aids Selectivity



(Hayden)

How the fixed condenser is connected in series with the antenna.

By Caesar Bianco

A small condenser in the antenna circuit of a radio receiver is at times very useful. When the low waves will not come in satisfactorily it is often due to the fact that the antenna is too long and is unsuitable for these waves. This condition is remedied by putting a condenser of about .00025 mfd. in series with the antenna as shown in the photograph. It "shortens" the antenna and makes it more adaptable to the low waves and consequently they will come in louder. Of course, at the same time it makes it less suitable for the longer waves. The condenser therefore should be placed in a convenient position so that it can be inserted and removed as occasion demands, as by switching.

The condenser has also another advantage in that it improves the selectivity of the set, particularly on the longer waves. The reason for this is that it loosens the coupling between the antenna circuit and thus reduces the effect of the antenna reristance on the tuning system.

Bureau Is Testing Where Fading Begins

Washington.

Dr. Thomas Parkinson, of the Bureau of Standards, is trying to find out at just what distance from a station fading begins to be noticeable to the ear. Using a Bureau of Standards test car, he is spending his evenings testing the signals of WRC.

Fading can be detected with a meter at one mile from the station, Dr. Parkinson says. He has not yet reached the point where fading is audible, but believes it is between five and ten miles.

SPARE THE FLUX

Be extremely sparing with the amount of flux used and use just enough solder to run in the joint and make a firm connection. Large gobs of solder are entirely unnecessary and are almost certain to lead you into trouble.

Double Transmission Called Fading Antidote

Example of WBZ-WBZA Cited by Horn, of Westinghouse, As Worthy of Imitation—Rigid Frequencies and Station Distribution Complete "Radio Happiness Cycle"

Pittsburgh.

Enough stations, properly placed; frequencies fixed rigidly by means of quartz crystal control; simultaneous transmission from two or more stations in regions where "fading" is noticeable, or where atmospheric and physical conditions distort signals.

This is the formulae of C. W. Horn, superintendent of radio operations of the Westinghouse Electric and Manufacturing Company, for solving the major problems confronting radio broadcasters today.

Horn, who has participated actively in the development of broadcasting, is responsible for the operation of KDKA, at Pittsburgh; KYW, Chicago; WBZ, Springfield, Mass., and KFKX, Hastings, Neb., all Westinghouse stations.

Cites WBZ-WBZA Case

Horn cites the synchronization of two transmitting stations, 100 miles apart, in order to broadcast, the same program simultaneously on exactly the same wavelength, as one of the outstanding accomplishments of radio engineers in the past year.

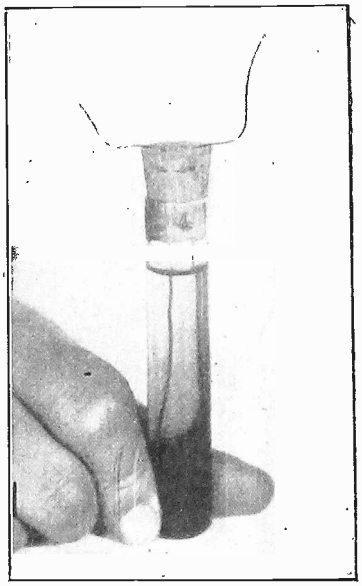
These stations, WBZ, Springfield, Mass., and WBZA, Boston, are kept absolutely in step, without any deviation from their fixed wavelength of 333.1 meters. To the listener, the program apparently comes from only one transmitter, though in reality the incoming waves originate from two stations and travel different paths. Thus at a store two things were accomplished—heterodyning, or whistling, was averted by keeping the two transmitters at exactly the same rate of vibration, and the "fading" effect was reduced to a minimum.

How System Is Worked

The problem of synchronizing these stations called for designing apparatus to fix and control the two waves at a frequency of 900,000 cycles per second. The starting point was an oscillator of fairly low frequency, controlled by means of a tuning fork or Piezo (quartz) crystal. These reasonably slow vibrations were conducted over a specially compensated land line from Springfield to Boston. At each station harmonics, or multiples of the fundamental frequency of the oscillator, were separated and amplified for broadcast modulation.

The use of short-wave telephony for continuous broadcasting across the ocean was again very forcibly demonstrated last summer when KDKA for three days maintained a schedule of broadcasts which were picked up in Australia by local stations and rebroadcast. Previously, through the international relay system of Westinghouse stations, programs had been transmitted to England, Australia and South Africa, and in a few instances had been retransmitted.

Polarity Test Easily Made



(Hayden)

THE simple test tube, with two stiff wire leads entering a salt solution constitutes a polarity indicator.

By Edgar Breese

A simple polarity indicator may be made as shown in the photograph. First obtain a small test tube and a cork or rubber stopper that fits into it. Through this stopper force two pieces of stiff bus bar wire separated as far from each other as possible. These wires should be long enough to extend almost to the bottom of the tube. It is important that they do not touch each other at any time.

Into the test tube pour a small amount of saline solution, or fill the tube up with water to within a half inch from the stopper. Then put a pinch of common salt into the water. When the salt is dissolved the polarity indicator is ready for use. Connect the line to be tested across the bus bar terminals which extend out of the stopper. As current flows through the tester, bubbles will arise from the vicinity of the immersed terminals. There will be twice as many bubbles from one as from the other. The greater number arises from the negative.

The action that takes place is the breaking up of the water in the test tube. The two components are hydrogen and oxygen. There are twice as many hydrogen molecules as oxygen molecules in a molecule of water. Hence there will be twice as many bubbles rise at one terminal as at the other. Hydrogen is electro-positive. that is, its molecules are attracted by a negatively charged body. Hence the hydrogen molecules appear at the negative terminal.

Artists Names Suffer Mutilation By Fans

WBBM Performers' Mail Bears Strange "Monikers" and Suggestion Is Made That "Noms de Radio" Be Adopted, Like John Piano and Mary Sweetsinger

Chicago, Ill.

Is it important that an air audience be able to recognize the name of a favorite artist when it is announced over the air or seen in print?

The question has arisen at WBBM as to whether a popular radio artist should not have a "fool-proof" name which it would be impossible to mispronounce or to misspell.

Every day the "fan" mail to the station carries scores of misspellings of the names of the staff performers. No two listeners seem to hear in the same way the names that are announced. There are mistakes in spelling easily explainable and there are mistakes in comprehension impossible to explain.

Initials cause the most trouble. Fred L. Jeske, "the baritone with the lovin' voice" and Colonel Nut of the Nutty Club, is most often written of as Fred Eljesky. Lester D. Mather, musical director, becomes Lester Demather. Marian Carlisle, soprano, is usually Mary Anne, and Eunice Hoeffer's name offers almost insurmountable difficulties to those who would applaud her organ playing. Nate Caldwell, chief announcer, has been appropriately addressed as Callwell; at other times he is Colder, Colwell, and Coldwater.

As a solution for these difficulties it is suggested that labels or "noms de radio" be selected. These would be suggestive, simple and impossible to misspell. For instance, there might be Mary Sweetsinger, John Piano, Peter Violin or Raymond Tenor. More trouble would arise, however, when it came to James Piccolo and Robert Basso Profundo.

Simple names of the Smith, Brown, Jones class might offer a remedy. And then enter the correspondents who spell their own names Smythe, Browne and Jounes.

"The Prisoner's Song" Pooh-Poohed by Convict

Cincinnati.

"The Prisoner's Song" isn't popular with prisoners or prospective prisoners.

This fact developed at WLW, the Crosley station in Cincinnati, when a man who was leaving in a few hours to serve five years in the penitentiary called the studio and asked that a number be played for him.

The studio director was all ready to indulge in a large groan, because "The Prisoner's Song" was put on the pension list at WLW long ago, but the prisoner elect surprised him by asking for "Roses of Picardy."

So the organist played the selection and the prisoner-to-be got what he wanted for the last time in five years.

RADIO CLUB IS GOAL OF HICKSVILLE FANS

Hicksville, O.

A special effort is being made to organize a local Radio Club. A number of enthusiastic fans got together recently and discussed its possibilities.

Every person interested in radio, whether owning a receiver or not, was invited to attend this meeting.

The principal object and purpose of the club will be to improve radio reception by eliminating interference caused by defective electrical wiring and electrical devices.

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.

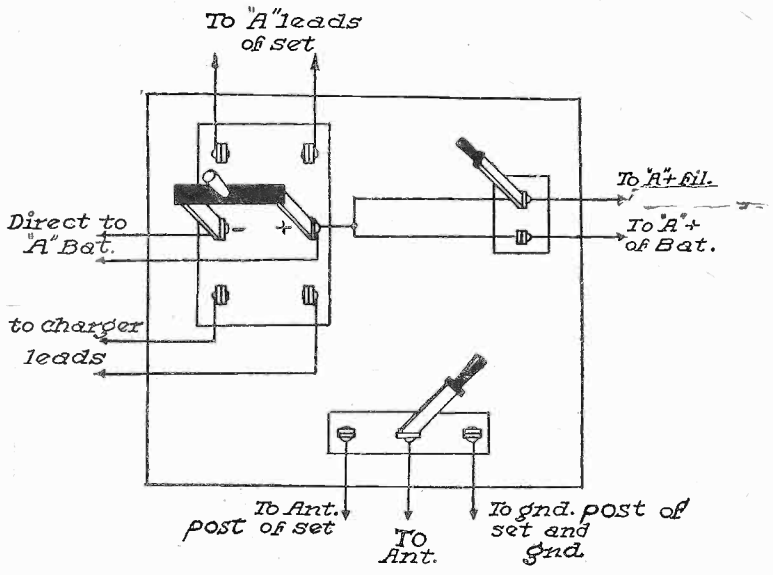


FIG. 502

How to hook up switches for filament battery and antenna-ground control.

MY DAD presented me with a 5-tube receiver, A and B batteries, and a charger as well. The A battery is of the storage type, while the B batteries are dry. Now, in this set, rheostats are used to control the filaments, there being no provision made to shut off the filament supply, other than with the rheostats. I have a double throw, double pole; a double throw, single pole and a single throw, single pole switch. Please give a layout showing how to use these switches, for cutting in and out the filament supply, the charger and the antenna-ground, this being connected so that the antenna goes to set or to ground.—Franklyn Morris, Atlantic City, N. J.

Fig. 502 shows the layout using these switches. A piece of Bakelite or hard rubber four inches wide and six inches high is required. The double pole switch is placed toward the left following the connections indicated. The antenna switch is shown at the bottom, with the proper connections. The filament cut out switch is shown to the right. It will be noted that you now have two filament cut outs, that is, the double throw and single throw. The double pole switch can be thrown to the "on" position all the time, except when charging, using the single switch for cutting the filament supply in or out; or the single switch can be left out, using the double switch for filament control.

* * *

I HAVE been given a pair of .00035 mfd. straight line frequency variable condensers; four -01A type tubes and three, four-to-one ratio audio frequency transformers. Please give me a circuit design for the use of these parts, stating any other data that may be necessary to build the set.—Charles Mullone, Jersey City, N. J.

