FEB. 19 1927

RADIO WORLD

Reg. U. S. Pat Off.

America's First and Only National Radio Weekly

Vol. 10 No. 22 256 *15 Cents* *Illustrated*

BIG SIX RECEIVER

B Eliminator Problems And Their Solution

27,000,000 LISTENERS!

Lower Ratio, Yet Higher Volume Results!

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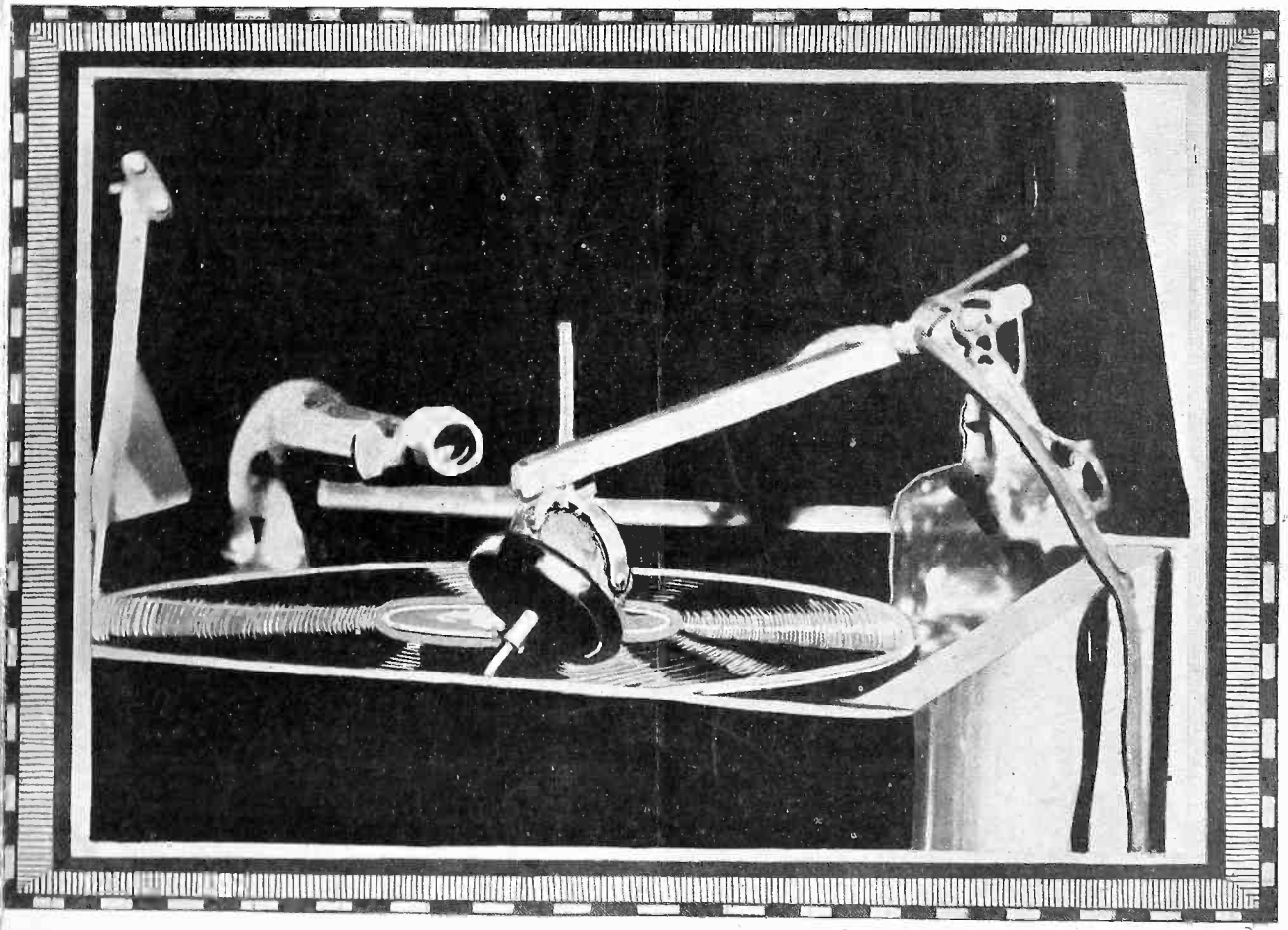

(Hayden)

A DEVICE enabling one to play phonograph records on a regular phonograph, but to amplify and reproduce them electrically, using the audio channel of a radio set, can be made at home, as shown above. See article on page 6.

BST 5

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

B. S. T. Has the "Punch"

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

277 Delaware St., New Brunswick, N. J.

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

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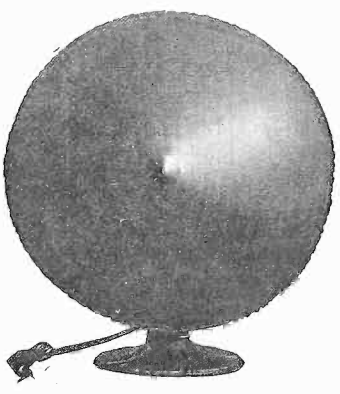

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Vol. X
No. 22
Whole No. 256
FEBRUARY 19, 1927
15c Per Copy. $6.00 Per Year

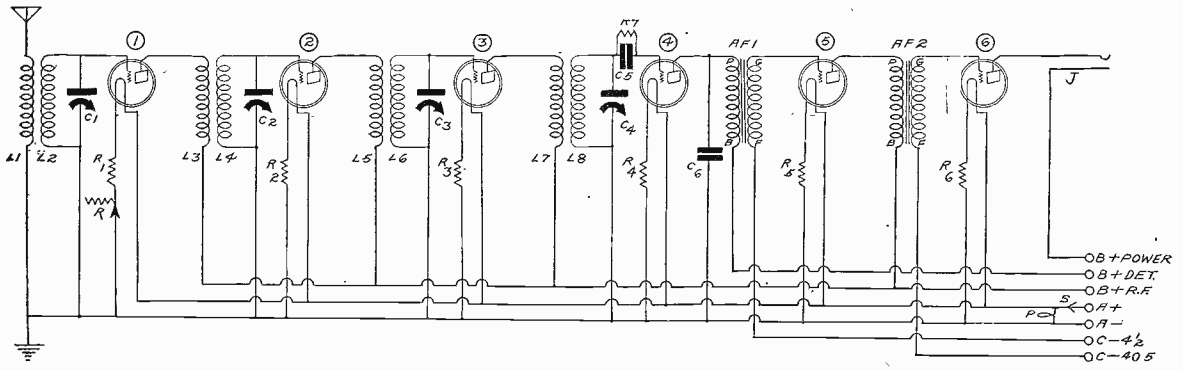
RADIO WORLD

A Weekly Paper Published by Hennessy Radio Publications Corporations from Publication Office, 145 W. 45th Street, New York, N. Y.
Phones BRYant 0558 and 0559

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

The Big Six Receiver
Has 4 Tuning Controls, Easily Manipulated

Big Gain In Sensitivity and In Selectivity Results from the Addition of the Third Stage of Tuned RF



THE BIG SIX, a receiver of great volume, exceptional ease of operation, high selectivity, fine tone quality and unusual distance getting ability.

By Wentworth Wood

THAT a high degree of selectivity is required at this time for cutting out interference is admitted. There are several ways in which to attain adequate selectivity. One is by means of regeneration and another is by means of several tuned circuits in cascade. Each of these two methods has its advantages and its disadvantages. The advantage of the regenerative type of circuit is that a high sensitivity may be obtained with the use of fewer tubes, but the disadvantage is that the set is likely to cause much interference with other receivers in the vicinity and be a little difficult to tune accurately. It also cuts off the sidebands to a greater degree than a non-regenerative circuit and therefore the quality as obtained with the regenerative circuit will not be quite so good as that obtained with a non-regenerative receiver.

When a non-regenerative circuit is employed for getting sensitivity and selectivity several stages of RF amplification are necessary. The disadvantage of this arrangement has been the difficulty of tuning many circuits at the same time. Two circuits are not difficult to handle, but three are very troublesome, and four still more of a puzzle. All the tuned circuits must be in resonance with the desired signal before it can be heard at all.

Difficulty Solved

If each of the tuned circuits is very selective it is practically impossible to strike the right combination of dial settings to bring in a desired station with full volume. However, the difficulty of tuning several circuits at the same time no longer exists, as far as the practical operation of the set is concerned. As high as four sharply tuned circuits can now be handled as easily as one, because four-section gang condensers will afford control from a single dial, or a localized assembly may be employed, as in the present instance. The ease with which station after station may be brought in with great volume and without interference is a revelation to those who have operated multi-control receivers where the dials are generously separated.

There are many problems that must be solved before a circuit of the gang condenser type can be operated successfully. In the first place each section of the multi-section condenser must be like all the other sections. There must be no material differences in the capacities and in the variations of the capacities of the different sections. That is, the condensers must not only be the same at one setting but at all possible settings. That is esentially a problem of manufacture and not of receiver assembly.

Simplicity and Success

What applies to such condensers also applies to a certain extent to the coils that are connected across them. That is, they must have the same inductance value and they also must have the same distributed capacity. The indentity of the inductance values is a problem for the manufacturer of the coils but the equality of the distributed capacity to a large extent falls on the builder of the circuit. Much of the distributed capacity of a coil enters because the coil is placed near other conductors, such as tuning condensers, shielding, leads, etc. This capacity is unavoidable but the coils may be placed in such a manner with respect to their surroundings that this capacity is the same for each coil. Or if there is a slight inequality this may be adjusted very easily by vernier condensers, either improvised or purchased for the purpose. Some makes of gang condensers have vernier attachments for taking care of any slight differences which may arise from the coils or the condensers themselves, or from the placement of the parts.

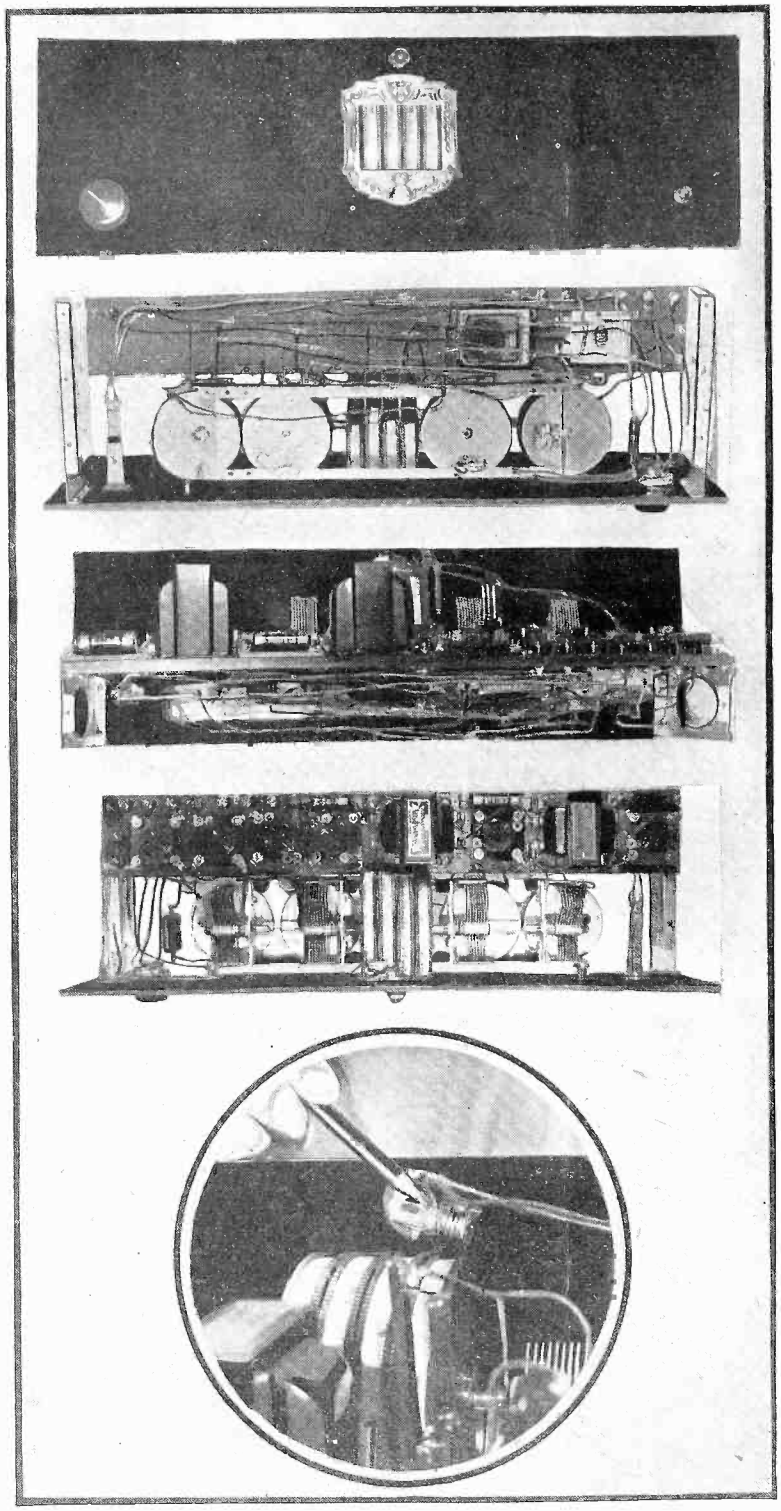
Greater simplicity, consistent with success, attends the localized control, because each circuit is individually tuned.

One essential in the construction of a receiver of this type is the elimination of stray coupling between stages. Both magnetic and electric coupling must be eliminated. There are several ways of doing this, too. The magnetic coupling may be eliminated by adjusting the coils to the proper angle, and by keeping them far apart.

The correct angle for any type of coil can only be found by experiment, but for solenoidal coils of the usual size and shape the angle is 54°, that is, the axis of the coil is to make 54° with the line passing

LIST OF PARTS

One Na-ald localized tuning control (four section) (C1, C2, C3 and C4).
Two Thordarson R-200 audio transformers, (AF1 and AF2).
Six Amperites, R1, 2, 3, 4, 5, No. 1-A, and No. 112, R6.
One Carter 20-ohm rheostat (R).
Six Benjamin sockets (1, 2, 3, 4, 5, 6).
Nine Eby binding posts.
One Carter single circuit jack, (J).
One Bruno light switch (PS).
One Sangamo fixed condenser, .001 mfd. (C6).
One Sangamo grid condenser, .00025 mfd. with clips (C5).
One Tobe Tipon grid leak, 2 megohms (R7)
Four Sickles No. 30 transformers, L1L2, L3L4, L5L6, L7L8.
One 7x24 inch panel.
One pair of American Hardware brackets.
One baseboard or sub-panel, either hard rubber or bakelite, 7x23 inches. Acme Celatsite.



(Hayden)

IN THE top photo we have the front panel view of the set. Note the position of the pilot light, above the controls. Second photo from top shows the bottom layout. In the center photo we have the back view. How the parts are layed out on the top of the subpanel, is shown in the second from bottom photo. The bottom photo shows how the pilot light is turned a bit to the side, so that it should not hit the top of the cabinet, when the set is inserted.

through the centers of all the coils. Making the angle smaller tends to introduce magnetic damping and too much of this should be avoided as much as over regeneration, which will occur if the angle is much greater than 54°. This is based on the assumption that the windings are connected in the usual way, that is, so that the grid and plate terminals are at extreme ends and the battery terminals in the middle, both windings being in the same direction.