Such a circuit is shown in Fig. 503. It is a reflex receiver, using a radio frequency amplifier, which also acts as an audio frequency amplifier; a non-regenerative detector and two stages of straight audio frequency amplification. The transformers are used in the reflex and audio stages. The variable condensers are used to tune the secondaries of the radio frequency transformers. These contain forty-four turns and wound on three-inch diameter tubings, using No. twenty-two double cotton covered wire. On each of these tubings is a primary winding, which consists of ten turns. If you live very close to a station, space the primary about one-quarter inch from the secondary winding, or decrease the number of turns on the primary winding to six. Should you not desire to wind your own coils, you can purchase any standard tuned radio freqency transformers, which have secondaries large enough to be shunted by the variable condensers you possess. Be sure of this fact, because, if there are too few turns, you will get only the low wave stations and if there are too many the high wave stations will be favored. The filaments of the radio frequency and detector tubes are each controlled by rheostats, having a resistance of fifteen to twenty ohms, and having resistance wire capable of passing one-quarter amperes. In the audio portion of the circuit, a single ballast resistor is used in the filament circuit. This should be a 112 Amperite. Across the secondary winding of the audio frequency transformer in the radio stage, a .0005 mfd. fixed condenser is shunted. Be sure that this condenser is C. K. A .00025 mfd. fixed condenser, shunted by a 2 megohm grid leak is used in the grid circuit of the detector tube. B plus 1 equals about forty-five volts. B plus 2 equals about sixty-seven and one-half volts. B plus 3 equals from ninety to one hundred thirty-five volts. A filament switch is inserted in series with the A positive lead. If ninety volts B are used on the amplifiers, then use a four and one-half volt C battery. If you use one hundred thirty-five volts B, then use a nine volt C battery. A six-volt A battery is used to supply the filament voltage. Be sure to follow the marked posts on the audio transformers for connections. Now as to the radio frequency coils. The beginning of the primary of the first RFT goes to the antenna. The end goes to the ground. The beginning of the primary of the second RFT goes to the plate of the RF tube, the end going to the P post on the AFT1. The beginning of the secondary winding of the first RFT goes to the rotary plates of the first variable condenser and to the G post in AFT3. The end of this winding goes to the stationary plate post of this condenser and to the G post on the first socket. The beginning of the secondary winding goes to the rotary plate post of the second variable condenser, and to the switch post. The end of this winding goes to one terminal of the grid leak and condenser combination and to the stationary plate post of the second variable condenser. The parts for this set can be placed on a baseboard, seventeen inches long, and six inches wide. A seven by eighteen inch cabinet with panel should be used. The dials for the variable condensers should be placed at the ends of the panel, with the two rheostats in between. The single circuit jack at the output, can be placed in the right hand corner, while the filament switch is placed in the left hand corner. The coils can be placed on inch cabinet with panel should be used one at right angles to the other, with the circumference of one coil exactly in line with the center of the horizontal portion of the other coil. These coils should not, however, be very close to the end plates, about a four-inch space being allowed. This can be worked out with the aid of one-quarter inch hard rubber bushings, which should be bolted to the screws on the plate. The three audio transformers can be placed in a row, about 2 inches from each. The binding post strip is placed toward the rear of the baseboard. The C batteries can be placed in the cabinet, close to the audio transformers. Use flexible wire to wire up the set, being very careful to keep the plate leads away from the grid leads.

* * *

I HAVE a five-tube receiver, using two stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer coupled

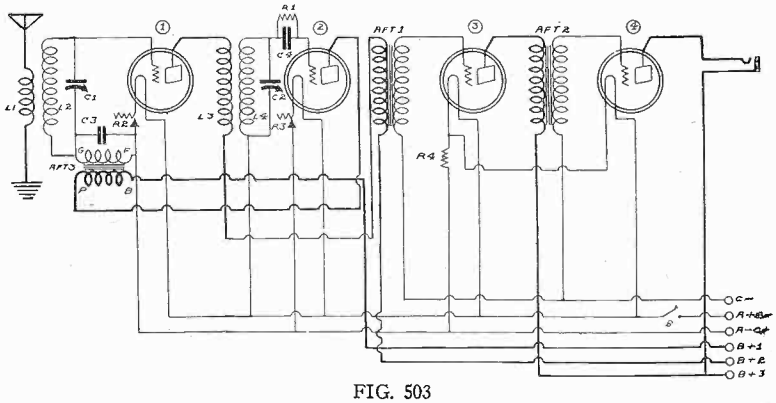


FIG. 503

The circuit diagram of a four-tube reflex, desired by Mr. Mullone.

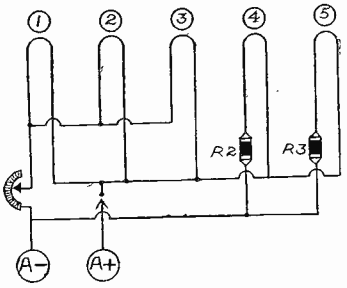


FIG. 504

The circuit design for hooking up filaments as requested by Sidney Greenstein.

audio frequency amplification. The 301A type of tubes are used throughout. At the present time I am using a rheostat in the filament circuit of the two RF tubes, one in the filament circuit of the detector tube and one to control the filaments of the audio tubes. Now I wish to rebuild my set, and use a single rheostat. The control on the RF and detector tubes is not critical. This applies to the control of the AF tubes also. Therefore, could I place the filaments of the RF and detector tubes on a single rheostat, while the filaments of the AF tubes are connected to an Amperite? If so, please show the diagram, illustrating this method, showing how to connect up a filament switch, also.—Sidney Greenstein, Bx., N. Y. City.

Fig. 504 illustrates this system of wiring. A 10-ohm rheostat is used in the RF-detector filament circuit. Instead of connecting the filaments of the audio tubes to a single Amperite, one is used in each leg. The purpose of this is to allow the use of a power tube in the last stage. That is, you can insert an Amperite to pass the current the filament of this tube draws. The arrow and dot in series with the A plus lead indicates the filament switch.

* * *

AT THE present time, I am using a single circuit tuner, as per enclosed diagram and am troubled with interference. L1 consists of fifty turns tapped at the tenth turn from the beginning. C1 is a .0005 mfd. variable condenser, while L2 consists of thirty turns of No. twenty-six single silk covered wire. The antenna coil is wound on a three inch diameter tubing, while the tickler coil is wound on a two and three-quarters inch diameter tubing. Please show how to increase the selectivity value of the set.—Harry Wright, N. Y. City.

Fig. 505 shows how to make this set more selective by the addition of an absorption coil in the grid circuit. A ten-turn coil is inserted in series with the grid lead. This winding is made on a three-inch tubing, using No. twenty-two double cotton covered wire. A one-quarter inch space is left and forty-four turns are wound. Across this latter winding, a .0005 mfd. variable condenser is shunted. By pushing the primary further away from the secondary winding, you will gain more selectivity.

* * *

REFERRING TO the circuit diagram of the three-tube receiver shown on page 15 of the May 15 issue of Radio World. (1)—Could I use a three-circuit tuner in the radio frequency circuit, instead of the radio frequency transformer and the variometer. The primary of this coil consists of ten turns, while the secondary consists of forty-four turns. This is wound on a three inch tubing, using No. twenty-two double cotton covered wire. The tickler consists of thirty-six turns of No. twenty-six single silk covered wire, wound on a two and three-quarter inch diameter tubing. (2)—How many turns should the radio frequency coil L3L4 contain. (3)—What size variable condensers should be employed? (4)—Can a rheostat be used to control the filament of the radio frequency tube?—Lincoln Digmar, Clason Point, N. Y.

(1)—Yes. (2)—Ten on the primary, forty-four on the secondary, wound on a three inch diameter tubing, using No. twenty-two double cotton covered wire. (3)—Use .0005 mfd. variable type. (4)—Yes, a twenty ohm type. The filaments of the audio tubes should be controlled by a ballast resistor of the one-half ampere type.

* * *

COULD THE parts for the receiver diagrammed in the Radio University columns of the Sept. 25 issue of Radio World, be placed on a baseboard six inches wide and twenty inches long, and then in a cabinet seven inches high and twenty-one inches wide, the panel being the same size as the cabinet? (2)—How should I connect up a C battery in the audio circuits of the first two tubes?—Herman Manger, Atlantic City, N. J.

(1)—Yes. (2)—Break the return lead of R5 and R7, which is now connected to the minus A. Run this to the minus post of the C battery. The positive post of this battery is brought to the minus A post.

* * *

I AM going to build the neutrodyne set, shown diagrammatically in the June 26 issue of Radio World on page 11. (1)—Would it be advisable to use a double condenser in the first two radio frequency stages? (2)—If not, could three .00035 mfd. variable condensers, using radio transformers having fifteen turn primaries and sixty-two secondaries, each wound on three inch diameter tubings, with No. twenty-four double cotton covered wire, the secondaries of the second and third coils being tapped at the twenty-first turn from the beginning be used? (3)—Is is all right to use .00004 mfd. midget variable condensers? (4)—Could a double circuit jack be connected in the detector circuit output? How?—Willard Fordson, West New York, N. J.

(1)—No. (2)—Yes. (3)—Yes. (4)—Yes. The top terminal or spring is brought to the plate post of the detector socket. The second spring from the top is brought to the P post on the first audio transformer. The third spring from the top is brought to the B post on this audio transformer. The bottom terminal on the jack is brought to the B plus 2 post. This is the detector B voltage.

* * *

REFERRING TO the four-tube receiver shown in the Radio University columns of the Dec. 26 issue of Radio World. (1)—I do not wish to use the crystal and battery as shown. Can a piece of galena be substituted? (2)—How? (3)—Can the filament of the first two audio tubes be controlled by a single ballast? (4)—Can I leave the double circuit jack at the detector output out? (5) Is it necessary to shield this set? (6)—About how long should the antenna be?—Wallace Gordon, Port Jervis, N. Y.

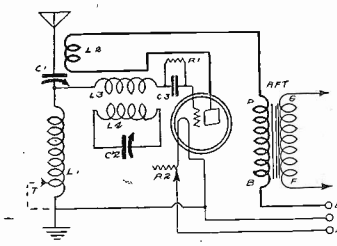


FIG. 505

The circuit diagram of the receiver with the special selector circuit.

(1)—Yes. (2)—Just disconnect the potentiometer, allowing the base of the crystal to run to the P post of the audio transformer and the rotary plates of the variable condenser to the B post on this transformer. (3)—Yes. Be sure that the filaments of both tubes draw the same amount of current and voltage. (4)—Yes. (5)—No. (6)—About 100 feet including the leadin.

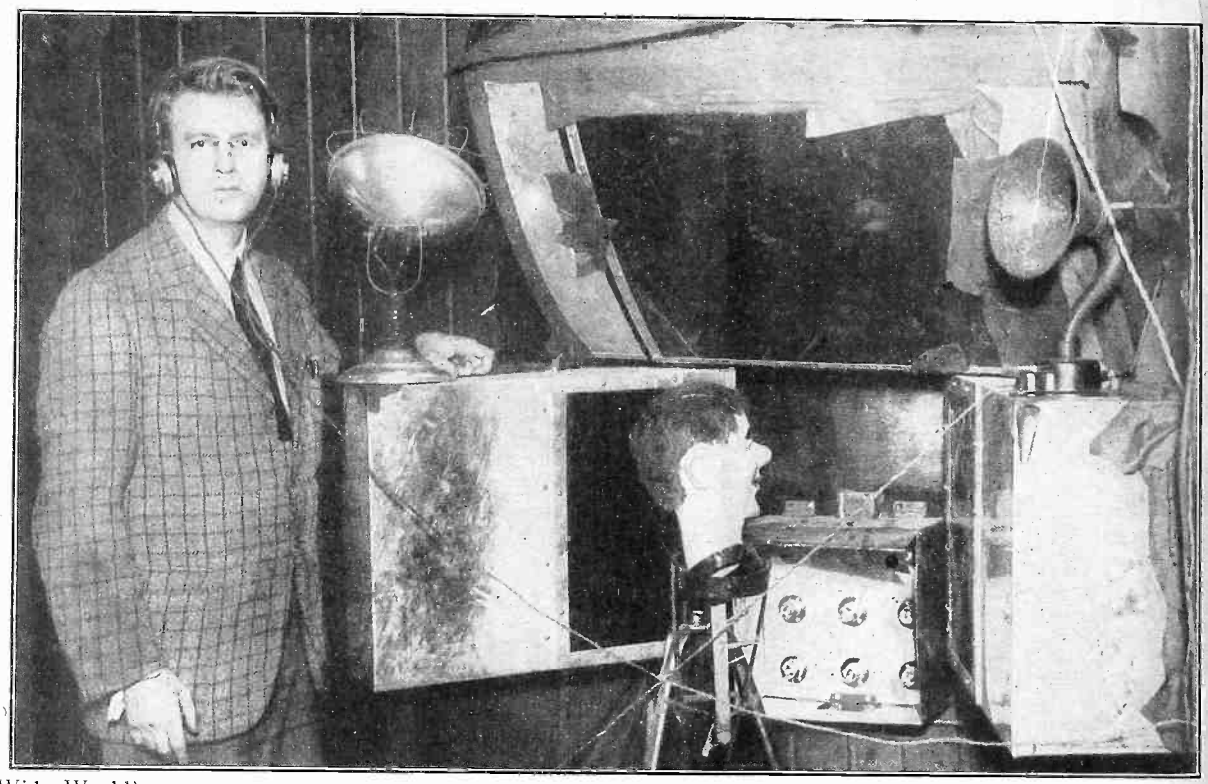
* * *

I HAVE built the three-tube reflex receiver described in the Radio University columns of the Oct. 9 issue of Radio World. The results are great, but I would like to get the signals a bit louder. Could I hook up another stage of transformer coupled audio? Are there any special precautions that should be taken?—Otis Melvin, City Island, N. Y.

Yes, you can add another stage. The plate of the present last audio tube goes to the P post on the new transformer. The B post on this transformer is not brought to the B plus post. Instead, it is brought to a new B plus post. The G post on the transformer is brought to G post on the new socket. The F post on this transformer is brought to the minus post of a C battery. The plate of the last tube is brought to the top spring of a single circuit jack. The bottom terminal of this jack is brought to another new B plus post. About ninety volts should be applied to the plate of the first audio tube, and about one hundred thirty-five volts to the plate of the last tube. Use a nine volt C battery in the grid circuit of the last stage. Use a four and one-half volt C battery in the grid circuit of the first audio tube. The filament of this new tube should be controlled by a ballast resister, passing one-quarter ampere. The F plus post on this socket is brought to the F plus post of the other socket. Be sure to follow this connection. Otherwise you will have no means of cutting off the filament supply, since you will note, the filament switch is inserted in the positive lead of the A battery.

(*Concluded on page* 31)

MOVING PICTURES AND SOUND TRA



(Wide World)

JOHN L. BAIRD, the Scotch inventor of a television system, listens in to the characteristic noise that eac picture makes during the transmission. At the time the photograph was taken he was transmitting the fac of a ventriloquist's dummy.

Baird Uses Infra-Red In His Television Tests

Unseen Light Is Carrier Wave in London Experiments—Modulation of Voice on Ultra-Violet Accomplished by Massachusetts Institute Professor

By Knollys Satterwhite

TELEVISION is making rapid strides. E. F. W. Alexanderson is not the only one actively engaged on the subject. Over in London a young Scotchman, John L. Baird, is holding up Great Britain's end. Just as Alexanderson has his revolving drum, so Baird has his televisor. Just what the details of the televisor are has not been made known, but the term is as closely associated with the name of Baird as the plaid coat he wears as a symbol of his nationality and for good luck.

One thing that is in common with the systems of Alexanderson and Baird is the inevitable photo-electric cell, that mechanical eye that sees in darkness as well as in the light. The latest accomplishment of Baird is to send moving pictures by means of infra-red rays instead of ordinary visible rays of light.

There is no greater difficulty in sending by means of infra-red light than with ordinary light. The photo-electric cell responds to both kinds. It is only necessary to illuminate the scene to be transmitted with the invisible rays and let the electric eye see the scene. The method of producing infra-red light is to filter it out of ordinary light.

For example, an incandescent lamp contains rays of all colors. A lamp that just barely glows with a red light emits infra-red rays as well as the red that is visible. It does not, however, emit any other colors nor ultra-violet. As the temperature of the incandescent body increases other colors begin to appear. When the light is of a white or bluish nature there are present a great deal of ultra-violet as well as the visible and the infra-red.

If it is only desired to use a certain color it is possible to employ filter which will reject all colors. Thus, a window of ordinary glass will cut out all the ultra-violet while a solution of a certain color will cut out most colors except that color. It is comparatively simple to cut out both ultra-violet and visible rays and let through infra-red.

The reason that Baird experimented with infra-red instead of ultra-violet is that infra-red is not as injurious to persons exposed to these rays. Ultra-violet rays burn the skin, cause headaches, injure the eyes, and produce other highly detrimental physiological changes.

Infra-red light has none of these undesirable characteristics, but both have the common property of being invisible to the human eye.

Pictures or scenes transmitted by means of infra-red light are slightly distorted because of the varying reflecting power of surfaces. For example, a certain surface may reflect blue light and not infra-red. Such a surface would appear black in the reproduced picture. Only those surfaces which reflect infra-red rays would appear bright in the reproduced picture.

What is the object of sending pictures by invisible rays at all? One object is to get a more intense illumination on the picture to be sent without having it so bright that the eyes would be injured. Another object is to enable one to take pictures in the dark without having anyone know of it. For example, it might be necessary to locate a warship or an airplane at night. At present this is done by means of searchlight of visible light. The ship or airplane can follow the beam just as well as those who direct the beam, hence the detection of their presence would become known as quickly to those detected as to those on the other side.

If a beam of infra-red light is projected

NSMITTED ON INVISIBLE LIGHT RAYS

his beam could not be followed as easily as the visible. But those who control he infra-red beam could easily follow it with a photo-electric cell, which would mmediately detect any light reflected rom the object sought. Of course, the defense against such a procedure would e to paint the plane or ship with a composition which would not reflect any of he infra-red radiation. It would remain erfectly black to the photo-electric cell.

Sound on Ultra-Violet

Not only can pictures and moving cenes be transmitted through space by neans of light and by invisible radiation, ut sound may be transmitted as well. his was recently demonstrated by Prof. tockberger of the Department of Physics f Massachusetts Institute of Technology.

Dr. Stockberger employed ultra-violet adiation in his experiments, although visible radiation may be used in the same ay. In one of his experiments he projected motion pictures by ultra-violet ght, and this was the first time that his has ever been done. The pictures ere projected with a standard projector ut all visible light had been filtered out om the light source before it went into e projecting machine. The result was at the projected picture on the screen as not visible. However, when a special reen is used, one coated with a flourscent substance, the pictures were visible. he effect is a ghostly greenish-blue glow milar to that which is familiar to users X-ray machines.

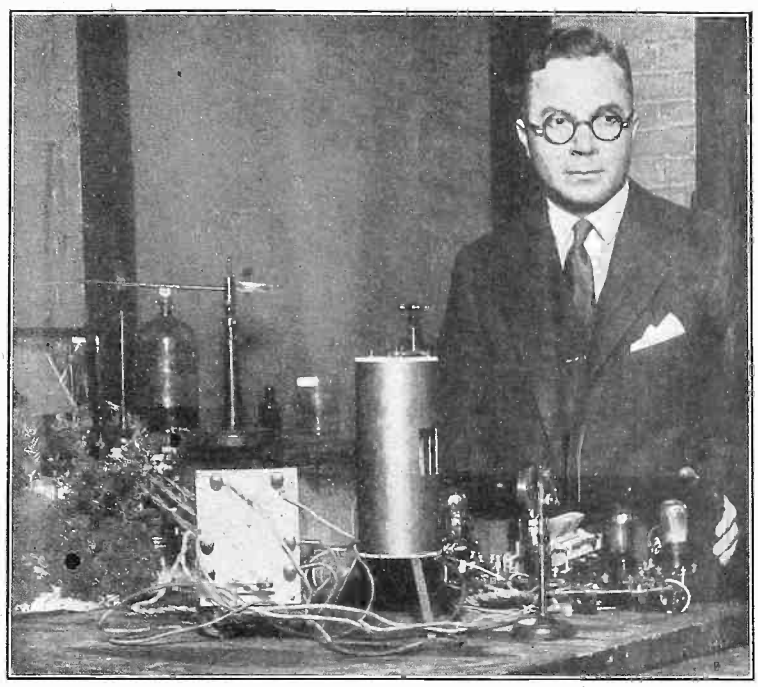
Another experiment demonstrated by r. Stockberger was to send sound by tra-violet light. The intensity of the ght beam was modulated in somewhat e same way that a high frequency radio ave is modulated. The modulated light eam is then picked up with a photoectric cell and the output amplified by ordinary amplifier and put on a loud peaker.

Directional Effect

One peculiar effect of sound transmission by ultra-violet light is that the beam an be directed in very definite channels. he light may be reflected, refracted, foused by lenses of suitable material and on. The beam travels in straight lines ore closely than ordinary visible light ecause of the shorter wave lengths of the tra-visible. One spectacular effect, if is term may be applied to anything that annot be seen but only heard, is that the und transmitted may be completely opped by interposing the hand, or any her body opaque to the short waves, beween the transmitter and the receiving oto-electric cell.

Still another remarkable demonstration y Dr. Stockberger is the use of ultraolet light to make objects visible in the rk. Thus, if a fence or an automobile painted with a phosphorescent subance, these objects begin to glow as on as the beam of ultra-violet light rikes them.

This may be used, as Dr. Stockberger ggested, to make automobile travel in e dark safer. Instead of equipping the tomobiles with glaring headlights to lind other car operators, the cars might equipped with a source of ultra-violet ght. This would not be visible to the erators yet it would make other cars d fences visible whenever the invisible ht beam struck them, provided that ese objects had been painted with a osphorescent paint which would glow n exposure to ultra-violet radiation.



(Wide World)

PROF. DONALD C. Stockberger, of the Department of Physics of the Massachusetts Institute of Technology, with his violet ray receiving set, receiving broadcast sounds and motion pictures on invisible beams of light. The pictures become visible only when thrown upon a flourescent screen.

All Radio Waves Have Colors, Expert Contends

Indianapolis.

Discussing "Radio Waves and Receiving Sets," over WFBM, Andrew J. Allen, secretary of the Indianapolis Broadcast Listeners Association, said:

"Tuning a radio set is simply a process of placing the secondary circuit of the tuning coil in resonance or in tune with the frequency of the wave that is desired. A receiving set has three distinctive circuits—(1) radio frequency circuit to intercept and amplify the high and inaudible electro-motive frequencies of the radio wave impulses; (2) detector circuit to rectify these impulses and convert them to audible frequencies; (3) the audio amplifying circuit to step up or amplify the audible frequencies and pass them out, as electro-magnetic waves, or impulses which actuate the headphones or loudspeaker.

"The theory is becoming more pronounced that the radio wave or energy impulse is a form of color or light wave of very high frequency too rapid for the eye to detect or mechanical genius to measure, but which can be converted into lower frequencies that in magnetic form are audible to the human ear. The feeble energy of a radio wave as it strikes the antenna or loop is measured in terms of one-millionth of a fly power. The radio wave travels with the speed of light at the rate of 186,300 miles per second."

Allen received much fan mail.

Long Deaf, Man Hears Music

Radio has probably meant as much to the deaf as to any other class of persons. While invalids, shut-ins, and the blind have testified concerning the joys it has brought them, to the deaf it has opened up a field of enjoyment which it was absolutely impossible for them to obtain in any other way. Many persons who have been unable to hear for years, have discovered that with a modern radio set and the use of headphones, they can again enjoy music, speeches, and other forms of broadcasts.

One case of this kind which was called to the attention of WCCO, St. Paul-Minneapolis, Minn., was that of E. J. Goward, merchant at Aitkin, Minnesota. He wrote:

"A new world of song, music and speech, has recently been opened up to me, by the use of the radio, that has lain dormant for twenty years, as far as my ability to hear is concerned, in any church, theatre, or public place, even from front row seats. Bearing that fact in mind you will be better able to appreciate my feelings of joy and thankfulness, when I tell you that I recently installed a modern radio, and with the headphones strapped to my ears I have been able to hear clearly and distinctly the human voice in speech and song, and all kinds of instrumental music as clear and distinct as in the days of my normal hearing, twenty years ago."

THE RADIO TRADE

Killing Summer Slump Discussed By Briton

Capt. J. W. Barber, Addressing Radio Manufacturers Association in New York, Suggests Transatlantic Broadcasts to Stimulate World-Wide Interest During the Hot Weather —Compares Conditions in Two Countries

By Herman Bernard

How to take the slump out of Summer radio business was discussed by Capt. J. W. Barber, of the Brownie Wireless Co. of Great Britain, Ltd., before the Radio Manufacturers Association, Inc., at the regular monthly luncheon at the Hotel Commodore, New York City.