The magnetic coupling may also be reduced greatly by employing coils which have small external fields, such as astatic and toroidal windings. The astatic, or figure eight type, is the easier to make and is a good coil. The astatic type of coil does not have zero external field except in one plane, but the outside field is always weak in comparison with the solenoid. The astatic coils may also be placed at an angle to minimize magnetic couplings. Shielding helps greatly in reducing coupling, but be sure to ground the shields.

The electric coupling can only be eliminated by placing the stages far apart. The term "stages" is here used because electric coupling may take places between any two parts belonging to different stages in the amplifier. Thus there may be coupling between two sockets, or two tubes, or two coils, or two condensers, or leads, or between the coil of one stage and the condenser of another. Generally there may be coupling between any two conductors belonging to different stages.

One type of coupling which cannot be eliminated by placement is the electric coupling through the capacity of the tubes. This can only be eliminated by balancing, usually called neutralizing.

Coils for the Set

One type of suitable coil for this set is the diamond-weave. This is as effective as the solenoidal coil and it takes much less space and it is therefore much easier to dispose of in the set without getting the various fields entangled. The angular placement should be about the same as for the solenoids. For home constructors the spider web variety is attractive because easy to make. A special former is necessary for winding. This should consist of a central core one inch in diameter provided with 15 or 17 spokes about 1½ inches long and equally spaced about the circumference. The secondary winding for a .00035 mfd. condenser should consist of 60 feet of No. 24 double cotton covered wire. The primary should consist of about 15 turns of the same kind of wire and wound over the secondary. If the two windings are in the same direction, the inside terminal should go to the grid and the outside to the plate. The middle two terminals should go to the filament and the B battery. Care must be taken that there is no short between the filament and the plate terminals, that is, a spacer should be put between the two windings to keep them apart.

The control of the filament current is automatic in all but the first tube, that is, Amperites are employed for dropping the voltage from 6 volts to 5 volts. In the first tube there is also an Amperite, R1, in series with a rheostat R. The Amperite is used here so that the maximum current that can flow in the first filament is the normal value of .25 ampere. The rheostat is connected in series with it for a volume control. Twenty ohms will give adequate volume control, as with this the filament current can be cut down to about one eighth of an ampere, which is low enough to make the tube inoperative as far as amplification is concerned.

Detector Tube

All the Amperites with the exception of the last are No. 1A. The last is a No. 112, which is suitable for either a CX-112 or a CX-371 power tube. It is suggested that the 371 tube be used, as the power handled is very considerable.

The detector tube used in this receiver is the new CX-300-A. This tube requires a negative filament return of the grid for best operation (zero grid bias). Hence the grid return lead is connected directly to the negative A supply line. The tube also requires a grid condenser of .00025 mfd. with a 2 megohm grid leak across it. To obtain best detection and at the same time to keep the radio frequency voltages out of the audio amplifier a by-pass condenser C6 is connected between the plate of the detector and the negative side of the A battery. This condenser should be between .0005 and .001 mfd.

Where an output of great volume is desired with a minimum of audio frequency tubes, nothing excels transformer coupling. Where quality is desired in addition, good transformers must be used.

More Volume from Lower Ratio In Audio Transformer a Frequent Condition

Impedance of the Winding In the Plate Circuit, Which Increases With Frequency, Is Important In Determining Voltage

By K. B. Humphrey

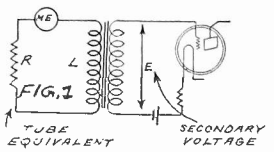


FIG. 1

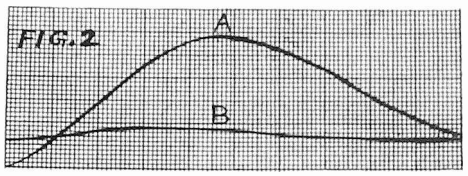


FIG. 2

THE choice of an audio transformer for an amplifier should not be made solely on the basis of its ratio. Ratio is not a true indication of the amount of amplification per stage.

When we consider how much voltage we can obtain across the secondary with a given input the problem is taken into consideration. Not only must the transformer itself be considered also the tubes with which it is necessary for it to work.

Before going into details of the ratio problem it is necessary to understand somewhat the action that takes place when the primary of the transformer is hooked up in series with the plate circuit of the tube. In Fig. 1 L represents the value of the impedance of the transformer and R represents the resistance of the plate circuit of the vacuum tube. The impedance, for any given frequency of the current flowing, is constant in the transformer, while the impedance of the tube must necessarily vary in accordance with the input. We then have a varying resistance (plate of tube) in series with a fixed impedance (of transformer primacy at a given frequency).

Importance of Right Impedance

The amount of voltage produced in the secondary is in proportion to the turns ratio, but the amount of voltage on the input will vary according to R and L. It is quite possible to have these values such that the voltage would be many times less in one transformer than in another.

Suppose a tube had an impedance of 14,000 ohms and the transformer had an impedance of 28,000 ohms. This is actually a very low value for any transformer. The frequency is supposed to be fairly low as at this point we usually concentrate when considering the design. Now, the voltage across any impedance is equal to the product of the resistance and the current flowing. As the amount of current in the circuit is the same, both being in series, we may consider the voltage as being that of a direct ratio between the two impedances or ⅓ across the tube and ⅔ across the primary of the transformer.

The impedance of the transformer varies with the frequency and becomes greater as the frequency is increased. This tends to increase the voltage across the secondary with an increase in frequency and will give a curve somewhat on the order shown in Fig. 2A. The drooping off at the high frequencies might be caused by a poor method of winding, where too much capacity in the secondary bypassed higher frequencies.

Voltage Ranges

What we are particularly interested in, however, is the first part of the curve. The minimum voltage which could be obtained would be ⅓ less than the maximum possible voltage. That is, the peak of the curve with no losses, could be made to come up 33⅓ per cent. more than the maximum. This value is not reached in practice unless some resonance effect takes place which will reduce the resistance at one particular frequency and cause a hump in the curve. If the impedance of the transformer is increased to say 5 times that of the tube the condition arises that the minimum can be only 1/6 less than the voltage at the peak. In other words the higher the transformer impedance the flatter the curve obtained. There are certain limits, however, in regards to voltage and design which make it impractical to increase the value indefinitely. There are plenty of transformers on the market in which the impedance is high enough, from 70,000 to 150,000 ohms, and give very good curves.

The Bypass Effect

It has been shown that the voltage across the primary has a decided effect on the output voltage and that the input voltage depends to a great extent upon the impedance in the primary of the transformer in relation to the tube impedance. That is, with a tube of low impedance we could expect a greater gain than with a tube of high impedance.

There is another factor which governs the amount of impedance in the transformer. It is impractical to make a secondary coil of too many turns because of the bypass effect, causing the curve to droop off as shown in Fig. 2A. The number of turns in the secondary is limited. The common way of getting a high ratio transformer is not to increase the secondary turns but to reduce the primary turns. It can usually be taken that the higher ratio transformers have less impedance in the primary circuit than the low ratio transformers.

This explains the phenomenon that sometimes a low ratio transformer will give louder and better results than a high ratio in the same amplifier. This is due to the extra impedance. It is obviously impossible to judge the amount of impedance in a transformer by looking at it, except that usually (not always) the larger transformers have the larger number of turns.

Core Is Important

The material with which the core is constructed also has a bearing and it is entirely possible to use inferior iron and construct a transformer which may have all the appearances of the better class type without in the least having good characteristics.

It is better to choose a transformer by reputation rather than by guess alone and at the same time to see to it that the bulk is there. In the second place it is sometimes better to get one transformer of low ratio and one of high ratio. In former years it was considered best policy to place a high ratio in the first stage feeding from the detector tube and a low ratio in the second stage. But the detector is of higher impedance than is the tube acting as a straight amplifier, even though they are the same kind of tube. It is then politic to place the transformer with the higher impedance next to the detector, i. e., in the first stage. A low ratio transformer is more likely to have the higher impedance therefore it is very likely to give the better amplification, and at the same time less distortion in this stage.

Expensive Flattening

Fig. 2 shows a curve marked B which may be taken as the curve of one of the better high impedance transformers or it may be taken as that of a poor transformer with very little plate impedance in series with it. It is obviously impossible to get a tube with very much less impedance and consequently it is better to insist on a high impedance in the primary.

Resistances and condensers across the secondary tend to flatten out the characteristic curve, at the expense of amplification. This makeshift usually is not advisable with the better class transformers.

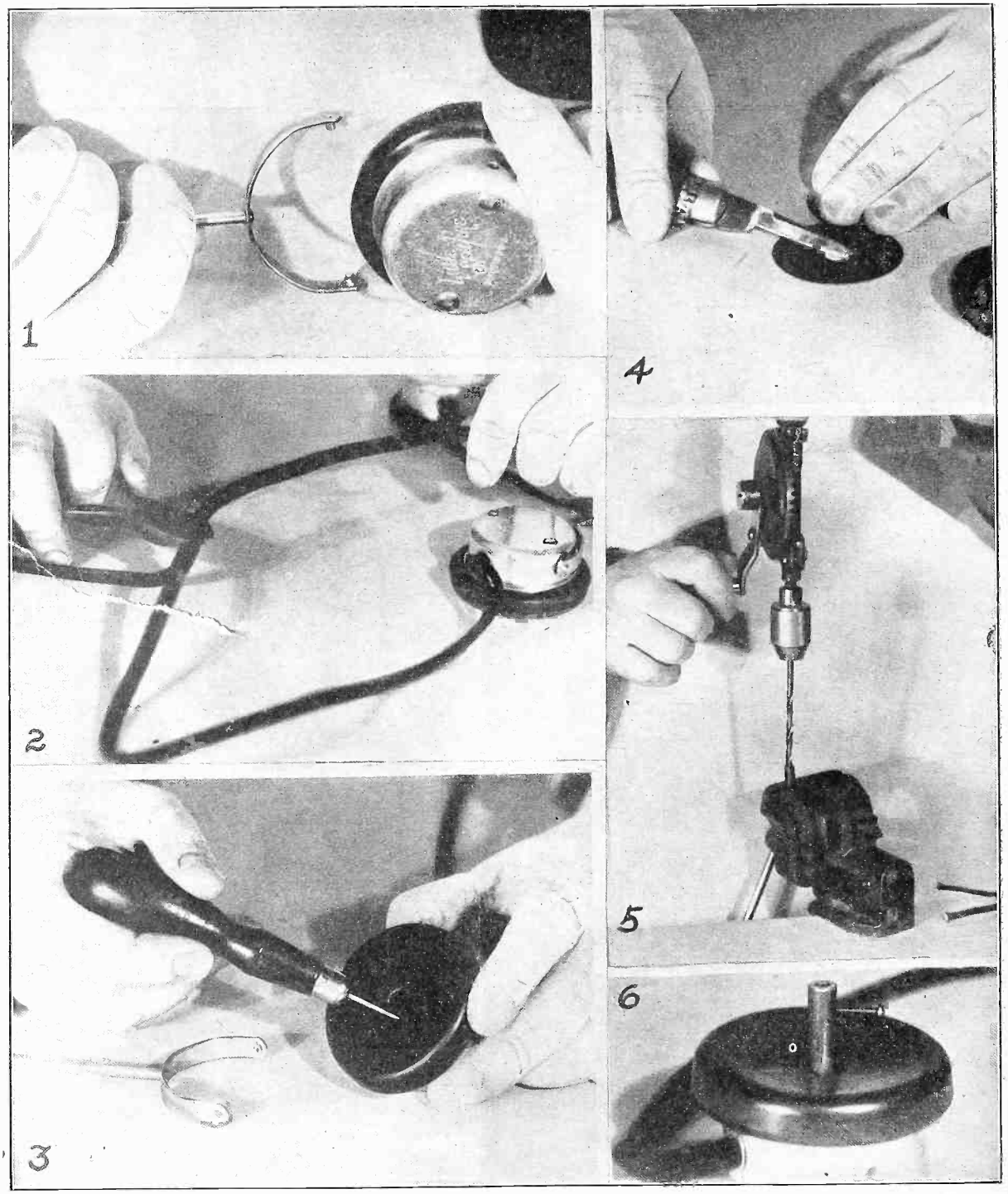
A condenser placed across the secondary has the effect of making the curve of the drooping sort and cutting off the higher frequencies. The consequence is that many of the overtones are lost. A condenser across the primary has much the same effect but not of the same order. A bypass of about .001 mfd. may be safely used across the primary of the detector stage without decreasing the voltage to an objectionable degree. This condenser is sometimes advisable at this point to curtail the tendency of radio frequency currents to get into the audio side of the receiver.

Circus Parades Off; "Mike" Replaces Them

Chicago.

The Hagenbeck-Wallace Circus, during its four next season, will carry a portable radio set, to broadcast the roars of the animals, songs by vocal artists and the band, etc., to take the place of the usual parade, which has been abandoned, due to the difficulties presented by traffic.

A Phonograph Pickup
That Feeds Your Radio Set and Speaker



By Herbert E. Hayden

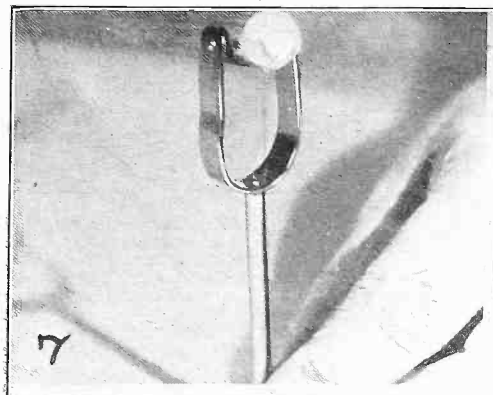
Photographs by the Author.

YOU can turn the crank of your phonograph a few times, place your favorite record on the turntable, start it going, and lean back in your easy chair for four minutes of uninterrupted reception from your loudspeaker! Four minutes of Caruso, Martinelli, Bori, Chaliapin, De Gorgorza, Gigli, Kreisler. And the sound is amplified in the audio channel of your broadcast receiver and comes out of your loudspeaker! Yes, sir!

Those who have a first-class radio set with cone speaker and all the perquisities for good quality may not care to add a phonograph to their furniture. It may be of interest that they do not need to have anything better than a turntable which will turn the record around at the proper speed, and a simple pick-up which will transfer the vibrations on the record to the audio amplifier of the receiving set. The loudspeaker will then sing out or play up as well as the best phonograph reproducer. The details of the simple arrangement has been told in pictures for those who care to try their skill.

Fig. 1—The basic part of the pick-up is a small telephone receiver taken from an ordinary headset. It should be small and light.