Capt. Barber, then on one of his several visits to this country, disclosed the results of his comparative observations. He said the condition of radio in the United States, even with the multiplicity of stations, was far better than that in England.

As for price cutting, he said that was a problem in the British Isles, too, but that the Government helped the manufacturer. The owner or licensee of a patent is protected against the sale of his product at less than the standard price. Also, if one does not have a patent, the trade association has a "stop list" that makes it virtually impossible for an offending retail or jobber to get any more goods. Neither of these plans, it was pointed out, obtains in the United States due to legal reasons.

Better Business for Summer

As for improving Summer business, radio manufacturers in England realized "it is always Winter somewhere," so cultivated overseas markets during "English Summers." He counseled Americans to do the same, but more particularly to assume world leadership in exciting Summer interest in radio, and arranging international programs, if need be by short wave transmission and broadcast relay.

"We, too, are troubled with the bogey—if you call it that—of seasonal business," said Capt. Barber, "by which I mean the drop in the curve that almost paralyzes business for a number of months in the year. But it is always Winter somewhere, so we cultivate the overseas markets.

"It is unfortunate that something can't be done internationally to flatten out the curve, for instance, international broadcast arrangements to make radio a universal, non-seasonal commodity.

"America—it may be trite to say it—is the melting pot of all nations. Therefore it is most logical for you to institute broadcast arrangements, perhaps on short waves for rebroadcast by stations on their regular wavelengths, to appeal to the separate sections of your nationalities when their thoughts run not along radio lines but to outdoor sports.

Predicts International Programs

"Before many years you will no doubt be receiving regular trans-Atlantic broadcasts."

The Captain also discussed receivers in the two countries. The most popular type in Great Britain, he reported, is the two-tube set. By adding a stage of audio sufficient volume is obtained to operate a speaker.

Stations there are about 100 miles apart, so crystal sets are in high favor. He said his company makes 1,000 such sets a day. A good crystal set, at $2.50, and a pair of earphones constitute an installation.

"I would be delighted," he said "to see more expensive sets in greater demand in Great Britain. We should have more stations and interest the public in better sets. Of course, our receivers are not so selective as yours, because there is need for that, the stations not being numerous enough. But everything is in favor of conditions as they exist in this country (the United States). Our difficulty is that we are a poor country, while you are a rich country, and we have to make sets that suit the meagre pocketbooks of our workman."

The speaker commented adversely on the recent transfer of broadcasting management from the British Broadcasting Company (privately owned) to the General Post Office. He deplored the effect of putting radio into politics and said he had been told that since the change of management the programs were inferior. He prophesied there would be debates in Parliament as to why one woman singer, from a given city, was paid more than another woman from another city, such arguments being due to sectional feeling, rather than to artistic considerations in which the public is concerned.

Issues Two Warnings

"Whatever happens," he warned, "never let control of radio programs in your country come into political hands."

Another warning was that a joint association of manufacturers, retailers and jobbers was unpracticable, as the British Radio Trade Association "blew up" after the dealers and jobbers had been admitted to membership, and had to be reorganized on a strictly manufacturer basis.

"I have a deep sympathy and respect for the dealer and the jobber," he hastened to add, "and I make this suggestion just as much in their behalf as in any other."

The meeting was the second largest ever held by the R. M. A. in New York City. There were 75 persons present, or two fewer than the record number. The Chicago meeting recently set a new record—53.

The R. M. A. trade show will be held in the Stevens Hotel Chicago, June 13 to 18. Of the 20,000 square feet of space available, 11,175 feet were sold without a personal visit for solicitation, B. W. Ruark reported.

Centralab Makes Selector Device

A new device designed to give sets greater selectivity on the low broadcast waves, where congestion is greatest, has recently made its appearance. It is a new product of the Central Radio Laboratories of Milwaukee, pioneer variable resistance manufacturers, and is known as the Centralab Short Wave Selector. Stoner & Heath, Inc., 122 Greenwich Street, New York City, are distributors for the eastern territory.

This device can be connected to any set in a few minutes without making any change in its internal connections, and is provided with a switch to cut it in and out, as desired. In addition this device is neat and compact, and can be mounted on the front panel of the set.

Committees Chosen For Mid-West Meet

Des Moines, Ia.

E. T. Collins was recently chosen general chairman of the committee on arrangements for the Mid-west radio convention to be held in Des Moines February 23 and 24. The other members on the general committee are J. M. Camp, secretary, and Lee L. Wissler and H. B. Sixsmith.

The complete list of committees chosen to arrange the details of this first convention of dealers, broadcasters and listeners is as follows:

Publicity—Hugh B. Lee, Henry A. Wallace, E. R. Gray, C. T. Higgins, Rodney Selby, John McCarroll, Graham Stewart, Irwin Femrite, J. A. Rawlings, Jos. F. Hearst, E. N. Hopkins.

Broadcasting—W. H. Heinz, Dean Cole, Jack Whitney, E T. Collins.

Arrangements—E. N. Hopkins, George Hamilton, Ed O'Dea, Harry W. Warren, C. C. Gardner, H. E. Bowman, J. C. Hammond, R C. Hopley, H. E Sorenson, William H. Metz.

Program—H. B. Sixsmith, Francis St. Rustell, J. M. Camp, H. F. White, E. M. Petersburg, Joe Carmichael, Leo L. Wissler, V. L. Thomas.

Finance—Ed. O'Dea, F. A. Beatty, George Hamilton, H. R. Collier, V. L. Thomas.

Entertainment—Mort Zucker, Gordon Lathrop, Ralph Townsend, Ralph Starr, John Rober, R. H. Miller, R. H. Castner.

New Owners Begin Making Myers Tubes

The purchase of the Myers Corporation was made recently and the new owners began operation of the plant under their own management.

The corporation name, well-known for a number of years throughout the radio industry, is retained by the new owners, who have announced that the same high standards of manufacture and inspection which made Myers' tubes favorably known to the trade and the consumers will be maintained. The plant at Cleveland is being fitted with new and improved equipment to increase production and enable the reorganized corporation to meet the growing demand for high quality radio tubes.

All of the executives of the reorganized corporation have had years of manufacturing and sales experience and have given considerable study to the radio industry and to the trend of consumer demand. The research and engineering departments are headed by engineers who have attained unusual success in the radio field.

Dealer Started Career With Store In Home

Portsmouth, Va.

The Stanley Radio Company owes its growth to D. E. Stanley, its owner, who, realizing, when the radio industry was in its infancy, the importance of what it might develop into, utilized his knowledge of radio, which he acquired at the Navy Yard, and opened up a small establishment in his home.

The fine work he put out and his familiarity with radio increased his clientele to such an extent that he was forced to move to larger quarters on County St. There his store quickly won favor.

FIRE IN BOSTON STORE

Boston

Fire recently destroyed about $200 worth of receivers and apparatus in Mack's Radio and Battery store at 399 Ferry St. The fire started in the wareroom and had gained headway before the fire apparatus arrived.

39,000 DeForest Shares and Royalty for Crosley

Cincinnati Manufacturer Elected President of Jersey Company and Will Run It—Fee Is Three Per Cent. of First $3,000,000 Net Sales

Complying with the authorized agreements, allowed by the Court of Chancery of New Jersey, between the DeForest Radio Company of Jersey City and Powel Crosley, Jr., prominent Cincinnati radio manufacturer, a new Board of Directors and group of officers of the DeForest Company have been elected.

Mr. Crosley was elected president and Dr. Lee DeForest was elected vice president and consulting engineer. The board of directors consists of Mr. Crosley, Dr. DeForest, Lewis M. Crosley, Charles Sawyer and R. E. Field of Cincinnati, James I. Bush and Arthur D. Lord of New York.

"I have been familiar for a long time with the affairs and business and difficulties of the DeForest Radio Company," said Mr. Crosley.

"I have always believed that the name DeForest and certain other rights of the company could be made of great value.

"After giving considerable study to the matter, and at the request of a large number of stockholders, I have entered into an agreement for the operation and management of the company with the intent to develop its business and to enable it to occupy the position in the radio field to which its name and other rights entitle it."

The DeForest Company will still maintain its name, according to Mr. Crosley, and not change or submerge its identity in any way. As a compensation for his work, Mr. Crosley will receive 39,000 of the 211,000 shares of treasury stock outstanding and 3 per cent. commission on the first $3,000,000 of annual net sales.

An announcement from Public Relations, Inc., 383 Madison Avenue, New York City, set forth:

"Powel Crosley, Jr. created a radio General Motors when he recently added control of the De Forest Radio Company to his already tremendous holdings in the industry. The Cincinnati manufacturer acquired not only the immensely valuable De Forest basic patents, but a modern tube plant with a capacity of 10,000 audions per day and the services of Dr. Lee De Forest, 'father of Radio,' as chief consulting engineer. He has already produced and sold 1,500,000 radio instruments —the world's largest radio manufacturer."

Openshaw Accepts Position With Pilot

Martin Openshaw, has resigned from the Radiall Company, manufacturers of Amperites, to accept the post as general sales manager of Pilot Electric Manufacturing Company, Inc., Brooklyn, N. Y.

The job of piloting the sales of the Pilot organization, with its tremendous output, offers ample scope for the dynamic energy which has made Openshaw one of the well-known figures in the radio industry. Under his guidance the well known Pilot policy will be continued, namely "From raw materials to finished product under one roof." This will assure the continuance of the price policy which has given Pilot prominence in the parts field for over nineteen years. In addition to directing the destiny of Pilot sales, Openshaw will also handle the Beacon Radio Manufacturing Company, makers of Trinity Receivers.

See Jay Batteries Are in Great Demand

The See Jay Battery Company, 913 Brook Avenue, New York City, is running night and day to keep up with orders, showing that this line of batteries stands high in popular favor among fans. This concern manufacturers a full line of genuine alkaline element, rechargeable B batteries to meet every radio need. In line with the trend toward power supply, the See Jay Power Unit provides noiseless, uniform supply. This unit is plugged in on the power line and left alone. It is made in several models from 100 volts to the maximum voltage for power tubes. Safe delivery is assured and it is covered by a money-back guarantee. An illustrated 32 page booklet on power supply troubles will be sent by this concern on request.

Sacramento, Cal.

William P. Carmody of the Wright & Kimbrough Company, recently announced that Bert Norton opened up a complete radio store and repair shop at 1005 Thirteenth St.

New Resistance Booklet Covers Big Field

The Ward Leonard Electric Company of Mount Vernon, N. Y., have just published a booklet, "How to Use Resistance in Radio," covering the various uses of resistance in radio circuts.

Power amplifier and high-voltage plate supply units popular today have brought the subject of radio resistances and the problems attached to their use to the attention of the experimentor.

Included in the Ward Leonard booklet is a non-technical presentation of the entire "current supply" question and much other material of interest to fans.

* * *

Miami, Fla.

The Guy H. Robinson Electrical Company, wholesale and retail radio dealers, 104 N. E. Fortieth Street, Miami, Fla., recently announced a new unit which is known as the "Crosley Lowave," designed to bring in short wave stations. The unit can be used in connection with any radio set, it is said. It uses three 301-A tubes or their equivalent, picks up the short wave station on its wave length and translates its frequency to one within the band of prescnt broadcasting. This opens up to interested radio fans an opportunity to listen to what is being broadcast on the other wave lengths, including WLW, which will be simultaneously broadcasting on 52 meters almost immediately, it is announced. WGY, KDKA and other stations will also be broadcasting on short waves.

The Merola is another unit for magnetic electric reproduction that is announced by this company. This is an electrical reproducer which is intended to be used to convert an ordinary phonograph by means of a radio set into an electrical phonograph.

* * *

King City, Mo.

Thomas Abbott, who recently went into the radio business in King City, Mo., opening up the Abbott Radio Shop, is having quite a lot of success in this new business enterprise. Abbott has calls night and day to doctor sick radios. He is agent for the Thorola and the Grebe Synchrophase radios.