Fig. 2—Cut the connecting lead to one of the earpieces of the headset near the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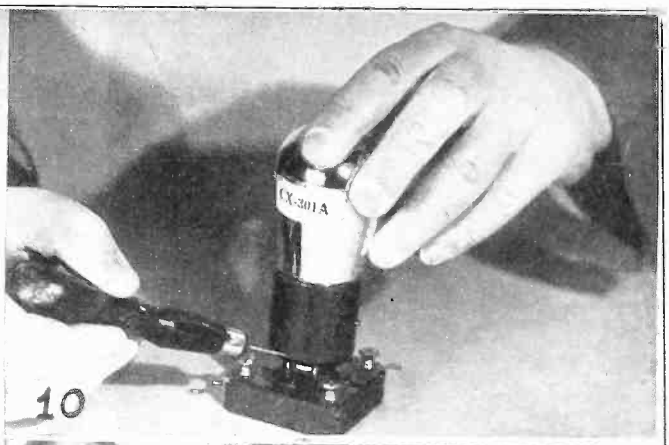

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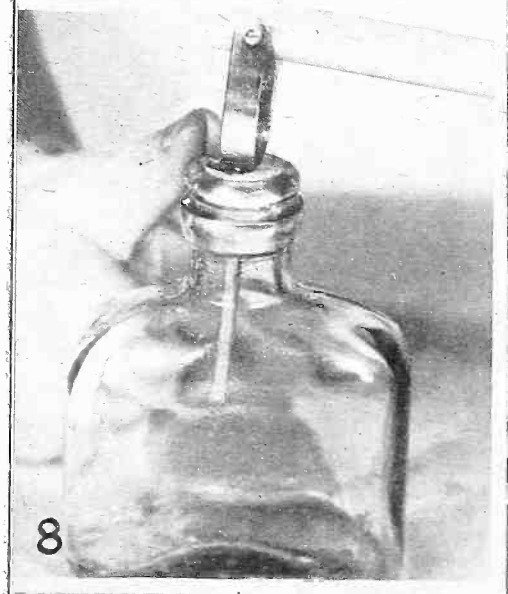
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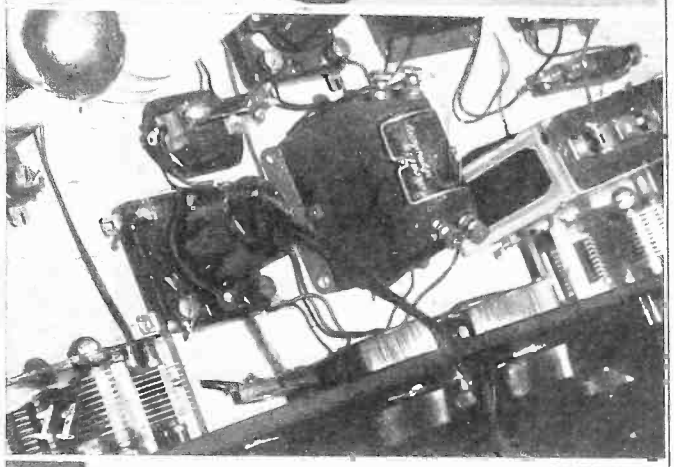
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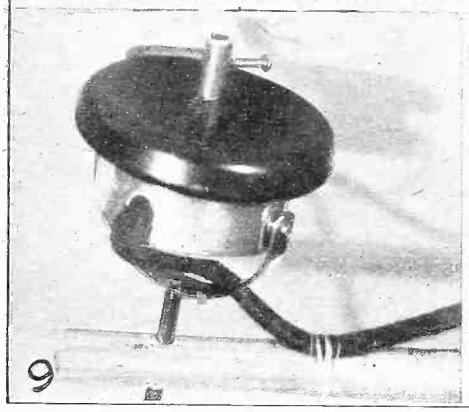
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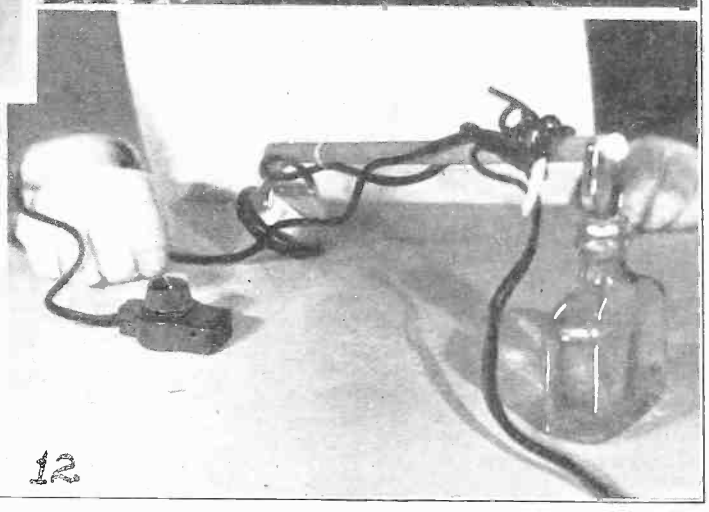
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form of the cord. Expose the terminals and use for connection to the set, as will be shown later.

Fig. 3—With a sharp pointed tool describe a circle on the diaphragm before removing it from the case. This circle is for reference only.

Fig. 4—Remove the diaphragm from the case and with a sharp pocket knife scrape the enamel from the surface inside the circle described previously. Clean surface thoroughly.

Fig. 5—Now take a brass rod of a quarter or 3-16-inch diameter and cut off a length of 1 inch or 1¼ inches. Place it in a vise and drill a small hole in one end of it. The size of the hole is not important but may well be 1-16 inch. The depth of the hole should be about half an inch. This hole is to take a regular phonograph needle. When this hole has been made in the end of the rod, drill another hole in the side of the rod. This hole should just run into the other and is to be used for a set screw. The side hole should be drilled and tapped for 2-56 machine screw.

Fig. 6—The next step is to mount the round rod on the diaphragm. The undrilled end of the rod should be squared off and thoroughly cleaned. It may then be fastened to the diaphragm by soldering to the circle which had been cleaned for the purpose. The phone units may then be assembled. This figure shows how it looks after this step has been completed.

Fig. 7—Now take a dowel of from ⅜ to ½ inch in diameter and about a foot in length and drill two holes diametrically near the ends. These holes should be at right angles to each other and they should be if such size as to just take the "handle" of the fork from the headset. Shape one of these forks as shown in this photo and attach it to the dowel as shown. A long machine screw may be used for the purpose, and two nuts should be used to secure it and to prevent it from working loose. A lock washer will also be of help.

Fig. 8—An anchor and swivel are necessary for the device. For anchor a large ink well or a small bottle may be used as shown in this photo. The handle of the fork is driven through the center of the cork in this manner. The bottle is placed

Concluded on page 25)

B Eliminator Problems

How to Get Voltages and Cure Motor-Boating

By William P. Lear

Radio Engineer, Universal Battery Co.

B ELIMINATORS differ in method of rectification used and filteration scheme employed as well as the general construction and means for controlling or regulating the voltage.

The majority of B eliminators use the Raytheon or gas filled tube as a rectifier of the high voltage alternating current to a pulsating direct current. This method was used by radio amateurs quite a while prior to its adoption for use in B eliminators.

Then there is also the chemical rectifier used by some manufacturers to convert the alternating current to DC, as well as the filament type of electron rectifier and the oxidized disc principle of rectification. Each one of these methods has certain drawbacks and certain advantages.

The chemical rectifier has as its chief drawback the fact that liquids must be used and are subject to evaporation and must be replaced at intervals, requiring some attention, besides being more or less messy.

The electron or filament type tube rectifier has the disadvantage of being rather short lived and expensive from the new point of upkeep.

Two Popular Tubes

The Raytheon type tube or gas filled rectifier, such as are manufactured by the Raytheon Mfg. Co. and Q. R. S. Music company, dominate the market, so far as rectifiers are concerned, for use in B eliminators. There is a very good reason for this condition, even after considering their defects, which are really small compared with their advantages over the other systems of rectification available.

Rectification means the changing of the alternating current (which supplies your home with energy) to a form of direct current known to those in the electrical industry as pulsating direct current. It is vitally important that a B eliminator employ a system of rectification that will give the least trouble and cost and least to operate. The gas filled rectifier tube meets this need, especially so, now that the gas filled type tube is available in a larger size or capacity. Heretofore it has been practical, but not satisfactory because of the high internal impedance, or its inability to handle large amounts of current for any length of time, but this condition has been remedied by the manufacturers of these tubes so that very large amounts of current can be rectified by these tubes without an appreciable loss, making it possible to design a circuit for a B eliminator which will give results equal to that of a fully charged B battery.

There are more than one method of filtering this pulsating direct current, or smoothing this current to a point where it about equals in quality that of a battery, and because of the fact that it is easy to accomplish this result a number of manufacturers have negelected to ascertain the actual output characteristics of the current their B eliminator is delivering at varying loads.

The Filter Circuit

A conventional filter circuit consists of two choke coils which are simply two cores of iron on which a large number of turns of wire have been wound. The iron used, the size of the wire, the number of turns, together with the resistance, are important factors as to the ability of this part of the filter circuit to change the pulsating current to direct current and also to supply a sufficient quantity of same.

It is possible to use a choke wound with very small wire and a large number of turns upon a small size core, which will have the necessary inductance properly to smooth out the pulsations but will not possess the ability to pass sufficent current to properly operate a radio set using a very large number of tubes. Even though it will operate a set using five or six tubes, trouble will be experienced, due to the fact that the resistance of these choke coils will not allow for instantaneous overload of the circuit. This condition exists when a very loud note is received by the radio set, which consumes 200 to 300 per cent more energy at that particular time than is ordinarily used by that radio set.

Unless these choke coils are wound with heavy enough wire, it will be impossible for them to take care of this situation and will materially decrease the smoothness of operation and tone quality of that set in particular, but a choke coil only tends to prevent the passing of any alternating current or its component through these chokes and would be useless were it not for the condenser which is shunted around each of these choke coils. These condensers act as a storage tank or storage battery to absorb the extra power or voltage which is not being used during the period the radio set is idling or not working. Then, when a loud note, or extra strain is put upon the B eliminator by the radio set, the condensers discharge for a brief period of time (not to exceed two seconds), providing the extra energy which is necessary, after which time the B eliminator has a chance to catch up and again charge the condensers for the next overload.

Vital as "Smoothers"

This is a very necessary purpose of the condensers but their effect on smoothing the current is greater and more necessary than their effect upon holding the voltage steady.

The voltage possible could vary a large amount and the B eliminator would still be satisfactory to use on some sets and for some people, but should there be a hum present or AC component (as B eliminator manufacturers call it), the B eliminator under such circumstances would be impractical and unusable. Therefore, a certain percentage of the eliminators on the market are designed solely to produce a pure direct current without any thought to the load which may be applied on them, instantly or for any length of time. This type of B eliminator is rapidly becoming recognized by its inability to produce faithful and undistorted tone quality on sets which operate on B batteries quite satisfactorily.

The filter circuit and rectifier circuit are very important parts of the eliminator, but the method of controlling the voltage seems to be giving the B eliminator manufacturer the greatest worry. It is found that continuously variable resistances are not always satisfactory, because any voltage from absolutely zero to the maximum can be obtained and there is no method of indicating exactly or approximately the voltage being obtained, and also due to mechanical and electrical problem. This trouble reacts upon the manufacturer and his cost of manufacturing the B eliminator using this item. It would be impossible to arrive at a fixed resistor which would give a definitely fixed predetermined voltage available from any particular binding post or tap, owing to the fact that for increased loads consumed, less voltage is available through a resistance unit, eliminating the possibility of using fixed resistances in series.

The Unit Strip

The only other way in which a resistance unit, not of the continually variable type, can be employed is to shunt the entire resistance strip across the output of the B eliminator and then take taps off this resistance at various points, in order to obtain various voltages. This system has not been practical, to date, but from now on, should be in vogue as it pretty nearly solves the resistance problem for the manufacturers of B eliminators.

It operates on the "drop-in-voltage" principal and uses a wire wound resistor unit which does not change its resistance with the weather or other local and physical conditions, besides having the advantage of giving approximately the desired voltage on various loads with provisions for readily adjusting or compensating for any slight difference in voltage that may be wanted.

The reason that this method has not been used is probably due to the fact that rectifier tubes available would not handle enough current to allow a certain portion of it to be dissipated through this shunt resistance but now, with the 85 milliampere rectifier tube, such as the BH Raytheon and the 85 milli Q. R. S. tube, this problem has been solved and no difficulty should be encountered in using this method of regulation.

The shunt resistance unit consumes from 20 to 50 milliamperes which, to the casual observer, would seem a gross waste of energy, but the actual figures of efficiency and cost show that there is a negligible difference as far as the cost of operation is concerned, whereas there is a considerable increase in tone quality and ease of voltage regulation which more than make up for the very slight difference in efficiency.

Voltage Known In Advance

It is possible with this method, to tell the user approximately where he might obtain voltages, and after these voltages have been obtained, there is no reason why they should ever be changed unless the eliminator is connected to an entirely different set.

All types of B eliminators will not work on all types of radio sets and it will be found few B eliminators will work well right away, on a resistance coupled type of radio set without changing the hook-up on either the radio set or eliminator.

It seems that so much common inductance in the B eliminator causes "motor-boating" to occur which means a sputtering or putting, resembling in sound the noise made by a motorboat. This can be remedied in a B eliminator employing the series type of resistance by connecting a 10,000 ohm resistance unit between the B— and B amplifier and between the B— and B intermediate — that is, using two 10,000 ohms resistance units, each shunted by a 10 to 14 mfd. capacity condenser.

Cure For Motorboating

This will, in the majority of cases, clear up any "motor-boating" which may have been present and will materially increase the tone of the set, especially when handling large volume. Regardless of whether a radio set is resistance coupled or not, the 20 mfd. condenser across the respective negative and positive B battery terminals will materially increase the efficiency and tone of any set. The condenser acts as a reserve storage battery to absorb the excess voltage when not needed and to supply the excess current when the load is very suddenly applied by the radio set which, in turn, is caused by an instantaneous increase of volume or a sustained loud orchestration.

If condensers are used in this manner when the B eliminator is of the series resistance type, care should be taken to have the radio set turned on with the tubes lit, before turning on the B eliminator, so as to prevent the high voltage of the B eliminator from burning out or breaking down the condensers. These condensers do not, of necessity, have to be more than 160 working volt rating.

There is a new condenser being marketed which is of the electrolytic type and has sufficient capacity to handle the situation previously described.

U. S. Programs Flood Arctic

Stations Completing Special Broadcasts

Chicago.

WINGING their way on superpower waves a hundred messages went to inhabitants of remote posts and settlements of the Arctic circle—broadcast from KYW. It was KYW's fourth and last special Far North program of the Winter.

The messages were addressed to members of the Royal Canadian Mounted Police, in far-flung posts of the Northwest Territories; to representatives of the Hudson's Bay Company and Revillon Freres, great trading companies; to sturdy trappers and traders who spend the dark months of Arctic winter preparing the scant northern products for civilization; to loyal, humane missionaries who spend the long, drear spell amid ice and darkness ministering to human needs.

Spans Arctic Circle

Geographically, the Westinghouse Far North broadcasts—inaugurated in 1923 by KDKA, Pittsburgh—span the whole Arctic circle in the Western Hemisphere. Greenland and Iceland to the northwest Bache Peninsula on Ellesmere Island, the farthest north inhabited post, where Sergeant Arthur Joy, two R. C. M. P. constables and a tribe of Eskimos dwell in solitude; Pangnirtung on the south and Pond's Inlet on the north end of Baffin Island, where Hudson Bay empties into icy seas—police posts at extremities of the island; to the steamer Bay Maude, of the Hudson's Bay Company, frozen in the ice of Bernard Harbor, 12 degrees from the North Pole; Aklavik, in the delta of the Mackenzie river, within a short distance of the line dividing the Yukon territory between Canada and the United States; to Point Barrow, Alaska's farthest flung post—to these scattered settlements and many more, are the messages addressed by friends, relatives and business associates.