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reador. 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 .....

F. L. Pittman, 103 3Patent Office, Washington, D. C.
Radio Engineering and Supply Co., 323 Leflang Building, Omaha, Neb.
William Adams, 4622 Pennsylvania St., Frankford, Philadelphia, Pa.
John Leather, 45 Ontario St., Schenectady, N. Y.
Alpin H. MacDonald, 1722 Hamilton Ave., Trenton, N. J.
Roy Scott, 1517 Plymouth Ave., Bronx, N. Y. City.
William B. Leonard, Liberty, Ind.
Harry Liedlich, Riverhead, N. Y.
Ned Biffle, Paul Valley, Pauls Valley, Okla.
Claud Gerlach, 410 Heath, Logansport, Ind.
W. Clarke, 318 Rhodes Ave., Toronto, Ontario, Canada.
F. J. Carow, 715 Balfest, Toledo, O.
L. E. Williams, 49 Union Ave., Portland, Ore.
Waldo Stevens, Chester, Utah.
A. N. Kingsafer, 209 South Carrol, South Bend, Ind.
Alton H. Brouno, 540 State St., Watertown, N. Y.
H. F. Murphy, 24 Cottage Place, East Orange, N. J.
C. W. Schwartz, 434 West Grand St., Elizabeth, N. J.
Charles W. Biel, 88 Johnson Park, Buffalo, N. Y.
Robert E. Noone, 213 North State St., Indianapolis, Ind.
Earl Radio Co., 102 Eaton St., Buffalo, N. Y.
J. C. Richard, 220 Sunnyside Ave., Mill Valley, Cal.
H. B. Graeff, 826 South Coronado St., Los Angeles, Cal.
B. L. Newhouse, 2217 East 34th St., Minneapolis, Minn.
C. L. Coleman, 701 Cherry St., Chattanooga, Tenn.
Edwin Jacob, 317 South Pierce St., New Orleans, La.
John Blake, 131 Elliot St., Brattleboro, Vt.
Hardus Sorkness, Hemet, Calif.
R. E. Renfrow, 1112 Dawson Ave., Long Beach, Cal.
E. W. Duchman, 1064 East 94th St., Brooklyn, N. Y.
Thomas C. Wood, Box 2A, R. D. 1, Menlo Park, Cal.
Fred J. Merklein, 321 Marion St., Brooklyn, N. Y.
G. C. Dibrell, 803 C. St., N. W., Ardmore, Okla.
C. H. Colby, Benson, Minn.
P. W. Frederick, Mansfield, O.
E. Scheffknecht, 17½ North 17th, Belleville, Ill.
Eduard Martin, 2040 North Laurence St., Philadelphia, Pa.
Carl H. Miller, P. O. Box 283, Rockton, Ill.
Harry Moore, 105 West 28th St., Jacksonville, Fla.
C. B. Noe, 763 Elmwood St., Jackson, Mich.
I. H. Durgan, 8 Leighton St., Waterville, Me.

NEW CORPORATIONS

Radio Sales Corp., 326 Milburn Ave., Milburn, N. J., radio and electrical equipment; 125,000. (Incorporated under the laws of New Jersey).

Triangle Broadcasters, 4147 Broadway, Chicago, Ill., own and operate a radio broadcasting station; $5,000; Richard W. Hoffman, Stanley A. Matas, Min Nelson. (Attys., Schwartz and Cooper, 105 West Monroe St., Chicago, Ill.

Helicon Radio Condenser Corp., 215 De Federmand Building, Peoria, Ill., manufacture radio appliances and other mechanical appliances, 500 shares of no par values; H. F. Drobisch, F. C. Schaulhauser, S. F. McGrath. (Attys., McGrath and Stone, Jefferson, Peoria, Ill.).

Norman Electric Corp., N. Y. City, radio; $10,000; S. J. Goldberg, M. J. Levine, A. Eisenstat. (Atty., D. L. Sprung, 7 East 42nd St., N. Y. City).

Broadway Broadcasters, N. Y. City, radio broadcasting, $20,000; S. Gelb, C. M. Warburton. (Atty., L. J. Feinstein, 1,440 Broadway, N. Y. City).

Radio Equipment House, Inc., New Britain, Conn., Frederick E. Potter, W. W. Marshall, Louis W. Keith. (Incorporated under the laws of Connecticut).

MERGERS

Richardson Radio, N. Y. City, mergers the Cornell Electric Mfg. Co.

AT YOUR SERVICE

Remedying Noises in a Receiver

This department is conducted by Robert L. Eichberg, director of the Extension Division of the Federated Radio Trade School, 4464 Cass Ave., Detroit, Mich. All questions regarding the construction, repair, selling, merchandising and advertising of radio apparatus should be sent direct to Mr. Eichberg at that address, where they will be promptly answered. The answers to questions of general interest will be printed here. All others will be answered by a personal letter from Mr. Eichberg. By a special arrangement RADIO WORLD *is able to offer this service free to all readers.*

It is a very simple matter to determine whether noises are originating in the audio end of the set. It is necessary only to connect a pair of phones across the primary of the first transformer or resistance coupler. If the noises continue, although in a lesser degree, they originate in the detector or radio frequency stages. But if no noise is heard, the audio amplifier is at fault. The problem is to determine which piece of apparatus is causing the trouble, and then to rectify the defect.

How to Proceed

The first thing to do is to find which audio stage is the source of the interference. This is done in the same manner as described before, connecting the phones across each transformer primary. The first noise will be heard immediately after the offending stage. The fault may lie in the tube, socket, transformer, or wiring. Once the exact location is found, the remedy is usually but a few moments' work.

The most frequent symptom is a high-pitched, continuous whistle, heard no matter whether a station is tuned-in, whenever the filaments are lighted. This is generally caused by the impedance of the transformer being incorrectly matched to the impedance of the tube. Connecting a .001 or .002 mfd. fixed across the primary or a .5 of 1 megohm resistance across the secondary of the transformer usually will correct the fault. Sometimes a combination of both is needed. A microphonic tube will show similar symptoms, but the noise produced will be more like that of a siren, starting faintly and building up to a wail. It can be stopped in almost all cases by wrapping the tube with electricians' tape or adhesive plaster, or by using one of the special devices on the market for the purpose of deadening tube noises, e. g., the McDonald howl arrester.

Defective Sockets

A "crackling" noise denotes poor contact in ninety-nine cases out of a hundred. And in the great majority of these cases the trouble lies in poor contact between the tube prongs and the contacts in the socket. In the old V type sockets, the prongs may be bent upward so that the pressure which they exert on prongs will be greater. The newer X type sockets have variously shaped contacts which may be bent, when necessary, to give more tension. A cracked socket should always be discarded, because dust or other conductive material lodging in the crack is apt to cause leakage of current, with consequent noise or weakening of signals. Shaking the tube gently while the set is in operation will disclose poor contact in the socket.

Unless a hot iron is used with rosin-core solder, a joint may be stuck with rosin instead of metal. This joint may appear tight, but its resistance will be high. Likewise, a joint buried in a large mass of solder may not be tightly stuck. That goes to show that economy is not the only reason for using the smallest possible amount of solder in making a joint. When the terminal of a wire is fastened by means of a screw or nut, see that it is tightly held. Use a lock-nut or lock-washer to make sure that the joint remains tight. It might also be well to mention here that soldered joints wherein acid or paste is used may be all right for a time, but are likely to corrode later, unless the utmost care is taken to remove all traces of flux after the job is completed.

The test for a loose wiring joint is to grasp each wire firmly with a pair of pliers, and shake it. The crackle will be heard loudest when the wire which contains the poor joint is shaken. In making this check-up, do not overlook the speaker cords, or the B and C battery leads to the set.

It is also advisable to check over the contacts in the jacks, to ascertain whether or not they are clean and tight. They may be cleaned with very fine sand paper, and tightened by bending. The tube prongs and socket contacts should also be kept bright by the occasional application of sandpaper.

Questions and Answers

A YEAR AGO at this time I ordered a Diamond of the Air kit from a New York firm. The parts came O. K., but I have been unable to make the last stage work. The receiver works at Det. output O. K., but I cannot get it to operate at speaker output. By taking a tube out of the socket and using phones in speaker output it is possible to hear faintly. I am using CX-301-A tubes in first and second sockets and other tubes in third, fourth and fifth.

H. L. Fuller.

I would advise you, first, to check over the entire audio end of your set. First connect the phones to the output of the detector and see how strongly you can get a signal. Then try the phones in the output of each audio tube. If signals from each audio tube are not louder than from the ones preceding it, test out the condensers and resistances, using a battery and voltmeter in series for the condensers, and a battery and phones in series for the resistances. The meter should show no reading when connected in series with the condenser. A click should be heard in the phones when they are connected in series with each resistance. Disconnect all batteries from the set, and remove the tubes when making the tests. I am assuming that you are using the proper values of condensers and leaks, and that you are placing the lower resistances in the plate circuits and the higher ones in the grid circuits, as instructions indicate, also that your jacks are all in good condition, particularly the one in the first stage.

* * *

I HAVE a three-tube three-circuit set, I would like to make a five-tube set. Let me know what to do.

L. D. McHale.

Sets of the following types are giving consistently good results in all sections of the country. (1) Tuned Radio Frequency Set; (2) Neutrodyne; (3) Diamond of the Air; (4) Browning Drake. The two last named sets use resistance coupled amplification in their five tube models.

Western Electric Denies It Will Stop Cone Manufacture

Rumors that the Western Electric Company contemplates placing a radio receiving set on the market have been met with an official statement from the company's headquarters in New York that at present no such move is contemplated. The company continues, however, to manufacture a radio receiving set designed specifically for use with its public address systems and radio telephone broadcasting equipments.

Another report which has been circulated from time to time was that Western Electric loud speakers were to be withdrawn from sale to the public. It is stated now that there is no basis whatever for this report. Western Electric was the defendant in a suit brought by the Lektophone Corporation for infringements of its patents on the cone tvpe of loud speaker. It successfully defended this suit in the United States District Court during the Summer, and last week the Circuit Court of Appeals of the Second Circuit affirmed the decision of Judge Thatcher in the lower court and held that the Western Electric cone speaker did not infringe.

This decision confirms the position taken by Western Electric from the beginning of the controversy, which arose after its cone type loud speaker became popular with radio enthusiasts. While the line has never been widely exploited, the production of speakers has never been stopped and under this decision they will continue to be available to the public.

Aerovox Wireless Moves to Brooklyn

The slogan of the Aerovox Wireless Corporation, "Built Better," has evidently been lived up to by this well-known concern and has brought its own reward, for the enormous demand for their products has necessitated their removal to new and larger quarters at 60-72 Washington Street, Brooklyn. The plant was in full swing without losing one hour of production and with no delay in shipping to customers, and is still a 24-hour schedule. This concern manufactures high-grade fixed mica condensers, filter condensers, power supply condensers, blocks and Lavite resistances. Their products are used by more than 200 leading manufacturers of radio receivers and B eliminators, and have been approved by M. I. T., Yale University and the leading radio publications. Their products have been specified in successful circuits by authorities such as R. E. Lacault, Lewis Winner, James H. Carroll and others.

It is only a year ago that they had to double their floor space at their old headquarters, 489 Broome Street, New York City, and now they have to quadruple it. Any inquiries as to Aerovox products and their uses should be sent to the new address.

DAVIS REPORTS ON 1926

Pittsburgh, Pa.

The application of crystal control to transmitters, enabling broadcast stations to keep exactly on their assigned wavelengths, and innumerable refinements in transmitting and receiving equipment were the outstanding radio developments of 1926, is the belief of H. P. Davis, vice president of the Westinghouse Electric and Manufacturing Company.

WAR ON MISREPRESENTATION

Washington.

War has been declared by the Radio Merchants Association on dealers who misrepresent the equipment they sell either orally or through advertisements. The Washington Association has also initiated a program of education of dealers in order that intelligent service and advice may be rendered to buyers and owners of sets.

New Vitalitone Cone Is of Ship Model

The Vitalitone Radio Corporation, 88 University Place, New York City, has placed on the market an exquisitely modelled cone speaker. A beautiful real model of a gallant 17th Century Crusader ship, executed in statuary relief and colored most artistically in antique polichrome, sets off the cone. Base and edges are finished to match. The cone itself is the newest development of the Vitalitone, perfected after long and careful experimentation and research by the Vitalitone staff of engineers. It is actuated by the powerful Vitalitone adjustable unit and will not rattle or buzz and is sold under an unqualified guarantee. It combines a real reproducing instrument with an ornament that will do justice to the finest of homes. Literature will be sent upon application to the above concern.

Three New Directors for Wisconsin Trades

Milwaukee, Wis.

The Wisconsin Radio Trades association, at a special meeting, elected three new members to the board of directors of the organization. With this election the association will have complete representation in all branches of the retail and wholesale radio trade.

The new directors are Charles Krech of the Krech Electric Co., Henry M. Stuessy of the Kesselman-O'Driscoll Co., and Clarence Bates of the Bates Radio corporation. They replace Jack Brindley of La Crosse, C. J. Quinn of Neenah and D. N. Kasson of Milwaukee, respectively.

Magnatron Tube Factory Badly Damaged by Fire

Fire recently destroyed the interior of the two-story brick factory building of the Connewey Electric Company, manufacturers of radio bulbs, at 406-408 Jefferson Street, Hoboken, N. J. The origin of the fire was not determined, and there was no one in the building when the blaze was discovered by a policeman.

Many families living in frame houses in the neighborhood went to the street when, for a time, the blaze threatened to spread. The firemen confined it to the factory building.

The company makes Magnatron tubes.

NEWS FLASHES

Spokane, Wash.

R. L. Strickle, vice-president and manager of the March-Strickle Motor Company of this city, recently announced the inclusion of a radio department. The popular Day-Fan receiving sets will be handled, throughout the state of Washington and Northern Idaho.

The Van Ausdale-Hoffmane Company of this city, who handle the A-C Supertone, Crowley, Mohawk and Supertone sets, have added another receiver to this line, the Grebe Synchrophase.

* * *

Tulsa, Okla.

The Alhambra Radio Company which recently consolidated with the Radio Products Company, opened up new quarters, at 1309 East Fifteenth St. The Radio Products Company moved its stock from 315 South Boulder Ave. to both the old Alhambra store, at 1447 South Peoria Ave., and to the new enlarged quarters.

Lektophone Is Loser In Cone Patent Suit

Trenton Judge Dismisses Complaint Made Against Brandes for Alleged Infringement, Contradicting Findings in Other Jurisdictions—G. E. Defeated on Tungsten Filament

After the long legal struggle, the Lektophone Corporation suit against the Brandes Products Corporation, for patent infringement on loud speakers using the popular cone principle, was dismissed by Judge Joseph L. Bodine of the Federal District Court, Trenton, N. J. This decision was at variance with two others rendered in New York courts recently.

Lektophone had sought to restrain the Brandes Corporation from manufacturing any more speakers and to rebate on all sales profits. It served as a test suit, as well, since many other firms are making this type of speaker.

Some electrical concerns already had paid big royalties, some running as high as $200,000, as in the case of the R. C. A., to the Lektophone Corporation for the privilege of manufacturing and selling speakers employing the cone principle. According to Judge Bodine, however, the device was not covered by an inviolable patent.

General Electric Ductile Tungsten Patent Is Upset

Wilmington, Del.

The suit of the General Electric Company, begun in November, 1925, against the De Forest Radio Corporation, for infringement of the patent dealing with specific improvements of tungsten, as well as the preparing of this metal for filaments, also the manufacture and sale of tubes using ductile tungstein, was decided in favor of the De Forset Corporation. Federal Judge Morris held the ductility of tungsten to be an inherent quality of the metal, and consequently not patentable, and therefore dismissed the suit.

According to persons conected with the General Electric Company, further action will be taken. They state that much money was spent on research on the possibilities of this metal, and can not see why other concerns should be able to produce tubes using the element.

An appeal is expected.

$60,000 Load of Gold Overtaxes Batcheller

Washington.

One of the pet theories of Supervisor of Radio Arthur Batcheller, at New York, has been exploded.

Not so long ago Mr. Batcheller made a visit to the mint with a friend. A guide was assigned to show them through. During the trip of inspection, Mr. Batcheller paused before a stack of gold bars and wished he had as many of them as he could carry away with him.

"I'd get a nice car, a yacht and a radio set," he declared, "and a lot of other things."

"How much gold do you think you can carry?" queried his friend.

"Enough to do me for life," retored Mr. Batcheller, "or break my back trying."

"Well, I'll bet you that you can't carry $100,000 worth of gold," replied the friend.

The bet was made, and the guide obligingly piled gold bars onto Mr. Batcheller's outstretched arms. When $40,000 was on his arms, he began to look embarrassed. $50,000 and he was uncomfortable; $55,000 and he began to stagger. Before $60,000 were piled on his arms, he had to call a halt. It would have been impossible for him to carry $50,000 around a block, he said later and added:

"It's almost worth what I lost to have the feel of so much gold on my arms."

Chief Radio Supervisor W. D. Terrell when he heard the story was willing to bet anybody that if he were offered $100,000 he could carry it around a block on one trip.

U. S.-SWEDEN 'PHONE SOON

Stockholm, Sweden.

Director Lignell of the Government's Board of Telephones and Telegraphs, recently announced that wireless telephone service between his country and the United States is to be arranged very shortly. Regular telephone service with London, via the Continent, as well as Berlin, Paris, Vienna and other European capitals are now in use in this country.

75-Piece Orchestra to Play Often at NAA

Washington.

Sponsored by the Pan-American Union, a new seventy-five piece orchestra, to be known as the "United Service Orchestra," has just been organized and will begin practice. The orchestra will be under the joint conductorship of Lieutenant Charles Benter, director of the Navy Band, and Captain William J. Stannard, director of the Army band. It will be featured in concerts soon to be given in the Hall of the Americans at the Pan-American Building and broadcast by the Navy Yard Station, NAA.

Designed principally for broadcasting, the orchestra will be unique in that it will lay unusual stress on the basses. Eight double basses, twice the number generally used, will be included. Music of the New World will be featured in the concerts and visiting Latin American artists are expected to be invited to appear from time to time.

The first concert of the present season in which the new orchestra will appear will be the thirty-third of these given under the auspices of the Pan-American Union for the purpose of creating in this country a better knowledge of the music of Central and South America. It will be held some time next month.

Sees Big Field in Europe

Radio will in time mean more to Europe than it has meant to America, predicts Maria Kurenko, the Russian operatic soprano, who is a native of Tomsk, Siberia, and who recently offered a recital in the Atwater Kent series of Sunday night concerts which was broadcast from a chain of 19 stations.

At an early age Mme. Kurenko emigrated with her parents to Moscow. Her musical education started at the age of 12. Later she became a pupil of the famous Mazetti, at the Moscow Conservatory, simultaneously beginning the study of law at the University of Moscow.

Good Back Numbers of RADIO WORLD

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

June 5—Five-Tube Compact Receiver, by J. E. Anderson. A Tester for Tube Circuits, by Spencer Hood. Problems of Portables, by Hugo Gernsback.

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 17—A Double Duty Loop Aerial, by J. E. Anderson. How to Measure Coupling, by John Rider. A 1-Control Crystal Set, by Smedly Lyons.

July 24—Why the Super-Heterodyne Is the Best Set, by Herman Bernard. A 1-Tube Reflex Receiver, by H. A. Reed.

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

Aug. 7—The 5-tube Pabloid, by A. Irving Witz. The wiring of Double Jack, by Samuel Lager.

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-Lux 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 Super-Heterodyne Modulator Analyzed, by J. E. Anderson.

Any copy, 15c. Any 7 copies, $1.00. All these 31 copies for $4.25, or start subscription with any issue. RADIO WORLD, 145 West 45th Street, New York City.

AROUND THE TRADE CIRCUIT

Seattle, Wash.

A new radio store, known as the Junction Radio and Supply Company, has been opened at the Junction by H. L. Ward, in the Junction Building, a few doors west of the West Seattle State Bank. They will handle a full line of Radiola and Crosley radio sets, etc.

Mr. Ward was formely in the radio and automobile electric business in Pennsylvania.

* * *

The Yorkville Radio Company, No. 147 East Eighty-sixth street, New York City, has doubled its floor space by taking an annex in their present building. This additional space will be devoted to three de luxe radio salons for exhibiting rado receivers exclusively. Sid Vorzimer, president of the company, reports that 1926 was the best year in the history of his business by far, and he looks forward with confidence to 1927 eclipsing all previous years.

Allegan, Mich.

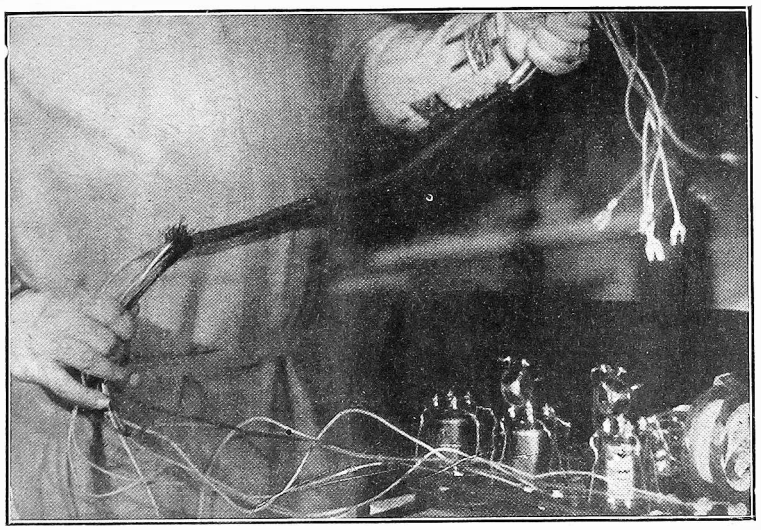
According to Hollis Baker, manager of the Baker and Company factory of this city, plans have been completed for the consolidation of his company with the Allegan Furniture Shops, also that papers have been made out for the purchase of, by the consolidated companies, the Jewett Radio and Phonograph Company plant, also in this city. The Jewett factory comprises three large buildings, where more than 300 persons are employed.

* * *

Charleston, Ill.

Roy Chambers of the Chambers Radio Company, this city, has recently disposed of his entire radio business and stock to Chester Harrell of the Stewart-Harrell Electric Company. All the radios, and other apparatus, will be moved to new rooms on Sixth St. Paul Conely, formerly employed by the Chambers Radio Company, and a highly experienced radio man, will be retained by the Stewart-Harrell Company.

Freak Reception Laid to Long Cable Leads



(Hayden)

An example of cable leads that are too long. They should be cut at the receiver end so as just to reach the batteries.

The battery leads in a set act as an antenna, which picks up signals the same as the regular antenna or as the loop. This pickup may be in phase or out of phase with the regular pickup. In one case the signal is intensified; in the other it is decreased. In both cases the behavior of the set is erratic.

When a loop is used the pickup by the leads intensifies the signals from one direction and decrease them from the opposite. In addition to this distortion effect of the field the cable introduces a resistance and makes the circuit less selective. Hence it is very important to make the battery leads as short as possible, or else to encase them in a metallic sheath, which should be grounded.

There is another objection to the use of long battery leads. There is certain amount of voltage drop in the wires, particularly in the A battery leads, and this makes it necessary to recharge the battery oftener than when the leads are short. In a circuit drawing a heavy filament current, as two amperes for example, the voltage drop may amount to almost a volt in some cases.

Children Are Hardest Listeners to Please

Very Keen In Discovering Tricks—Canadian Station Gets Their Aid In Developing Program Feature That Even Excites Grown-ups—Train Trip Is Devised With Amusing Sidelights

Montreal.