First Frozen Ship to Radio

The Bay Maude, caught in the first freeze of quick-falling Winter, was frozen in Bernard Harbor, Coronation Gulf, last November. It is equipped with radio receiving and sending apparatus; early in January the operator sent word by way of Aklavik that all the Far North transmissions of the Westinghouse stations had been received on board ship. Aklavik has been receiving the special programs practically since their inception, having previously confirmed the reception. The Bay Maude is thought to be the first ship ever frozen in Arctic waters which was equipped with radio to maintain vital contacts with home and country.

Mushing across Yukon barrens are two young Danish scientists, Guten and Engi Porsild, sons of Dr. Morten Porsild, Danish government scientist stationed on the Island of Disko, Greenland. Through the Westinghouse Far North broadcasts word of the boys twice has been sent to the father this Winter. They bear commissions from the Dominion government to investigate botanical growths in the Mackenzie delta, with a view to stocking reindeer there.

Long and Short Waves

They departed from Nome, Alaska, shortly before January, after the first snow had packed the trails. They expect to arrive in Aklavik about the first of March. Again, on their arrival in Aklivik, they will communicate with Westinghouse stations in the United States—through the medium of the Canadian Westinghouse Company, Ltd.—and word will be flashed to the father in Disko.

In communicating with Greenland KDKA uses long and short wave transmissions simultaneously. On the commercial broadcast length of 309 meters, KDKA has reached practically every radio-equipped settlement in the North, but with its powerful 63-metre experimental set, it has broken through the atmospherics of Spring and Summer. Thus, while the long waves reach far and wide during the Winter spell—when darkness hangs over the Arctic like a heavy pall, the high-frequency short waves penetrate the static of Summer, insuring year-round communication with the Far North.

At Godhaven, Greenland—on the Island of Disko—is radio station OGG, manned by Hugo Holten-Moeller. This station has received all of the Far North programs of the Winter from KDKA, although it has been impossible so far to check its reception of the other Westinghouse stations. On a special broadcast to Iseland, on last Christmas night, Station OGG was requested to rebroadcast the messages to Iceland. Confirmation was received of the reception in Greenland and of the rebroadcast, but it was not determined definitely if Revkjavik, capital of Iceland, had received the original messages. Holten-Moeller also received the Porsild messages.

Experiment Year Round

Although station KFKX, Hastings, Neb., was leased recently by the National Broadcasting Company for use as an experimental center in agricultural programs, it will complete its schedule to the Far North with its remaining program February 25. KDKA, Pittsburgh, will tune its last regular program one week from February 26, while WBZ, Boston and Springfield, Mass. will end the season formally on March 5.

Experimental communication, however, will be kept up throughout the year between KDKA and amateur and government stations in the Far North on the experimental short wave set.

JUDITH ANDERSON, who conducts the weekly cooking chats over WLW, the Crosley station in Cincinnati, presented William Stoess, musical director, with a cake, commemorating the fifth anniversary of the opening of this station. A 30-hour marathon broadcasting program was the feature of the celebration.

Sudden Silence a Tip That SOS Is On the Air

Stations Often Shut Down Abruptly, Even Without Informing the Listening Public of the Reason For the Halt—Speed Is in Interest of Humanity

"Ships that pass in the night" and what they say to each other on the air waves are of vast interest to Uncle Sam, so much so that the United States Government requires every radio station to keep one man exclusively occupied keeping a log of everything he hears on the air during the hours the station is broadcasting.

At WAAM, William Riedel, "Al" Reinhardt and Joseph Deppe, assistant operators, take turns sitting with a pair of phones over their ears and jotting down strange jumbles of letters on a typewriter. The chart they keep represents everything they can catch that vibrates the ether during broadcasting hours.

Mostly, these notes, which the government forbids making public, are memoranda of ships signalling each other as they enter the harbor, talking to land stations about docking facilities and the like.

Occasionally, without any warning, comes an SOS. In a flash, the operator pulls a switch that immediately stops broadcasting, leaving fans to wonder what has happened, so suddenly to halt their program. Frequently, the program is resumed after a few minutes or a few hours, but sometimes there are exciting times on the air that the radio audience knows nothing about until it sees the story in the papers next day.

Once in a great while, the broadcaster's log keeper is the first to hear the distress signal. Then it is his duty immediately to flash the appeal to the New York Navy Yard in Brooklyn, which relays it to Coast Guard stations and vessels at sea.

The Tone Army Advances

The Filtered Output Is Its Latest Weapon

By B. Erle Buckley

Associate, Institute of Radio Engineers

THE radio set that stands in the home today is the lineal descendant of the small crystal, coil and headphone set familiar some years ago. It is the offspring but bears little resemblance to its father, for the crystal is gone, the headphone is rarely seen, and all the binding posts that were on the front have been supplanted by a cable entering the set from the back. This leaves the coil and the panel as about the only remaining members of the original assembly. The panel stays black and behind it we find the coil wound on a supporting form of high-grade dielectric and not on an oatmeal box as of yore.

Today from four to ten tubes light at the touch of a switch, and the power may be supplied from the light socket. Music floods the room and it seems that the experimental side has been finished and radio has taken its place as a stabilized home necessity in a few short years. However, the experimental and research work still go on as intensively as ever and many problems are yet to be solved. Some of these are as far from solution as they were when broadcasting first made radio the common household utility that it is today.

Sound Progress

Perhaps the longest strides have been made in sound or music reproduction from a receiving viewpoint, for here a public educated to an appreciation of instrumental and vocal music demanded true value and an accurate picture of that which was broadcast. What the public wants the public usually gets. As a result of the investigations carried on by engineers in the laboratories of the country the range of audio frequencies given by the loudspeaker runs from about 100 to 2,500 cycles and in some cases over this. This means that tones in the lower register so essential to good music are not missing and tones in the upper register have that timbre without which they sound thin. The music was body, we say. But to take full advantage of these improvements it is important that certain precautions be observed.

Impedance Compared

First the loudspeaker must be chosen to match the constants of the amplifier, or if the speaker has been chosen and installed some form of coupling must be used to compensate for the speaker whose input characteristics are not in agreement with the output characteristics of the tube with which it is to be used. This lack of agreement results in what might be termed as a peaked frequency response or a loss of response at a designated frequency.

Like an electric generator and its accompanying output an audio amplifing tube works more efficiency when a proper load is placed upon it. The impedance of a speaker should be at least twice that of the output impedance of the tube. This optimum value of response to tone frequency is not obtained when a speaker is chosen and indiscriminately placed in a circuit whose output impedance is equal to or greater than that of the speaker.

It is about the various means of coupling and the proper choice of this essential that this article deals. There are two types generally used: (1), the compensating transformer or output transformer; (2), the choke coil and condenser arrangement. Both have their advantages but in my opinion the choke coil and condenser will give more flexibility and will adapt itself to a greater variety and number of speakers. And if more than one speaker are placed on line the choke coil and condenser or filter circuit with the proper resistance to control reactance will give a greater ease of handling.

It is also important that with the voltages used today as a result of rectified house current, and the current passed by modern output tubes, that some means be taken to keep excessive direct current out of the coils of the speaker.

Wire is Fine

For the wire comprising the coils of a loudspeaker is of very small diameter, i. e., .025 of an inch, and not intended to carry the amount of current passed on to it today. This matter becomes doubly important when it is noted that to repair any of the good makes of speakers after burnout costs from $4 to $5. I am connected with a laboratory which specializes in speaker design and repair and I have had ample proof of the needless expense many persons would have saved themselves had they adopted some means of protecting their speaker before inserting a power tube at a plate potential of 135 volts or more.

A third important factor contributing to good speaker reproduction is the advisability of placing the speaker at some remote point from the set itself. In fact, many persons desire the speaker in an adjoining or other room. This, however, is in accord with modern practice and is technically correct. Without filtered coupling, however, the voltage drop is considerable, as the plate potential must act through all the leads to the speaker and return to the set. This means the lessening of volume and, also due to the lowered plate voltage, less than full benefit from the power tube. By using a filtered output the direct current or applied plate voltage is kept within the set and the audio frequency current actuating the speaker is alone sent to the remote point.

Improves Quality

All of the foregoing points must be considered in gaining that most elusive of radio achievement, nearly perfect quality. And every designer of a modern receiver must take them into consideration, as well as every one who now has a set and feels that his tone quality is not all that it could possibly be.

Coupling transformers may be purchased today at almost any radio store. The General Radio Company, Silver Marshall and the Amsco Company, among others, manufacture them. A choke-coil condenser filter is manufactured by the Jaynxon Laboratories under the trade name of the Tone Bridge.

Volume Must Change 25% Before Ear Notes Difference

A Person Is Able to Distinguish a Change in Intensity of Two Signals When They Differ By About One Transmission Unit

The term gain is often used for amplification, just as loss is used for attenuation. The gain in a circuit may not only be due to the voltage amplification of the tubes used in the receivers and the step-up in transformers, but it may also be due to the proper matching of impedances. The latter is a negative idea in that proper matching prevents a greater loss or attenuation, but the measure of the gain caused by proper matching of impedances is positive.

Loss, or attenuation, may be due to improper matching of impedances, to shunt and series impedances as well as to the presence of resistances in the circuit. Strictly speaking, the loss is the actual loss of energy in resistances while attenuation is the reduction of current or voltage strength due to the presence of pure reactances.

Gain and loss, amplification and attenuation are variously measured in terms of Napiers, in miles of standard cable, and in transmission units.

A standard cable is a No. 19 gauge cable which has a capacity of .054 microfarads and a resistance of 88 ohms per mile. It has negligible inductance and shunt leakage. When gain or loss is expressed in terms of miles of standard cable frequency enters as a factor and it is necessary to specify at what resistance the measurement is made. When gain or loss are expressed in terms of Napiers or in transmission units the frequency does not enter. The figures merely express a ratio of two currents, or two voltages, or of two powers.

All the methods of expressing a gain or loss involve logarithms. A Napier is such a unit that the natural logarithm of the ratio of two currents is unity. A transmission unit is such that ten transmission units makes the common logarithm of the ratio of two currents unity. Suppose that the voltage measured in the output of one stage of an amplifier is ten times that of the voltage as measured in the preceding. The voltage ratio is then 10. The common logarithm of 10 is by definition equal to one, and this in turn by definition is equal to 10 transmission units, or T. U. as the term is abbreviated. Suppose the voltage ratio is 100. The common logarithm of 100 is 2, and that makes the gain equal to 20 T. U.

An average person is able to discriminate between an intensity difference of 25%. That is, if one signal has an intensity of unity, an average person is able to tell that a signal which has an intensity of 1.25 is greater. The common logarithm of 1.25 is about .097, which is equal to .97 T. U. Hence a person is able to distinguish a difference in intensity of two signals when they differ by about one transmission unit.

The Phasatrol Circuit

Constants and Assembly of Hookup

[Part I of this article was published last week, issue of February 12. Part II, the conclusion, follows.]

By Capt. Peter V. O'Rourke

SHIELDING is not necessary when Bodine coils are employed. Even when shielding is used to remove the last trace of outer-coil coupling and direct pick-up the losses introduced into the tuned circuits by the shielding is not as great as for the solenoidal coils. This greatly favors the astatic coil both when shielding is used and when it is not.

The substitution of a loop for an antenna is accomplished by means of a double circuit jack J1. This jack should preferably be of the low capacity type, but any of the ordinary jacks may be used for the purpose. A plug that fits into the jack should be provided on the loop terminals so that the loop may be inserted quickly. An important feature about the loop terminals is to separate them by about an inch and to fix them so that the distance between the leads is the same at all time no matter how the loop is turned. One way of doing this is to sew the two wires into a cloth ribbon of some stiffness, one of the wires being at each side of the ribbon. This method of confining the loop terminals prevents any change in the capacity across the coil as the loop is turned, and this is a very convenient feature in a loop set.

R is the Volume Control

The volume control in the set is the filament rheostat R in the filament circuit of the first radio frequency tube. From ten to twenty ohms will be sufficient to control volume in this set when a type A tube is used. In a receiver in which there is considerable pick-up by the individual coils a rheostat in one of the filament circuits would not be sufficient for controlling volume on local stations, but it is quite sufficient when the only pick-up is that which enters the set by way of the antenna. In addition to the rheostat there is an amperite resistor R1 in the filament circuit of the first tube. This is mainly for preventing overheating of the filament in case all of the rheostat R is cut out of the circuit.

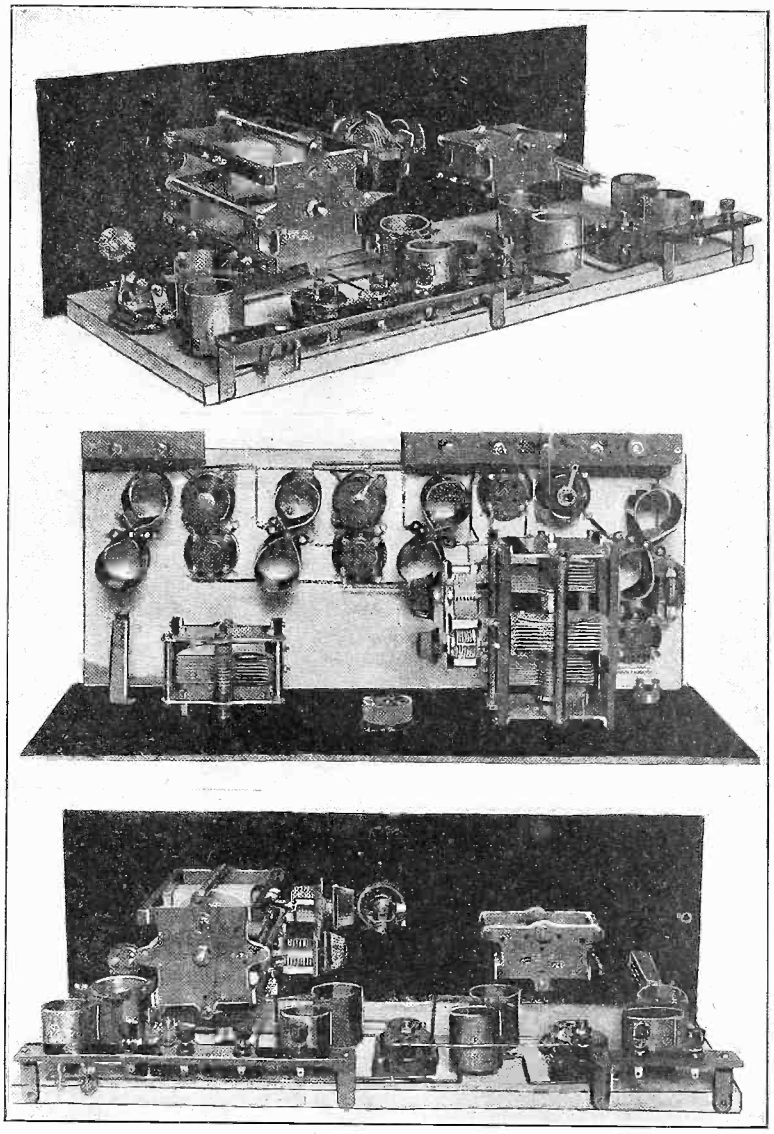
The filament current in the remaining tubes is automatically adjusted by R2, R3 and R4, also Amperites.