Children now have a definite place in the programs of stations, but in approaching this phase of work directors are faced with difficulties even greater than when preparing entertainment for the elders. Children are notoriously keen critics, so much so that many professionals will not attempt legerdemain in the presence of purely juvenile audiences. The youngsters are seldom deceived by the performer's patter and their keen eyes follow every movement while they always insist on a complete explanation. It is not always easy to bring adult entertainment to the childrens' scale of appreciation, and there are certain limitations in the cycles of fairy tales and nature stories.

Confronted by these difficulties, yet desirous of acceding to the demand for juvenile entertainment, George A. Wright, broadcasting manager of CNRV, Canadian National Railways radio station at Vancouver, British Columbia, hit upon a happy expedient. "Why not enlist the aid of the children?" he asked.

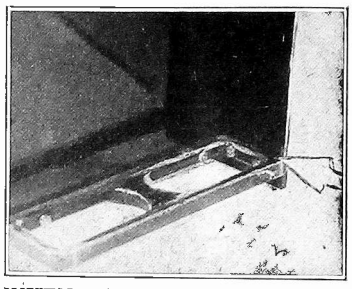
Then he put his project into execution with the result that the already great popularity of CNRV has been enhanced, and that is clearly evidenced by the increase in laudatory mail received at Vancouver and afterwards forwarded to the director of radio, A. R. McEwan at Montreal,

Piano Aids Story-Telling

One of the reasons prompting Mr. Wright to obtain the aid of children was the happy relationships which has been established between the station and the little pupils of the School for the Deaf and Blind, conducted by the Provincial Government at Point Grey, where a great deal of joy and sunshine has been radiated by means of the broadcasts. Ronnie Mathews, not yet in the 'teen years, who has displayed a remarkable aptitude for music and has become surprisingly proficient on the piano, was chosen to act as an aid to the station announcer. Later the plan developed with the establishment of a "radio train", complete with conductor and engineer, with "Aunt Emma" and "Uncle George" to shepherd the young flock. The "train" gathered as "passengers" youngsters who were known to the station and after the first "trip" through the air, letters fairly showered in at CNRV demanding passage on the "train" and insisting on halts at communities widely scattered along the Pacific Coast from Southern California to the farthest habitations in Alaska and Yukon and inland over half the continent. The "conductor" proved to be the proper sort of man for the position because at every halt for coal and water he played the piano which was part of the equipment of this wonderful "train". The "engineer" also proved a remarkable fellow because he insisted on making extraordinary visits to people along the line and once, while Ronnie was playing for the "passengers" he fell asleep in the coals.

An incident of one journey was the discovery of a hungry rooster who had to be fed and the listeners-in were asked to count the number of kernels of corn dropped into the capacious crop. This competition led to amusing results and set in motion a wave of happy laughter that surged along the Pacific Coast until it lapped against the foundations of Green Island Light and drew from the keeper of this most northerly of Canada's Pacific marine sentinels the frank admission that the entertainment was just as attractive to grown-ups as to the kiddies.

BRACKET HELP



WHEN INSTALLING a sub-base which uses brackets be sure to allow about a ¼" extra space from the bottom of the panel, (right), so that when you place the panel in the cabinet, the blocks of wood used to prevent the panel from slipping will not hit the bracket and prevent insertion.

Radiation Nuisance Decreases in Canada

Washington.

Interference from radiating receivers has been considerably reduced in Canada during the past year, according to a report received here. There are just as many radiating receivers in use, it is said, but they are being adjusted with some regard for the feelings of neighbors.

To reduce interference from radiating receivers, the Canadian Department of Marine and Fisheries, which has control of radio, issued a circular letter which was sent to the holder of receiving licenses. The letter called attention to the trouble that could be caused by improperly operated equipment and pointed out that a standard 301-A receiving tube, carefully adjusted to radiate the maximum amount of energy, has been heard over a distance of more than 7,000 miles.

Fortunately the average radiating set can only be heard over about one-quarter of a mile, the circular added, but in a city there may be several hundred receiving sets in that area.

Delaware, O.

The Triple Service Company, will soon open an electrical and radio store at the corner of East Winter and Union St., under the management of E. M. Shisler.

1,100 Stations, Maybe; 130 Being Erected

Washington.

A report of the Department of Commerce shows that the total number of stations may reach 1,100 before June 1 unless a radio bill is enacted. That would be twice as many stations as were in operation when the Government lost control of broadcasting last July.

Newly licensed stations already brings the total above 700. More than 130 stations are under construction. Plans are in progress for the construction of about 250 additional stations.

The new stations reported under construction are in the following cities: Marblehead, Mass.; Long Beach, N. Y.; Woodbridge, N. J.; Long Island City, N. Y.; Ozone Park, N. Y.; Brooklyn, N. Y.; Richmond, Va.; Columbus, Miss.; Meridian, Miss.; Oklahoma City, Okla.; Atoka, Okla.; San Antonio, Texas; Memphis, Tenn. (2); Burbank, Calif.; Yuba City, Calif.; San Diego, Calif.; Los Angeles, Calif.; Bellingham, Wash.; Lewiston, Idaho; Flint, Mich.; Cleveland, Ohio; Le Roy, N. Y.; Washington, Pa.; Auburn, N. Y.; Peckley, W. Va.; Cohocton, N. Y.; Endicott, N. Y.; Cambridge, Ohio; Toledo, Ohio; St. Paul, Minn.; Evanston, Ill.; Denver, Colo.; Ft. Riley, Kans.; De-Pere, Wisc., and Cozad, Nebr.

Dispute Is Foreseen Over the Long Waves

Washington.

An international dispute about the use of wavelengths for long distance wireless telephony is foreseen by experts of the Government who have been watching developments in the establishment of American-English and Canadian-English trans-oceanic telephone service.

Use of long distance wireless telephony on a large scale by the entire world may never be possible because of insufficient waves, according to these experts. It would follow that the waves available for such services must be divided among the various countries by an international conference.

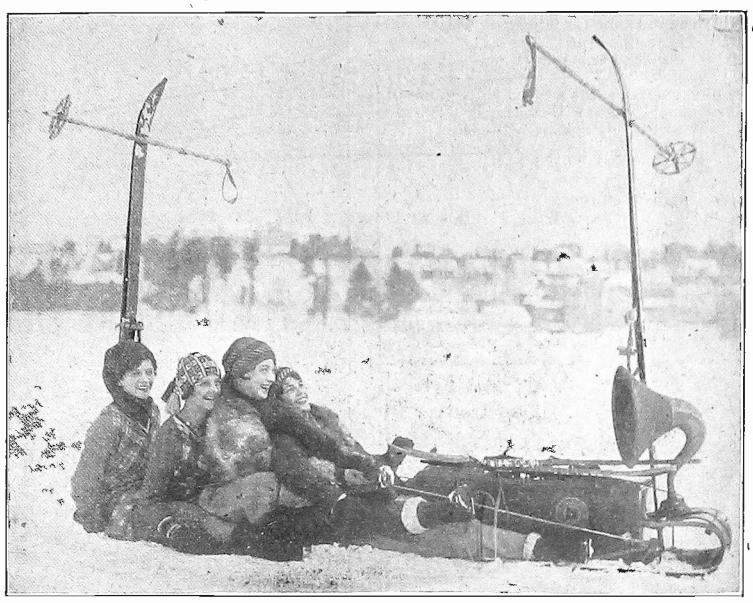
The band considered most likely to be used for wireless telephony is between 20 and 100 meters. In this band also are a number of other services such as long distance telegraphy, aircraft beacons, aircraft telephony, government telegraph stations, commercial telegraph stations, amateurs, short wave re-broadcasting, etc. This applies a definite limitation to the number of channels that could be used for international telephony.

With the beam system, the same wave might be used north and south, and east and west simultaneously. It is also believed that other inventions and methods may likewise increase the availability of channels. But it is doubted whether there will ever be sufficient for any very elaborate system such as that in use by land telephone companies.

MAKES 5,300 SETS A DAY

More than 5,300 sets a day are turned out at the Atwater Kent factory, Philadelphia, Pa.

HIGH JINKS WITH LOW AERIAL



(Herbert Photos)

WITH A couple of skiis and two ski-sticks it is entirely feasible to make an efficient pair of antenna poles. These pretty wireless enthusiasts of Lake Placid proved that statement by actually building one.

Business In Northwest

St. Paul, Minn.

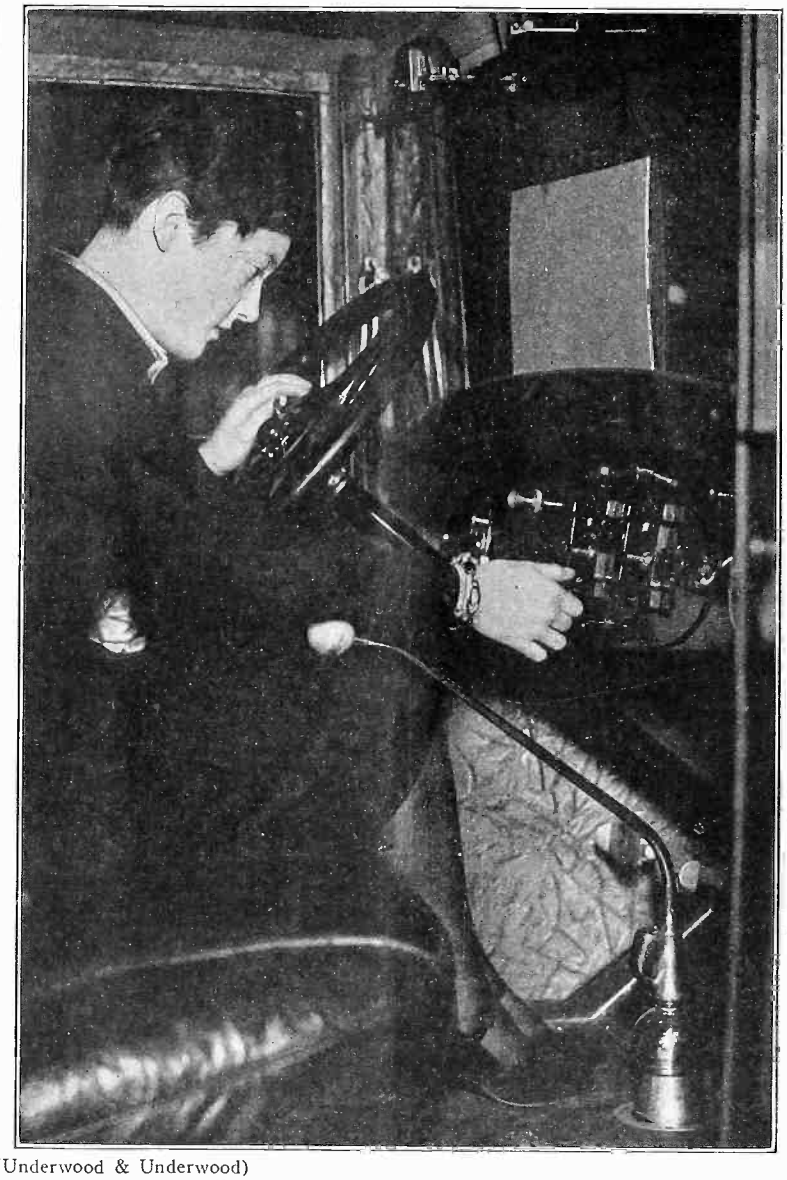
Northwest radio fans bought $30,000,000 worth of radios and accessories during 1926 according to a report made by the Northwest Radio Trade association. Sales of radio receiving sets equipment increased 40 per cent to make 1926 the largest radio year in the history of Minnesota.

Of the total amount sold, 27 Twin Cities jobbers sold 68,150 radio sets, of a value set at $7,620,000.

Nine manufacturers turned out 10,550 sets during the year, with a retail value of $1,100,000.

More than 22 per cent of the homes in St. Paul, Minneapolis, and Duluth now have radios, the report shows, and radio dealers have doubled in number in the Twin Cities alone, while jobbers increased from 50 to 67 during the year.