The grid leak R5 in this circuit should be from one to five megohms of the metallic conductor type. This type should be used to insure quietness of operation. For loud signals the lower value of leak may be used but when distant stations are to be picked a somewhat greater sensitivity will be obtained with the higher value. For average work the leak may be about two megohms. The condenser C5 in the grid circuit may be of any value between .0001 and .0005 mfd. For average conditions the usual value of .00025 mfd. may be used.

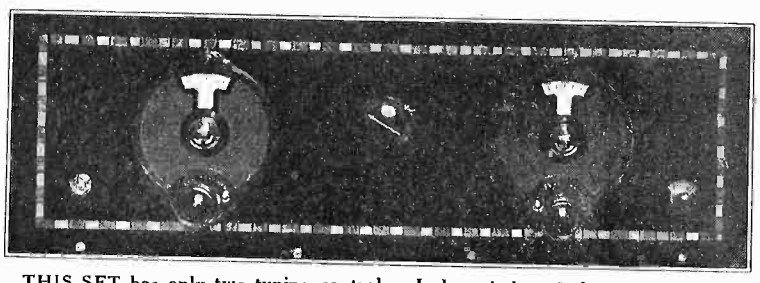
The condenser in the plate circuit C6 should not be larger than .001 mfd., while .0005 mfd. is a good compromise. If the coupling between the detector and the first audio is transformer or choke coil it should not be necessary to use any by-pass condenser here, because the self capacity of the coil is usually sufficient in a non-regenerative circuit. If, however, the coupling device between the detector and the first audio is a resistance the condenser should be employed, but even for this type of coupling its value should be about .0005 mfd.

The Phastrols themselves—manufactured by Electrad, Inc., and invented by John F. Rider—are simple to adjust. Simply turn the shank on each with a screwdriver until squealing stops.

The audio frequency amplifier has been omitted purposely because many fans desire to select their own type of amplification. Any type may be added to the tuner-detector described in this article. Some fans may prefer high class audio transformer amplification because of the high step-up obtainable with two tubes. Others will prefer the twin impedance type because of its inherent advantages, while still other may prefer either choke coil or resistance coupling because of the superb quality obtainable with these types. All may be satisfied by merely plugging in their preferred type in jack J2 provided for that purpose.



THREE VIEWS of the completed receiver.



THIS SET has only two tuning controls. Jack, switch and rheostat complete the panel parts.

Road to Efficiency for Bernard Electric

Bronze Beauty or Any Other Set Made Batteryless and Humless—Stabilization Necessary—An Idea Presented for Reconnecting B Voltage Leads

The use of Radi-A, a device that eliminates both the A battery and the charger, in conjunction with the Acme E-1 B eliminator, and a variable resistor to obtain high negative grid bias for the power tube, enables complete batteryless operation of almost any receiver, where the supply is alternating current, at 110 volts, 50 to 60 cycles. How this system was adopted to the Bernard Receiver, to constitute the Bernard Electric Bronze Beauty, was described in last week's issue, February 12. Herewith are some hints on how to obtain best results from this combination.

Motor-boating has to be considered, first because it is the commonest cause of trouble where B eliminators are used, and secondly because it is most often encountered where direct coupling is incorporated, for either radio or audio frequency amplification (resistance or impedance coupling). An easy remedy is to reduce the amplification slightly, by installing a higher value of resistance in the detector plate circuit. While the voltage drop in the higher resistor is proportionately greater, the amplification will be less, due to the reduction in B voltage and current. Another reason why this system tends to cure motor-boating is that the resistance used for coupling becomes much larger than the variable resistor on the eliminator, used for B+ detector voltage control, and this sharing of the load reduces the impedance of the critical circuit.

A Little Oscillation

The radio side of the circuit must be balanced against self-oscillation. It is a peculiar thing that when you use a B battery eliminator you are in danger of modulating the hum, or result of the ripple voltage, upon the reception as a whole, if any radio or audio tube is oscillating ever so slightly. Now, on the radio side a tube may self-oscillate slightly, and yet under ordinary conditions this would do no harm, perhaps even some good, due to action just at the oscillation point, or very slightly below it, perhaps. Receivers embodying a couple of stages of RF usually will break into pretty bad self-oscillation at around 350 meters, and the object of systems of neutralization is to keep the set stabilized, or usable, below that point. Hence neutralization is a process of obtaining decent reception, on low wavelengths, where otherwise no reception might be obtained there. But for the vital purpose of avoiding the hum it is necessary that the receiver be stabilized even to a greater extent than bare reception would require. Therefore the plate voltage of the B eliminator for the radio frequency tubes should be very carefully adjusted. The fixed radio frequency transformer in the first stage, peaked at a high level, has a damping effect upon the lower wavelengths, and this helps greatly toward stabilization.

You may notice that you hear a hum on low waves, but you will not hear any on high waves, the reason being the modulation of the ripple voltage effect on whatever tubes in the receiver are oscillating, even if only slightly oscillating. No hum will be heard when you get things going properly.

An Idea For Connections

The connection of the B plus lead to the radio frequency tubes deserves attention (Fig. 1, February 12). This was shown as the B+ Amp. lead of the Acme eliminator. All the audio tubes were connected to B+ power. In some instances better results will be obtained if B+ power is reserved for the last tube (6), while B+ detector is connected to detector and two RF tube plates. That leaves B+ Amp. for the plates of the first and second audio tubes. This suggestion is made because of the unknown value of the bypass condenser in the eliminator across B+ amp. If it is for RF it is small, if for AF it is large. Hence if a large condenser is used as bypass (say .1 mfd. or more) and radio bypassing is the objective, the higher audio notes are cut off, and reception is blurred and weak. A small bypass condenser for AF, on the other hand, does little good. Hence try the system as suggested, if signals are unaccountably weak.

Baird Sees Far-Off Person to Whom He Is Phoning

Glasgow.

Now it's the electric eye, according to John Baird, that ingenious and dexterous Scottish inventor, who recently demonstrated how it was possible to see through a wall. As well as seeing these objects, characteristic sounds of these objects are heard. He showed how it was possible to call up a certain party and see to whom you are talking.

Seattle Rallies To Support of Listeners' Club

Seattle, Wash.

Plans were outlined recently, which are expected to insure a large and influential radio listeners' club for Seattle, to be sponsored and financed by the radio dealers.

At the first meeting of the year of the Radio and Music Trades Association, which took the form of a banquet at the New Washington Hotel, it was revealed that plans were complete for the formation of a city-wide listeners' club, similar to the one in Portland, Ore., which has been so successful.

Augmented by the presence of out-of-town dealers, the gathering of more than 150 persons enjoyed the meeting.

Broadcast of two performances of the coming Seattle Civic Opera was assured by the action of the association in underwriting the opera to the extent of more than $2,000 authorized by the board of directors. More than half of this sum already had been pledged by the music group, and the balance will be raised in the radio group.

Dates for the 1927 Seattle Radio Show have been definitely set for September 2, 3, 4 and 5, and the association plans to assist in maintaining a high standard of radio programs throughout the coming summer.

Matt Gormley, who was president of the Radio Listeners' Club last year, was a guest at the meeting and urged that an entirely new organization be built up this year which would have the financial support of the radio dealers. He was assured that a committee headed by F. S. Kuhn was already at work and that a mass meeting of Seattle radio fans would be called within a few days to discuss local interference problems.

Youmans New Head of Columbus League

Columbus, O.

Thomas L. Youmans, 704 Neil avenue, was elected president of the Columbus Radio League for 1927, recently, at the league's annual meeting held at the Neil House. He succeeded Claude A. Bawden, first president. Mr. Youmans is a commercial photographer and has been one of the most active members of the fans' organization.

John W. Newton, president of the Capitol Camera Co., was named first vice president; M. K. Easley, technologist at the American Zinc Oxide Co., second vice president, and Prof. William A. Knight of the department of Industrial Engineering, Ohio State University, third vice president.

Earl Minderman, radio editor of the Columbus Citizen, was re-elected secretary, and M. M. Carothers, radio editor of The Dispatch, treasurer.

The 1927 membership drive got off to a flying start, approximately 75 new members and renewed memberships being chalked up at the meeting.

Lower Temperature Improves Signal

A study of the variation in strength of signals from the transatlantic radio stations at Tuckerton and New Brunswick, N. J., conducted by Dr. L. W. Austin and Miss I. J. Wymore of the Bureau of Standards, Department of Commerce, and extending over more than two years, appears to prove that there is some kind of inverse relationship between signal strength and local temperature, though of course this temperature effect is often masked by other influences. That is, when temperature is low, signals are strong while when the temperature is high, signals are weak.

A curve plotted to show monthly averages of temperature and signal strengths brings out this conclusion very strikingly. The average signals of February are more than twice as strong as those of July. The day by day relationship is less marked, varying from fairly clear in the the winter months to obscure in midsummer.

The commonly accepted ideas regarding the earth's atmosphere indicate that there should be no connection between the weather near the ground and conditions at heights of 62 miles or more, where the main variations in radio signal intensity are supposed to be produced. However, the Bureau's investigations show that the variations in signal strength are actually produced in the upper atmosphere and not in the portion of the wave traveling along the ground, because in the region involved there is no definite change in intensity as a result of long continued rains or droughts or because of the presence or absence of snow, at least for wavelengths over 1,000 meters. In addition, it is hardly conceivable that the rapid intensity changes observed during cold waves can be due to the penetration of frost into the ground, because this is of necessity a gradual process.

In this investigation the Bureau found it advisable to confine its studies to transmissions from stations at moderate distances, 120 to 370 miles. In the case of more distant stations, weather conditions can not be expected to be uniform over the entire signal path, while for distances less than 120 miles the variations in signal strength for the usual transaltlantic wavelengths may become too small for profitable study.

Experiments are still under way.

The Six-Tube Victoreen

Wiring and Circuit Theory Discussed

[Part I of this article was published last week, issue of February 12, and the constants cited refer to the schematic wiring diagram in that issue. Part II, the conclusion, follows.]

THE two detector tubes might well be of the same type, as the B voltage will be the same for each. The second detector (tube 6) has to handle a heavy load on strong local signals so a 112 tube (ordinarily used for the last audio stage) is a good choice. It is an excellent detector. If a 112 is used also for the first detector a gain in volume and a small gain in sensitivity are achieved. The oscillator may be a type A tube. For the intermediate channel the type A tubes or high mu tubes may be used.

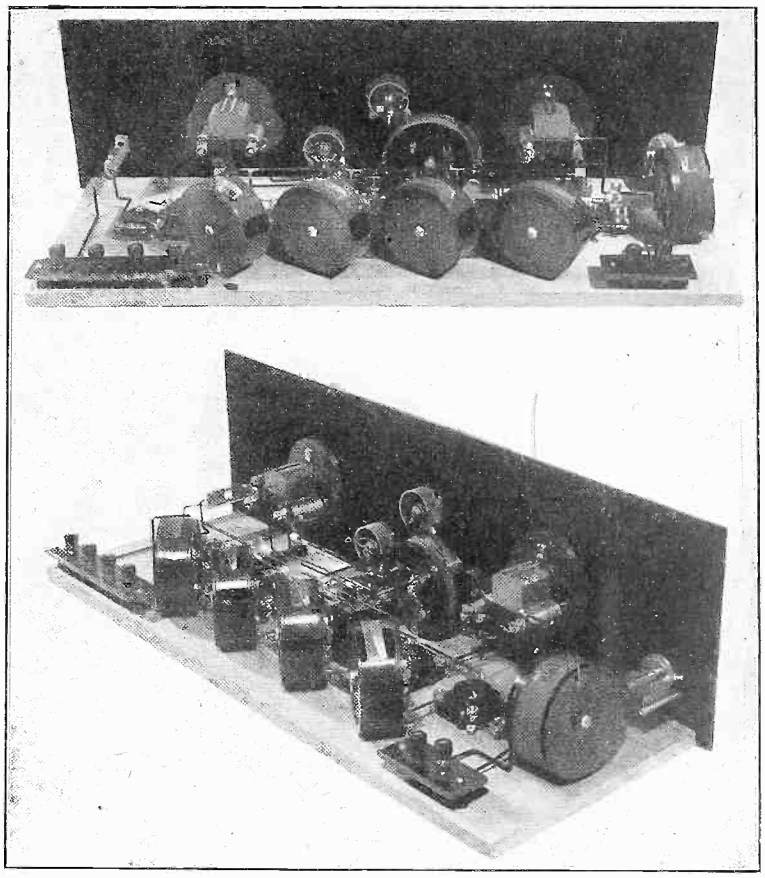
The rheostat R4 is critical on distant stations, as it controls the three intermediate frequency tubes, hence sensitivity. For local reception it need not be varied, unless a local comes in very weakly. It is better to use the potentiometer as the volume control for locals, and both the rheostat R4 and the potentiometer R3 for distant stations.

As for distance, it came in very well, even through locals. The tests were made at Red Bank, N. J. Volume was excellent. For instance, WJAZ, Chicago, came in actually louder than most locals. Other Chicago stations and WJR, Detroit, were loud, and every distant station tuned in was enjoyed on the speaker.

The audio channel may be anything the constructor prefers, and may be built as a distinct unit, or as part of a "power pack," that is, audio amplifier and B eliminator combination.

Well-Tried Hook-Up

The hookup is standard. The separation of the detector and B plus RF amplifier voltages is not quite usual in connection with this circuit, but makes for improved efficiency. The condenser C3 prevents tube blowouts in the event the stator and rotor plates of C2 are jammed together due to some accident. A high quality condenser for C3 is necessary, as any leakage across will charge the grid of tube 2 positively, hence prevent the oscillator from oscillating, and reception as well. C is a small variable condenser, to reduce the antenna coupling, as even with the five-turn primary L1 of the Victoreen antenna coil a long aerial may afford greater pickup than is desirable, since the static level may rise to a point near the signal when distant stations are received. The Precise .0001 mfd. condenser was used for C, and, though placed on the front panel to balance off the jack, might just as well be at the rear. In fact, the jack need not be on the front panel, and was put there only to make access to a particular location of the speaker a little easier. It is just as well to omit the detector jack, if you don't go in for earphone reception, and make the jack a part of the audio wiring, so the speaker can be plugged in.

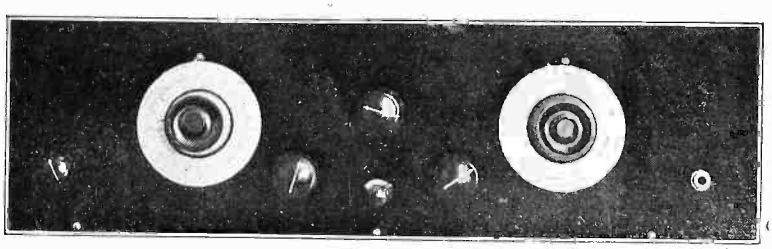


THE baseboard and panel layout of parts is shown in these two photographs. The angular position of the antenna coupler, extreme right, is to be determined experimentally. The conventional position is shown, but it is not always the best, as self-oscillation may be strong.

Circuit Theory.

The theory of the Super-Heterodyne has been fully explained in previous issues, so will be treated very briefly here.

The condenser C1 is turned so that its capacity, in conjunction with the inductance of L2, cause a given frequency to be most acceptable, e.g., the frequency of a desired station. Let us assume this frequency is 1,000,000 cycles (1,000 kilocycles; 300 meters). The oscillator circuit is then tuned to a frequency that differs from the station frequency to the extent of the intermediate frequency. Assume the intermediate frequency to be 60,000 cycles (60 kc; 5,000 meters). Then the station frequency is 1,000,000 cycles, the intermediate frequency is 60,000 cycles, and the oscillator is tuned to 1,060,000 cycles or 940,000 cycles, since each of these two differs from 1,000,000 by 60,000, the frequency that the intermediate channel passes. Therefore nearly all stations can be heard at either of two settings of the oscillator dial.



ON the front panel are the two 360-degree Remler dials for tuning. At left is the antenna series condenser knob. The rheostat for the three intermediate amplifying tubes is at right of the first dial. Next come the switch and the potentiometer. The oscillator rheostat and detector jack complete the list.

The Repeat Tuning

One setting represents the oscillator frequency subtracted from the station frequency (higher number on oscillator dial). The other setting represents the station frequency subtracted from the oscillator frequency. It is well to have the advantage of choice, as this helps a lot in eliminating secondary interference, including whistles of steady pitch.

The mixing of the two frequencies, or modulation of the one on the other, takes place in tube 1. This is not really a detector but the hookup for detction is like that for modulation. Detection takes place in tube 6. Herman Bernard

148 Stations Going Up; 280 More Contemplated

Likelihood That Total Number in Operation, Now About 700, Will Decrease Soon, Due to Terrific Economic Pressure—Problem for New Commission

Washington.

Expert opinion is that the compromise radio bill is much better than might have been expected.

The opinion prevails that the final product is the White bill with only a few changes. The controversy lasted six months, during which time the total number of stations increased from 530 to 700.

The most important change is that the proposed semi-independent commission would function throughout the first year and all matters pertaining to licensing of stations would go directly to it. After the first year, only matters of a controversial nature would be referred to the Commission as originally proposed in the White bill.

Under the compromise bill, the salaries of the Commissioners are fixed at $10,000 each for the first year, and $30 per day for each day in session after the first year.

There is a lot of speculation as to what the Commission can do about the surplus of stations. Advocates of the bill claim the Commission will have full authority to handle the problem in any way it sees fit. Another line of thought is that it may prove difficult if not impossible for the Commission to take such a radical step as requiring a number of stations to close down.

Still another view is that the Commission won't have to do anything about the present situation; that the stations on the air at present may be permitted to continue to operate and that during a short time enough of them will drop out to permit more satisfactory operation and reception.

To confound the holders of this view is the latest report of the Department of Commerce which shows changes in the broadcasting field between July 1 last and January 15. The report shows 181 new stations in operation, 148 stations under construction, and the construction of 280 additional stations is being considered. Furthermore, 150 stations have increased their power and 104 have changed their wavelengths. The changes by districts follow:

First District (Boston): 15 new stations, 15 stations under construction, 13 stations being considered, 5 have increased power, and 14 have changed waves.

Second District (New York): 25 new stations, 4 stations under construction, 36 stations being considered, 14 have increased power, and 13 have changed waves.

Third District (Baltimore): 9 new stations, 4 stations under construction, 7 stations being considered, 6 have increased power, and 2 have changed waves.

Fourth District (Atlanta): 2 new stations, 5 stations under construction, 9 have increased power, 4 are preparing to increase power, and 5 have changed waves.

Fifth District (New Orleans): 14 new stations, 17 stations under construction, 31 stations being considered, 7 have increased power, 13 are preparing to increase power, and 8 have changed waves.

Sixth District (San Francisco): 8 new stations, 13 stations under construction, 33 stations being considered, 11 stations have increased power, 3 are preparing to increase power, and 17 have changed waves.

Seventh District (Seattle): 24 new stations, 24 stations under construction, 24 stations being considered, 14 stations have increased power, 4 are preparing to increase power, and 10 have changed waves.

Eighth District (Detroit): 28 new stations, 14 stations under construction, 87 stations being considered, 22 have increased power, 3 are preparing to increase power and 7 have changed waves.

Ninth District (Chicago): 56 new stations, 52 under construction, 49 being considered, 62 have increased power, 19 are preparing to increase power, and 28 have changed waves.

Cities in which new stations are under construction follow: Nutley, N. J.; Paterson, N. J.; Lubbock, Texas; San Antonio, Texas; Duncan, Okla.; Cedar Grove, La.; Plainview, Texas; Logan, Ohio; Erie, Pa.; Oswega, N. Y.; Huntington, W. Va.; Bath, N. Y.; Auburn, N. Y.; Rollins, W. Va.; Akron, Ohio; Ticonderoga, N. Y.; Syracuse, N. Y.; Arkansas City, Kansas; Garnett, Kansas; Concordia, Kansas; Clinton, Iowa; Sioux City, Iowa; Blue Springs, Nebr.; Scottsbluff, Nebr.; Cozard, Nebr.

Station Changes

Washington.

Licenses have been granted by the Department of Commerce to ten new stations, while three stations have discontinued operation. None of the new stations is of sufficient power to cause much interference unless located in very congested areas. The new stations follow:

Station.	*Station and location.*	*M.*	*Kc.*	*Wt*
KROX	N. D. Brown, Seattle, Wash.	265.3	1130	100
WLBM	Browning Drake Corp., Boston, Mass.	480	624.5	50
KGEO	R. D. Chamberlain, rand Island, Nebr.	271	1106	50
KGEF	Full Gospel Church, Okla. City, Okla.	384	781	50
WMBQ	P. J. Gollhefer, Brooklyn N. Y.	210	1428	100
WMBU	P. J. Miller, Pittsburgh, Pa.	236.1	1270	50
KSCJ	The Sioux City Journal, Sioux City, Ia.	444	675	10
WMBR	Premier Elec. Co., Tampa, Fla.	250	1199	100
WMBW	Youngst'n B'Casting Co., Youngstown, O.	279	1075	50
KGFH	Frederick Robinson, La Crescenta, Calif.	218.8	1370	100

CHANGES

KGCN—Concordia, Kans., 210 meters, 1,428 kc., to 235 meters, 1,276 kc.

WMPC, Lapeer, Mich., from 222 meters, 1,351 kc., to 202 meters, 1,484 kc.

The call of WGHB, at Clearwater, Fla., has been changed to WFHH, and the wave of the station changed from 265.3 meters, 1,130 kc., to 355.4 meters, 844 kc.

KDYL, Salt Lake City, has changed its wave from 245.8 meters, 1,220 kc, to 246.8 meters, 1,215 kc., and increased its power to 250 watts.

KGCG, Newark, Ark., has changed its wave from 239.9 meters, 1,250 kc, to 234.2 meters, 1,280 kc.

The call of WSWS, Batavia, Ill., has been changed to WTAS.

WJR and WCX are now owned exclusively by the Detroit "Free Press."

The stations which have discontinued operation follow: KFYO, Texarkana, Texas; WWPR, Detroit, Mich., and KFOO, Salt Lake City, Utah.

Music Taste of Radioists At High Level

Pittsburgh.

The growth of radio programs, especially of their musical content, furnishes an interesting study in the trend of music itself. In six and a half years broadcasting has progressed so startlingly that whole concerts by great symphony orchestras today compose programs broadcast by chains of stations and covering the continent of North America.

Compare the lack of ostentation at the outset, at the real start of broadcasting, when KDKA, the first broadcaster in the world, transmitted the results of the Presidential election on November 2, 1920. No pomp, no ceremony, no great corps of artists, no vast outlays of electrical equipment, no elaborate studios such as are part of the broadcasting equipment of today. In fact, there were no receiving sets save those of a few scattered amateurs.

The First Classics

Within the first year of its life KDKA had established a plane of music program unsurpassed by any station in the world. It had gathered together, under the direction of Victor Saudek, a fine flutist, the KDKA Little Symphony Orchestra. The first orchestra to give classical music programs over the radio was the KDKA Little Symphony. For many months it excelled in the balance of its programs, its thoughtful pieces skillfully offset by light-opera selections; deep music contrasted to more expressive, fantastic compositions.

The growth of broadcasting in 1924 and 1925 was enormous. The lack of regulatory powers to cut down station interference caused severe disorder in radio for several months. The percentage of listeners who were affected by wave jumpers and interfering stations probably was a very small part of the whole; but the feeling grew among radio listeners that there were degrees of program quality among stations, as well as degrees of technical quality. Also, the numerous stations, despite the seeming predeliction for jazz and popular music, managed to get a sizeable amount of classical music into the air. The result was that classical music, and stations which presented invariably good music programs were very much in demand.

Branches Out

The organization of chain broadcasting with several programs by world-famous artists broadcast from concert halls, stages and theatres of New York City, undoubtedly had a great influence on the musical trend of the radio audience. But the greater part of the growth in that audience's appreciation came slowly, bit by bit, and was not marked by any one outstanding development.

During this Winter many stations inaugurated classical music periods—no longer as innovations, but as integral stock of their programs. A very few have attempted chamber music.

During those formative years in radio, Victor Saudek kept up his classic concerts at KDKA, biding the time until his audience was prepared for greater heights in music. In December last he decided that the time was appropriate for resuming chamber music recitals. Since his first concert, shortly after New Year's Day, he has given several chamber music recitals, and plans many more.

The gain in popularity of better-class music has made itself felt throughout the country, and program directors are constantly giving listeners better and better music.

White States the Case for Compromise Bill

Offers Solution to Problems of Interference, Monopoly and General Absence of Authority to Control the Air, Says Representative Who Led Fight in House for Relief Measure

By Wallace H. White, Jr.

Representative from Maine

Radio legislation may fall far short of what it should be, but it is at least a step in the right direction. First and foremost, it asserts unequivocally the power and authority of the United States over this means of communication and gives to the Federal Government power over the vital factors of radio communication.

What is the situation throughout the country with respect to radio? I have heard a multitude of complaints with respect to the conditions which obtain. Why do they exist? In large measure because in the Federal Government we have had and now have no adequate power of regulation or control over these agencies of communication.

Back in 1912 we passed a radio law. Since that time the whole industry has been revolutionized and that law is wholly inadequate and inapplicable to the conditions that now confront us. Some of us who have been giving our time to this subject have long realized that under that law there was no authority in the Federal Government to allocate wavelengths, to determine the power which the stations should use, to fix the location of those stations, to require the division of time—all in the interest of efficiency of communication. Some of us have also believed that in the absence of legislation by Congress it was inevitable that the Courts of the country sooner or later would determine, as they have determined, that priority in point of time in the use of a wave length established a priority of right.

Bill Grants Real Authority

You will find all through the country today men interested in this great question who are entirely content that radio legislation at this time shall fail. They are ready to take their chances of going into the courts of the country and asserting that through expenditures of money, through prior appropriation of wavelengths, they have acquired equitable rights which the courts will enforce against others and against the power of the United States.

This is the situation that confronted us, and the necessity of dealing with this situation and of conferring an authority of regulation to minimize interference which now sadly impairs broadcasting has been the compulsion back of the effort to get legislation.

This bill gives to the Commission, and thereafter to the Secretary of Commerce, subject to appeal to the Commission, the power to issue licenses if the public interest or the public convenience or public necessity will be served thereby.

This is a new rule asserted for the first time, and it is offered as an advance over the present right of the individual to demand a license whether he will render service to the public thereunder or not. It is one of the great advantages of the legislation. The bill gives to the Federal Government the power to determine the wavelength which every station shall use. Under existing conditions licensees use the wavelength they want and it matters not what are the consequences therefrom.

Monopoly Is Considered

We have given this authority and we have done many other things. We give to the Federal Government the power to fix the time in which the stations shall operate and the power which they shall use in the transmission of radio signals. We have heard a good deal about some of the great interests using 5,000 and 50,000 watts. And it is true; and why? Because there is no authority in the Federal Government under present law to control the power, and here for the first time we have a bill which proposes to give the Federal Government the power to regulate the number of watts these stations shall use.

This bill also deals with the question of monopoly. It starts out by asserting in the first place that the right to broadcast is to be based not upon the right of the individual, not upon the selfish desire of the individual, but upon a public interest to be served by the granting of these licenses. It places a limitation upon the right of the licensee to transfer his license at will; he may transfer that license only upon the express consent of the regulatory power of the United States. That is not all. We have provided that all laws of the United States relating to monopoly and agreements in restraint of trade shall be specifically applicable to the radio industry and to radio communication.

We have directed in this bill the licensing authority to refuse a license to any applicant found guilty of monopolizing or attempting to monopolize radio communication by any Federal Court or by any other body vested with authority by law to make such determination.

Question of Rights

We have recognized that it is not the right of a community to demand a station, that it is not the right of a state to demand a station, but it was the right of the entire people to service that should determine the distribution of stations; and it is written in the bill that it shall be the duty of the Commission to make such a distribution of stations, licenses and power as will give all the communities and States fair and equitable service, and that is the sound basis on which legislation of this character should be founded.

I have surrendered my views with respect to this legislation to some degree, and I have done so because it seemed to me that in the absence of legislation all these conditions of which we complain would continue, would be aggravated, and would become infinitely worse.

I have heard the suggestion that this bill is not the product of the conference committee but is the work of one or two men thereof. I directly and emphatically deny that statement. This bill represents the judgment of seven of the eight conferees on the part of the House and Senate.

Shopping News Broadcast

Boston.

WASN, the latest addition to this city's station list, operating on a wavelength of 280 meters, has inaugurated a new shopping news plan, sponsored by Jordan Marsh & Co., William Filene's Son's Company, C. F. Hovey, R. H. White, Gilchrist and the Shepard stores. The plan was worked out through the Retail Trade Board and the Boston Chamber of Commerce, for exclusive purpose of disseminating store news, during the entire day. The station is located on top of the Shepard Stores.

Bill Empowers Board to Deny Station Licenses

By Thomas Stevenson

Washington.

Officials of the government who have made a close study of the new radio bill believe it has sharper teeth than any previous legislative attempt in this field. In the hands of a good commission, the law can be made to deal effectively with existing confusion.

In some circles the belief prevails that the bill is weak in dealing with the congestion of stations. But the bill confers absolute authority upon the commission to handle the situation. In the first section of the bill it is made unlawful to use or operate apparatus for the transmission of communications or signals by radio without a license granted under the provisions of the act.

The effect of this clause is to nullify every station license now in existence.

Section 9 of the new bill says: "The licensing authority, if public convenience, interest, or necessity will be served thereby, subject to the limitations of this Act, may grant to any applicant therefor a station license provided for by this Act."

In other words (giving a literal interpretation to the bill) before existing stations may obtain new licenses, they must show that "public convenience, interest, or necessity will be served."

Under the bill, the stations are allowed 60 days in which to get a new license. After that time they must discontinue operation until such a license has been granted.