SET INSTALLED ON AUTO'S PANEL



(Underwood & Underwood)

KEEPING pace with radio's advance, designers are getting up circuits easily installed in given types of automobiles, and sturdy enough to withstand bumping. The dashboard installation pictured is one very easy to tune. A loop is wound under the car's top and is grounded through a condenser to the frame.

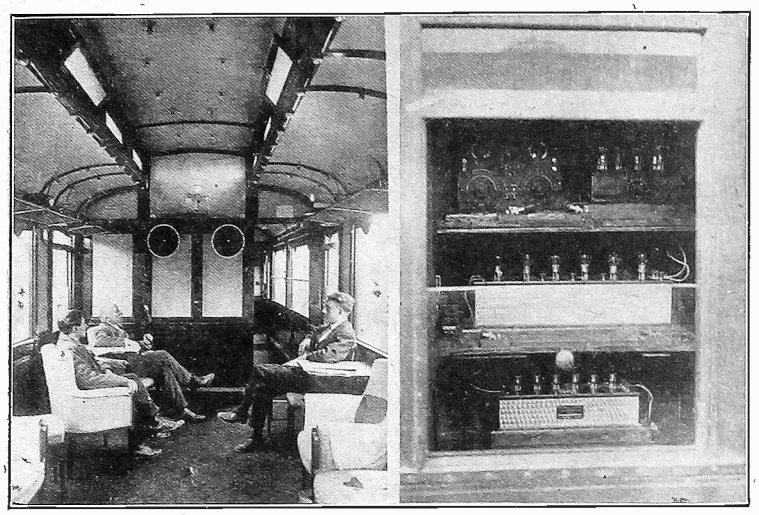
WATCH EXPIRATION OF YOUR SUBSCRIPTION!

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.)

THE TRANS-OCEAN 'PHONE

How the New York-London radio telephone system works was described and illustrated in the January 22 issue of RADIO WORLD. Send 15 cents for copy, RADIO WORLD, 145 West Forty-fifth Street, New York City.—Advt.

FRENCH TRAIN HAS SET ABOARD



(Underwood & Underwood)

AN INTERIOR view of the new luxurious smoking room on the Paris-Orleans train, in which passengers are listening in to a radio concert, while the French train speeds toward its destination. The receiver (top) contains the tuning and amplifier for short waves; (center) long wave amplifier; and (bottom) the audio frequency power amplifier.

All Stations Are Losing Money, Says Aylesworth

The National Broadcasting Company, announced that $3,800,000 will be spent during 1927 for providing entertainment to the public. It was also said that about $15,000,000 additional will be spent for talent by commercial firms sponsoring programs over this company's chain of stations. About $800,000 will be paid to the American Telephone and Telegraph Company by the N. B. C. for the use of the lines and special telephone engineers, who are placed at different points along a chain station broadcast. At present the N. B. C. employs 300 persons. The expenses for this force is expected to be in the neighborhood of $2,500,000. The N. B. C. has set aside $500,000 for individual talent, which will have nothing to do with commercial programs.

The N. B. C. will occupy part of the new building at Fifty-fifth Street and Fifth Avenue, New York City, by June. It will utilize four floors and eight studios. There will be an auditorium capable of seating a broadcasting orchestra of 150 musicians, and 300 guests.

Merlin H. Aylesworth, president of the N. B. C., stated that the policy of broadcasting advertising programs will continue, provided only a simple form of announcement of the firm sponsoring the program is given. No long-winded descriptive talks on commercial products will be permitted.

"The expenses for the year," said Mr. Aylesworth, "will be greatly in excess of the receipts.

"And, due to the fact that all broadcasting stations in the United States are operating at a loss, and because the public will not permit promiscuous plugging the trade' broadcasting, I expect to see many of the smaller stations among the 600 to 700 in the country gradually disappear as their owners' interests wane and the big deficits appear.

Kroblack Is Handled By Tilson & Tilson

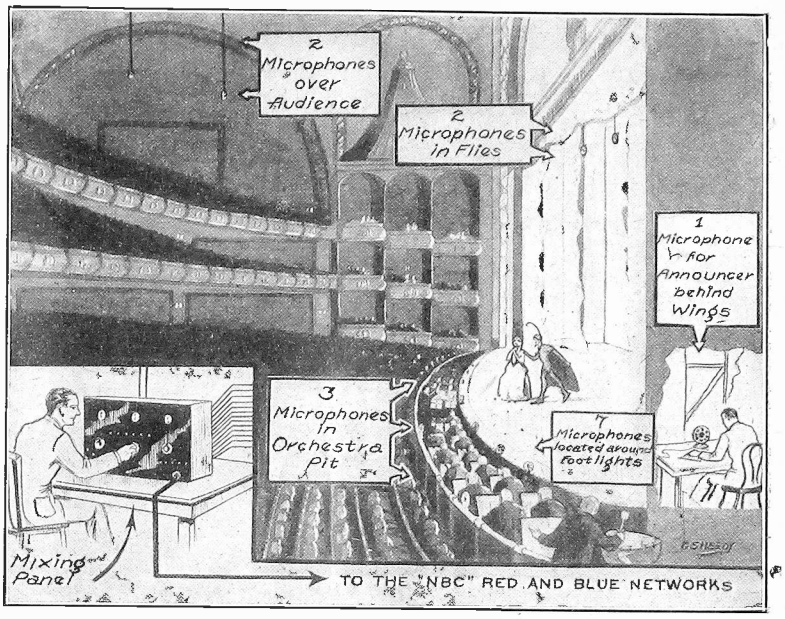
Tilson & Tilson, 154 Nassau Street, New York City, have been appointed exclusive sales distributors for the New Mountford Kroblack wire-wound resistances. These come in 10 and 20 watt capacities and test up to the most rigid specifications. They have been adopted by Thordarson and by many other leading B eliminator manufacturers. Interesting literature on these resistances will be sent upon application to Tilson & Tilson.

WRNY Staccatone Has Turned Cuckoo

The "Staccatone," the peculiar flute-like instrument which has been transmitting an identifying signal from WRNY, New York, during lulls in the programs of that station, has been modified so that it now produces a sound exactly like that made by a cuckoo bird. Radio listeners who pass the 374 meter setting in tuning their receivers can instantly recognize WRNY by the unmistakable chirping. The former signal broadcast by the Staccatone consisted of the first three bars of "The Stars and Stripes Forever." The constant repetition of these became tiresome, so the change to the more novel cuckoo tone was made.

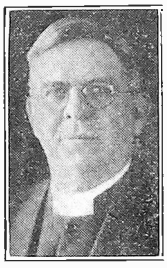
The Staccatone, which is the invention of Hugo Gernsback, is a combination of clockwork and a vacuum-tube oscillator generating audio frequencies.

RADIO AMERICA HEARS THE DEVIL



FIFTEEN microphones were installed in the Auditorium, Chicago, from where the Garden Scene from "Faust" by the Chicago Civic Opera Company was broadcast through the combined Red and Blue Networks of the National Broadcasting Co.

Cadman Brilliant, Wins Great Favor



REV. DR. S. PARKES CADMAN

One of the most popular broadcasters on the air is the Rev. S. Parkes Cadman, who speaks every Sunday from 4:00 to 5:00 p.m., before the Men's Conference of the Bedford Branch, Y. M. C. A., in Brooklyn, N. Y., which is broadcast by WEAF and the Red Network of the National Broadcasting Company, which involves tieup with stations receivable by about 75% of the people in this country. Rev. Cadman is known to millions of people in this country for his excellent method of discussing popular topics, and for his brilliant answering of questions.

THE RADIO UNIVERSITY

(*Continued from page* 15)

HOW SHOULD the three-tube set shown in the Radio University columns of the Oct. 30 issue of Radio World, be rewired, so that the second radio frequency tube is not reflexed?—Morris Merrill, Denver, Colo.

Connect the end of L2 (primary winding in plate circuit of first radio tube) to the top terminal of the single circuit jack. Connect the bottom terminal to the B plus sixty-seven and one-half volt post. In this way, the primary of AFT2 is disconnected. Disconnect the secondary winding of this transformer, also. Run the grid return of the second tube to the minus A post. The end of L4 (end of primary winding in plate circuit of second radio tube) is brought directly to the B plus sixty-seven and one-half volt post, also. The single circuit jack at this point is disconnected. You will note, that instead of taking the output out of the second radio tube, it is taken out of the first radio tube, since the reflex action takes place in this tube, only.

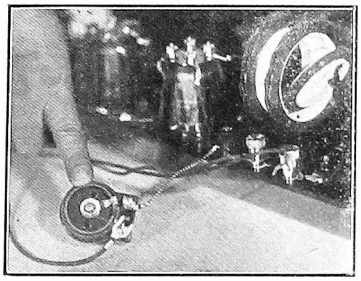
* * *

WHAT IS molybdenum? (2)—Please tell me what the following prefixes mean: deka, kilo, mega, bega, trega, deci, centi, milli, micro and bicro?—Thomas Julian, St. Louis, Mo.

(1)—A natural metallic element, belonging to the chromium group. It, however, is found only in molybdenite, sheelite, etc. When found in this form, it apears as foliated scales, very much like graphite, except for the color, which is a deeper blue. When used with such reducing agents as hydrogen or carbon, molybdenum can be obtained. It is a very difficult metal to reduce to flexibility. However when in this state, it is used as a supporter for tungsten filaments in lamps. (2)—Deka equals ten, kilo equals one thousand, mega equals one million, bega equals one billion, trega equals one trillion, deci equals one tenth, centi equals one hundredth, milli equals one thousandth, micro equals one millionth, and bicro equals one billionth.

HOW TO BUILD THE BERNARD, the beautiful 6-tube thumb-tuning set, fully described and illustrated in the Oct. 16 issue. Send 15c for a copy. Namepieces for affixing to front panel free to all on special request. Radio World, 145 W. 45th St., N. Y. City.

BETTER SENSITIVITY



(Hayden)

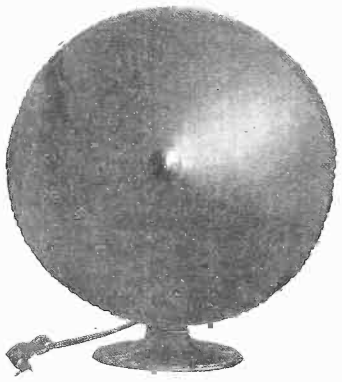
WHEN testing radio receiver it is often desirable to insert a high variable resistance in series with the plate lead, or with the plate battery, particularly B plus detector. Sometimes nice adjustment of The voltage greatly improves reception.

NEW BALKITE AGENCY

St. Louis—A Balklite service station has been opened by the Fansteel Manufacturing Co., at 1415 Pine street, with A. F. Reutlinger as manager. Service will be available at this factory branch on all Balkite radio apparatus.

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.

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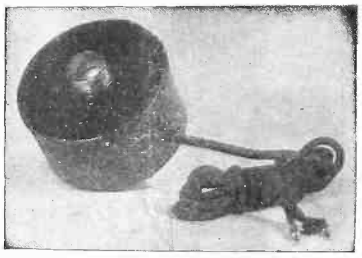
Satisfaction Guaranteed or Money Back

Tested and approved by Radio World Laboratories

B. S. T. UNIT

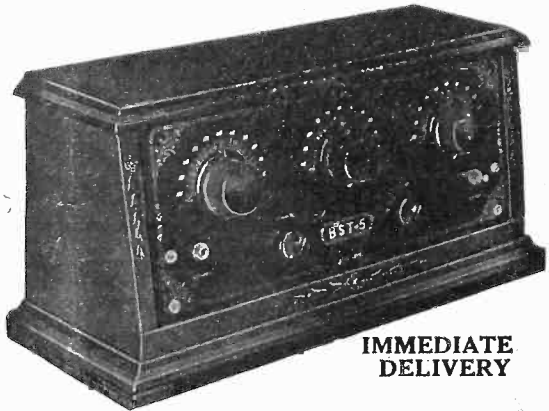
This Separate Unit is Adaptable for any Horn, Cabinet or Console



$5.00

Mail Cash, Cheque or P. O. Money Order

B S T 5 $40.00



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

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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,
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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.

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