Whether the Commission will decide that 700 broadcasting stations, a large percentage of which are located in a few cities, are essential to "public convenience, interest or necessity," is a question only the commission itself can answer. But everybody who has given the matter much thought has a very positive opinion about the matter.

Moreover, the Commission is not obliged to issue licenses for periods longer than it sees fit, be it one day, one year or three years. The Commission may not issue broadcasting licenses for periods longer than three years.

With the exception that the Commission will be in continuous session the first year, the difference in salaries, and the section that makes it obligatory for stations to afford equal opportunities to be heard to all legally qualified candidates for the same office, the new bill is almost exactly like the old White bill. With a few changes in language here and there, the switching about of a few sections, there isn't much difference so far as effect is concerned.

KGA, Spokane, Heard Far in First Program

Spokane, Wash.

KGA, Spokane's new broadcasting station, gave its dedicatory program recently, with thousands listening in from all over the country, as indicated by the telegrams which began pouring in soon after the broadcast was on. Messages came from as far north as Ketchikan, Alaska, and as far south as San Diego, Cal., as early as 9 o'clock. Denver, Colo., reported splendid reception.

Mayor Charles A. Fleming voiced the city's welcome and pride in the new station and John F. Davies, president of the Spokane Chamber of Commerce, gave the new station a "send off" during the dinner hour.

Vincent I. Kraft, Seattle, president of the Northwest Radio Service company, which owns and operates the chain of broadcasting stations with which KGA is linked up, came to Spokane to participate in the opening ceremonies. W. C. (Doc) Gordon and L. J. Jensen alternated as announcers for KGA's opening broadcast.

Reception In Hospital Tests Curative Effect

Psychological Reaction on Convalescents Studied, Each Patient Having a Separate Receiver and Aerial—Earphones Used to Avoid Annoying Others

The psychological effect of radio music on convalescent hospital patients is being tested in one of America's most up-to-date institutions for the sick at Miami Beach, Florida. In this hospital each patient has a radio receiving set with a separate aerial.

The hospital is one of the most modern institutions of its kind in America, situated with Bay Biscayne on one side and the Atlantic Ocean on the other, all outside rooms and with the latest scientific apparatus. The sets are all one-dial Atwater Kents and are used without batteries. Each set is equipped with headphones so as not to disturb patients who may not wish to listen in.

In most hospitals the patients' beds are equipped with head-phones which are served from a central radio set. Thus they must take the programs selected for them by the operator of the main set.

Founder Is a Fan

James A. Allison, multi-millionaire founder for whom the hosptal is named, is a radio fan himself and conceived the idea that hospital patients above every one else ought to be able to select the particular kind of music and program they want.

When a special radio equipment was considered, an obstacle was encountered in the fact that many patients did not know how to operate complicated three dial sets, so simple one-dial sets were chosen so that patients by a mere turn of the fingers can bring in a procession of stations from which they can take their choice of program.

The Allison Hospital was a great haven for the ill and injured left in the wake of the Miami hurricane. Mr. Allison threw the hospital doors open to the Red Cross and turned his complete facilities over to the storm victims.

Like to Hear Home Stations

Patients from all parts of the United States, whether ill or simply enjoying a rest, find great pleasure in picking out their home stations and others to which they like to listen.

Another unique feature of this hospital is that patients who are able to eat and whose diet is not prescribed, select their meals from a regular menu as in hotels.

To a commodious roof garden, convalescents are taken each day for an unobstructed view of the ocean and healing sunshine.

Good results are reported.

Public Address System Speeds Up Convalescents

One more hospital has been added to the list of those using a Western Electric public address system combined with a radio receiving set in the role of an agent of mercy. This is the General Hospital at Elizabeth, N. J.

When the new buildings of the hospital were erected two years ago the walls and floors were wired for the installation of a public address system with headphone plugs at each bed. A radio receiving set connected with the system gives each individual with headphones the benefit of the radio program which, if given through a loud speaker, might prove disturbing to patients in a more serious condition.

The convalescents thus are speeded on the road to recovery with this entertainment, instead of finding time hanging heavily on their hands with nothing to do but brood over their ailments.

The equipment was made by the Western Electric Company and embodies all the latest improvements in range, selectivity and fidelity of reproduction. It is controlled from the desk in the main office of the hospital and is operated throughout the day and evening. Patients are allowed to listen in as late as the nurses deem advisable.

Before the equipment was installed experiments were tried with private sets in rooms and wards of the hospital. It was found that the radio induced a nervous and mental relaxation, often overcame insomnia and reduced irritability during convalesence.

A separate equipment has been installed in the nurses' home. Nightly programs from a loud speaker in the main reception room provide entertainment and bring about a gathering of the nurses after the strain of long hours on duty.

They enjoy this very much.

Radio Music Dispels Fear of Surgeon's Knife

Chicago.

In making public the results of recent tests held here, Louis Curtis, vice-president of St. Luke's Hospital, stated that radio has been successfully employed in banishing fear during operations, where only local anesthetics are employed. The music produced, distracts the patient's attention, he said, and therefore prevents the mental shock which usually accompanies these cases, where only the local anesthetic can be given due to the poor physical condition of the patient.

Sometimes, the earphones are used, while at other times, a loud speaker is placed in the operating room.

HOW EXPERT IMP

FREDERICK D. WEAVER, staff organi before the microphone this way, until i earphones

Roxy To Retu Assembl

Will Broadcast Over Blue Netv in Theatre in Which Ac Given Unu

Roxy with his familiar "Hello Every body," a greeting known to thousands o radio fans, will be back on the air soo in a series of weekly broadcasts. He wil be heard through WJZ and the affiliate stations of the National Broadcasting Com pany's Blue Network, WBZ, Boston an Springfield; KDKA, Pittsburgh; KYW Chicago; WHAS, Louisville; WMC Memphis; WSB, Atlanta, and WSM, Nash ville.

A new "Gang" is assembled and wil include many old favorites and a few nev performers heretofore unknown to radi listeners. "Gamby" and "Doug" (Mlle Maria Gambarelli, dancer and singer, an Douglas Stanbury, baritone), known as th "Sweethearts of the Air"; Phil Ohman an Victor Arden, pianists; Adrian da Silva tenor; Celia Branz, Contralto; Geoffre O'Hara, composer, author and singer; Dor othy Miller, soprano; Gladys Rice, colora tura soprano; Beatrice Belkin, soprano Anna Robinson, soprano; "Wee Willie Robeyn, tenor; Joseph Stopak, violinist Jim Coombs, basso; Frank Moulan, come dian; and Florence Mulholland, contralto will compose the new "Gang."

To support these artists Roxy is now en gaging vocalists and instrumentalists t form two of the largest organizations of

VES BROADCAST

WBAL, Baltimore, who used to play found more useful to have him wear playing

n Soon; New "Gang"

Weekly from Special Studios tics for Microphone Are Attention

their respective types ever to face a microphone. One of these units will be a vocal chorus of 100 male and female voices and the other a complete symphony orchestra of 110 instrumentalists under the alternate guidance of four conductors, H. Maurice Jacquet, the noted French leader, Charles Trevin, Erno Rapee and Frederick Stahlberg. The musical equipment which Roxy intends to use in his new series of broadcasts is complete in every detail. On his staff, he will have dance orchestras, string ensembles, quintets, quartets, trios, marimba bands, and balalaika orchestras, etc.

One of the largest organs in the world, now being installed in the new Roxy Theatre, will also be one of the features of the series.

Special studios, located at the Roxy Theatre, New York City, said to be of the finest type built, tests having revealed that the acoustical conditions are ideal for broadcasting purposes, surpassing even the expectations of the architects, will be used.

Roxy's first appearance was made in May 1923 and the quality of entertainment furnished on the air by Roxy and his "Gang," together with the cordiality, and sentiment exercised by Roxy himself in presenting the programs, made them one of the outstanding events of the air.

Organist Wears 'Phones To Gain Artistic Effect

Sound of His Own Playing Thus Is Confined to Reception from the Microphone and the Musical Instrument Is Played with Special Regard to Acoustics

Baltimore.

The advent of radio into the world of science and more immediately into the realm of the home, has literally put "music on the air" and has awakened the layman to the acute curiosity as to how this is done.

But comparatively few persons sitting in their living rooms listening-in to various programs as they go around the dial, realize the vast amount of research and experimental work that is constantly being conducted in broadcasting studios to perfect the broadcasting of the output and thus aiding, as much as possible, the reception of various features on home receiving sets.

The organ, though a most enjoyable instrument to the majority of music lovers, is perhaps the most difficult to reproduce faithfully over the air. The main reason for this lies in the fact that, unlike most other instruments, the organ is really a battery of instruments, and, unless proper attention is given to this combination of organ tones, they will not do themselves justice and are likely to be mediocre and unsatisfactory when recorded in a purely mechanical device, such as the microphone.

When WBAL, Baltimore's super power station, added to its musical programs a semi-weekly organ recital from one of the largest and most magnificent organs in the South, it was confronted with these facts and immediately set about to correct them in order to provide as perfect reproduction of this beautiful instrument as was possible.

The logical and practical means to remedy the defects, it was found, was to exclude from the ears of the organist the direct sounds of the organ and let him hear instead, the product of his own efforts as recorded on the microphone and through the amplifiers. The most effective way to achieve this, it seemed, was to have the organist wear earphones or an aviator's helmet while broadcasting. And so, Frederick D. Weaver, WBAL's staff organist, was provided with a set of earphones which he wears every time he puts the WBAL organ recitals on the air.

The tones sound through the earphones the instant the keys are struck, more promptly, in fact, than they sound when the ear-phones are not used, since the console is 35 or 40 feet away from the organ pipes and the performer can notice a perceptible lag in the tones reaching the ear. The earphones also eliminate all echoes; this was demonstrated by striking a short chord on the full organ, then taking the earphones off and hearing the chord again from the hall.

"It is indeed, a queer sensation, as the chord is struck but once," Mr. Weaver said.

It has also been found that certain organ tones register better than others of even greater power; consequently, when broadcasting, the organ is played in an entirely different manner than in ordinary recital. Certain pedal tones can not be used at all, when broadcasting, Mr. Weaver explained.

These organ recitals are given over WBAL every Monday and Thursday evening from 7.30 to 8 o'clock, Eastern Standard Time. Mr. Weaver, who is considered one of the finest organists in the South, uses the James Wilson Leakin Memorial organ, recently installed in the concert hall of the Peabody Conservatory of Music, this city.

The organ's tone won much praise.

Too Free and Frequent Ads Called a Menace

Stations are cautioned to be more careful not to permit advertising features to become offensive because of over-commercialism, in a statement issued by the National Better Business Bureau through Edward L. Greene, managing director. The statement:

Each form of advertising has its own advantages, its own limitations. If an advertiser attempts to use the outdoor poster, for instance, as a medium for wordy "reason why" copy, he offends twice over; for, not only does he prepetrate an ineffective advertisement, but the unsightly poster which results tends to discredit outdoor advertising as a medium.

Similarly, the clumsy broadcasting continuities of certain advertisers on the air, who have not learned the art and the manners of this means for building good will, may not only irritate radio listeners against those advertisers themselves, but may provoke ill will toward all that broadcasting which produces revenue for the stations. This is, perhaps, much a matter of taste, but so is most effective advertising.

In the periodical world, skillful editing of advertising copy by publications has often aided the advertisers to attune their messages to the tastes of the publication's readers. This service does not always take the form of a censorship; it is phrased oftener as "Better do so and so, instead," than as "You cannot print that." It therefore, seems to us that all broadcasting stations have even more at stake than the advertisers themselves, if that is possible. For, a recent leniency on the part of leading stations toward the advertising talk employed by firms engaging their facilities seems to have lessened the scruples of some smaller stations as to who shall broadcast. Bad taste on the part of some advertisers who ought to know better has been followed rather closely by the broadcastings of some blatant mountebanks.

The highway of the air has a clean record. Broadcasting nuisances have been few. Radio has not served the blue sky promoter, the charlatan and fraud extensively as yet. This is perhaps one factor in its present effectiveness as a builder of public good will. Isn't it worth while to keep it that way?

Some recent programs have occasioned letters of protest to the National Better Business Bureau from broadcast listeners. Within the last week one New York station broadcast a period in which not only was the name of the advertiser repeated ad nauseam, but the advertisement was a combination of "free" lot and puzzle scheme.

We shall appreciate having the comments of station managers similarly interested on the current trend in some recent broadcasting which we commented upon.

A THOUGHT FOR THE WEEK

THERE'S a town in Wales called LLANFAIRPWELLGWYNGYLLGOGERYCHEY-RNDROBWELLANDYSILIOGOGOGOCH. Broadcasters, try that on your microphones!

RADIO WORLD

The First and Only National Radio Weekly

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

TELEPHONE BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATION CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
(Just East of Broadway)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
FRED S. CLARK, Secretary and Manager
European Representatives: The International News Co. Breams Bldgs., Chancery Lane, London, Eng.
Paris, France: Brentano's, 8 Avenue de l'Opera
Chicago: Hackett & Hackett, 901 Hearst Bld.
Los Angeles: Lloyd B. Chappel, 611 S. Coronado St.

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

SUBSCRIPTION RATES

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

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

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 3½" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Time Discount

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

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

CLASSIFIED ADVERTISEMENTS

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

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

General Receiver Tax Adopted in Philippines

First Example of Such Step Under the United States Flag Is Reported to Commerce Department by Trade Commissioner Butler at Manila

In the Philippine Islands, a United States possession, listeners pay universally for the privilege of receiving radio programs. A bill to that effect was adopted by the Legislature in Manila and represents the first instance of a universal receiver tax under the United States flag. In all other countries the listeners pay a tax. In the Philippines previously only a restricted sort of tax was in effect.

That the Nieto radio bill became a law was communicated to the Department of Commerce by Trade Commissioner M. Butler, at Manila. The full text of a statement by the department follows:

In the past, broadcasting in the Philippines has been hampered because the stations had no financial support save that obtained from the sale of receiving apparatus, a portion of which accrued to the broadcasting concern. Hereafter, every owner of a receiving set will help to support the station whose broadcasting he receives.

Owners of Sets to Contribute

Broadcasting, where it is supported by the sale of receiving equipment has, according to the general manager of an American radio concern in the Philippines, a distinctly reciprocal character. Either the establishment of an adequate transmitter and acceptable programs must create the demand for sets, or the sale of sets must reach such a volume that the proceeds may be devoted to the improvement of facilities and programs.

In the past only a portion of the sales of receiving apparatus in the Philippines would accrue to the support of broadcasting, and as the total possible sales in the Philippine Islands are limited, the result to be expected was not reassuring. Under the Nieto Bill, which has now become a law, an equitable situation is created whereby every owner of a set helps to support the programs which he hears, regardless of whether the merchant from whom he purchased his receiver is carrying on broadcasting or not.

Expect Big Benefits

In connection with the other radio activities which are being undertaken in the Philippines at this time, it is expected in the islands that radio broadcasting will be developed so that the Philippine Islands will be able to enjoy the many benefits and advantages which broadcasting can bring to a people.

The installation of the new transmitter at the transmitting center at Manila Heights is being expedited. When completed this station is expected to have 10 times the over-all efficiency of the present station. The new Radio Manila should be heard therefore with reliability throughout the archipelago.

Better Studio Facilities

At the same time that the transmitter is being installed, arrangements are being made for new and improved studio facilities and an adequate staff is being organized to carry on the arrangement of programs and service. In short, every effort is being made to furnish the finest possible service to the Philippine public.

With all these factors realized the new Radio Manila went on the air a short time ago. From then onward, radio broadcasting in the Philippines should follow the logical development which it has enjoyed in other parts of the civilized world.

75% Jazz Preference Reduced to Only 5%

In a recent talk to members of the New York Advertising Club, George F. McClelland, vice-president and general manager of the National Broadcasting Company, stated that they were now able to connect up 35 broadcasting stations, enabling nearly 15,000,000 persons to listen to an individual's voice. He stated there were approximately 671 active broadcasting stations in the United States, and 950 throughout the world. Mr. McClelland estimates that the normal listeners-in total 25,000,000, increasing to nearly double that number when some great national event is broadcast.

He said that the public taste had greatly changed. Three or four years ago the demand for jazz was nearly 75 per cent. Today it represents a preference of only 5 per cent.

According to Government estimates, there are 300,000 employed directly or indirectly in the radio industry. The early sales of radio sets and parts amounted to $2,000,000. In 1926 this amount had grown to $500,000,000, while the estimated sales for 1927 are $535,000,000. The gross sales credited to the radio industry from 1920 to 1926 inclusive are $1,492,000,000.

Station in East Picks Up Pacific And Rebroadcasts

The method of rebroadcasting programs from remote stations over WAAM in Newark, N. J., devised by Paul Godley, radio engineer, has passed the experimental stages, and many WAAM listeners have reported that they have been thus enabled to hear Pacific coast stations for the first time. Mr. Godley's parties are held each Friday night, or rather each Saturday morning, starting a moment after midnight. The rebroadcasting continues as long as the reception is good.

Two sets have been installed at Cedar Grove, in an isolated section of the state, where reception is known to be exceptionally good. For the rebroadcasting, Mr. Godley uses a six-tube set, with two stages of radio amplification, a detector and three stages of tone amplification. A loudspeaker is set up directly in front of the WAAM microphone and the remote control wires carry the reception to the sending station in Newark, where it is rebroadcast. In addition, Mr. Godley uses another machine, this one a seven tube set, as a kind of "scouting machine". While sending from one remote station, Mr. Godley picks up another distant point with this "scout" and there is never any lapse in the sending. He uses an aerial 35 feet high, 150 feet long, and grounded to the hot water system.

"I believe that these DX parties will do much to create renewed interest among radio fans who have never been able to get distant stations", Mr. Godley said in discussing the latest party. "We have received many phone calls, telegrams and hundreds of letters, telling how the program was coming in. But especially interesting were the telephone calls that came in asking for the dial settings on our rebroadcasting set. These we gladly made known over the air, and in a half dozen instances we received second messages saying that by following our instructions, the listeners in were able to tune in stations on the Pacific Coast with their own sets.

"We shall be glad to hear from any listeners when we hold our next party and we shall be pleased to give any advice possible over the air that will enable them to get the stations to which we are listening direct, without the necessity of rebroadcasting it. But for those who wish to hear the coast stations it is only necessary to tune in on WAAM and get the rebroadcast."

Frisco was heard recently.

An Audience of 27,000,000!

Aylesworth Prophesies Listeners This Year

Pittsburgh.

THE development of broadcasting in the United States from a single station with 700 to 800 listeners six years ago, to nearly 700 stations serving a radio audience of between 20,000,000 and 25,000,000 people was traced in an address by Merlin H. Aylesworth, president of the National Broadcasting Company, delivered before the Engineers Society of Western Pennsylvania.

Pittsburgh, Mr. Aylesworth declared, will always stand in radio history as the pioneer city from which the first trail was blazed for a nation-wide broadcasting service.

"Just as the first SOS call received from a sinking ship at sea thrilled the world into the recognition of what trans-Atlantic wireless telegraphy meant," said he, "so did the returns announcing the election of the late Warren G. Harding as President of the United States, broadcast by KDKA on November 2, 1920, focus the attention of the country to the new art of mass communication which radio had brought."

A Challenge to the World

With the development of a nation-wide broadcasting service now projected by the National Broadcasting Company, Mr. Aylesworth added, broadcasting progress in the United States will challenge the world. The first step, he explained, of what may prove to be a joining of the West to the East, will be the formation of a Pacific Coast Division by the National Broadcasting Company. Through a studio in San Francisco leading stations in Oregon, Washington and California will be served with National Broadcasting Company programs originating in San Francisco.

Under arrangements expected to be completed by April 1, said Mr. Aylesworth, a permanent network system of thirty-five stations as far north as Canada, as far west as San Francisco, Portland and Seattle and as far south as Atlanta, will serve the nation with the facilities developed by the National Broadcasting Company.

Mr. Aylesworth paid tribute to the far-seeing policy of the Westinghouse Electric and Manufacturing Company which led that organization to embark upon a program of broadcast development long before there was a radio audience or a field for radio receiving sets in the United States. The work of station KDKA, he said, had brought Pittsburgh to many million homes in the United States and had made the city a familiar name in many countries abroad.

Interest Is Increasing

After reviewing the early history of broadcasting in the United States, Mr. Aylesworth discussed the great progress which the art had made to date. "Today", he said, "nearly 700 active broadcasting stations in the United States compete for the favor of the radio audience. Illinois, the keystone of the middle West, ranks first as a state, in the extent of its broadcasting facilities. New York comes next, followed by California and the State of Pennsylvania.

"Interest in broadcasting is continually increasing. The list of proposed stations is constantly growing larger. Notwithstanding the present congestion in the air, it is now impossible to fine a wavelength which is not used by at least a half dozen stations, whereas most of them are serving fifteen or more stations, some of which are entirely too close together.

"Radio broadcasting today is recognized for what it is; a great humanizing and cultural force, educationally comparable only to the press of our country. Reflect upon the fact that already radio broadcasting commands an audience of 20,000,000 people in the United States and that by the end of 1927 this audience probably will be increased to 27,000,000 or 28,000,000 radio listeners.

Penetrate Science of Sound

"A new science of electro acoustics has been created for broadcasting. Our engineers have progressed greatly in learning how to handle sound in the air.

"Microphone technique has been improved to the extent that not only the middle register, but the high notes and low notes of music or the speaking voice, can now be handled by the microphone.

"Modulation systems have been worked out by which distortion in radio transmission practically has been eliminated.

"Sound control systems have been developed by which an invisible radio-conductor mixes and controls the output of the microphone, so that a concert might be transmitted in perfect form by the broadcasting station.

"No greater demonstration is needed of the progress made in the technique of broadcast transmission than the feat performed by the National Broadcasting Company on January 21, in broadcasting the Garden Scene from the opera 'Faust', direct from the stage of the Auditorium in Chicago. Very few of the millions of people who heard this act reproduced with marvelous fidelity in the comfort of their homes recognized the great technical problems thus solved. Fifteen microphones were used to pick up the music from the Chicago auditorium."

Problems to Solve

Broadcasting, Mr. Aylesworth pointed out, had still many problems to solve. He continued:

"With the great advances made in the technique of radio transmission, with neary every American boy a radio 'expert', it may seem strange perhaps that there are any fundamental problems left for the electrical engineer to solve in radio broadcasting. Yet it is made plain to me by our own engineers that a vast, unknown continent of space, between the radio broadcasting station and the radio receiving set, still remains to be explored before we can say we have fully plumbed the possibilities of radio communication.

"Unless broadcasting transmission is to slow up the progress of broadcast reception, the broadcasting station must ever look forward to the goal of perfection. It is apparent that no receiving set developed can give better results than the best available broadcast transmission.

"We have theories about everything, but we have yet to discover, it seems, why electro-magnetic waves can cover greater distances over salt water than over land; why with the same power from the transmitting station we can reach greater areas over flat land than over hilly country, over moist land than dry land.

Short-Wave Puzzles

"Our engineers are still balked by the exasperating phenomena of short wave transmission, when reception is often good 1,000 miles away from the broadcasting station and almost impossible at the distance of 100 miles from the transmitter.

"Great progress has been made in controlling static disturbances, but the engineering mind will not rest content until it has tracked the beast to its lair and put a final stop to its depredations. The mystery of 'fading', or the sudden variation of signal strength sometimes noted in radio reception, has not yet been pierced.

"Great tasks of discovery still challenge the radio scientist, and the National Broadcasting Company in addition to its administrative and operating activities, must pursue an unremitting course of scientific investigation."

The phenomenal progress made in radio photography in recent years, Mr. Aylesworth said, had brought radio television at least within thinking distance. Laboratory developments, he indicated, would soon demonstrate that photographic images could be transmitted by radio in seconds, rather than in minutes as heretofore.

Television on the Way

"Even in the discussion of a subject as ethereal as radio," he declared, "it may not be permissible to take one's feet off the ground. Yet the concurrence of events is such that it is difficult to keep the mind from projecting itself to the day when radio will not only be the great carrier of sound, but the carrier of sight.

"When facsimile documents and pictures are transmitted across the ocean by radio in twenty minutes—and this is its present commercial record—there is at least room for speculation as to radio television.

"When one year later, a half-tone photograph is transmitted in two minutes by radio, and this is a feat recently accomplished under laboratory conditions by Dr. Alexanderson, of the Advisory Engineering Staff of the National Broadcasting Company, the progress is indeed remarkable.

"But when we are told, as I have been, that improved apparatus now being developed in a great electrical laboratory is expected to transmit a photograph by radio in seconds, rather than in minutes, we are approaching, to some appreciable extent, the day when an image may be flashed in a fraction of a second.

"But here you will have to paint your own picture, dream your own dreams, choose your own seat by the fireside screen and receive the programs of a sight and sound which some day the National Broadcasting Company in cooperation with its associates in the electrical field may develop."

Power Co. Taxed $2,000 For Causing Interference

Milwaukee, Wis.—What is believed to be the first case in America where a public utility has been held liable for interference with radio reception reached its conclusion when the State Supreme court upheld a Circuit court jury in awarding $2,000 damages to Peter J. Walter. Suit for damages was started by Walter against the Milwaukee Electric company on the grounds that a high tension line near his home made it impossible for him to tune his set properly.

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.

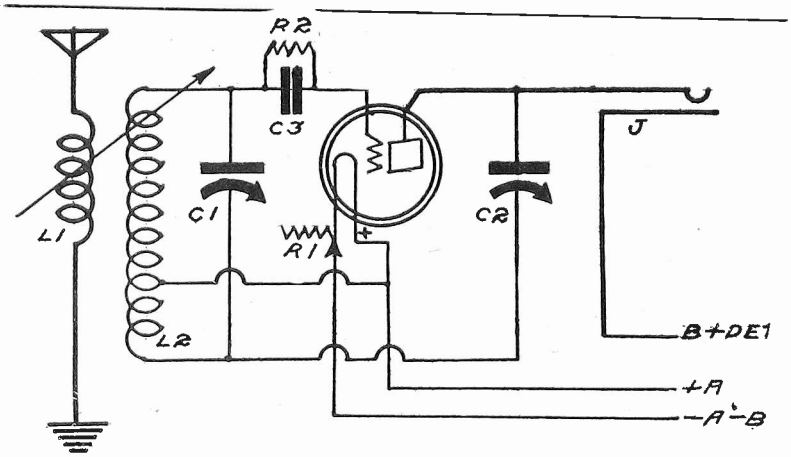


FIG. 515

The circuit diagram of the one-tube receiver requested by James Domen

PLEASE GIVE me the circuit diagram of a one-tube receiver, using regeneration with the Hartley system, wherein the primary winding of the coil used in this circuit is automatically variable. I have a .0005 mfd. and a .00035 mfd. variable condenser, which I would like to use in this set. The coil data would also be appreciated.—James Domen, Atlanta, Ga.

The circuit diagram of such a set is shown in Fig. 515. The .0005 mfd. variable condenser is used to tune the secondary winding L2, which consists of fifty-three turns of No. 22 double cotton-covered wire, wound on a three-inch diameter tubing. This winding is tapped at the eighth turn from the beginning. The primary winding, as you requested, is variable, and consists of fifteen turns. It is wound on a two and one-half-inch diameter tubing, using No. 22 double cotton-covered wire. This winding is placed inside of the secondary winding near the beginning. The .00035 mfd. variable condenser C2 controls regeneration A twenty-ohm rheostat R1 is used for controlling the filament temperature of the detector tube. C3 is a .00025 mfd. fixed condenser, while R2 is a two meghom grid leak. The variable primary winding is, to a great extent, a regenerative control as well as volume control. That is, when the low waves stations are tuned in, if the coupling between the primary and secondary is tight, the set will squeal and be difficult to control, even with C2. However, you can adjust both the primary and C2 to such a point, where the tube does not squeal, and still the signals are loud. On the low waves, this point will be obtained when L1 is very loosly coupled to L2. As you go higher up, the coupling should be tightened. This system should be followed out carefully for best results. Greater ease of tuning can be obtained if the primary is so aranged that as you turn C1 the coupling is automatically varied. This contraption can not well be made at home. It can be bought completely made up, and is known as the Karas Equamatic coil. If you wish to use this coil you may tap it at the fifth turn fro mthe filament end. This plate coil, however, may be wound as a separate coil, 10 turns on a two-inch diameter. It is placed close to the secondary winding. At the output, a single circuit pack or a pair of binding posts can be used. Use the —01A type of tube with forty-five volts on the plate. A six-volt A battery is, of course, used for filament supply. Use a fairly short antenna, about 100 feet, with a good ground.

* * *

I HAVE built the five-tube Neutrodyne receiver described in the May 8 issue of RADIO WORLD in the University columns. The results are fine, when the local station around here does not come on. As soon as they begin, I have to shut off the set, for all I get is that station. They are about three blocks away from me. What could I do to tune them out? I use radio frequency transformers, with fifteen turn primaries and sixty-five turn secondaries, wound on two and three-quarter inch diameter tubings, with No. 26 double silk covered wire. My antenna is about one hundred and twenty-five feet long, including the leadin.—Hurley Maxdrown, Pontiac, Mich.

First reduce the number of turns on the primaries on each of the transformers, so that they contain ten turns. Also wind forty-five turns on a three inch diameter tubing, with No. 22 double cotton covered wire. Shunt a .0005 mfd. variable condenser across the windings of this coil. Break the antenna connection to the set. One terminal of this condenser and coil is connected directly to the antenna. The other terminal of this condenser and coil is brought to the antenna post on the set.

* * *

CAN A tuned radio frequency transformer, having a twelve turn primary and fifty turn secondary wound on a three inch diameter tubing with No. 22 double cotton covered wire, be used to couple the radio frequency tube to the detector tube, in the circuit shown in the Radio University columns of the Sept. 11 issue of RADIO WORLD.? (2)—How would this be connected? (3)—There is no space between the primary and secondary windings of this transformer. Should there be? (4)—Should I employ regeneration? (5)—What system?—Jerry Callsom, Mexico City, N. M.

(1)—Yes. (2)—The beginning of the primary winding is brought to the P post of the radio frequency tube socket. The end of this winding is brought to the B plus sixty-seven and one-half volt post. The beginning of the secondary winding, if next to the connection of the primary winding brought to the B post, should be connected to the rotary plate post of the .0005 mfd. variable condenser and to the plus A post. If this terminal of the winding should be next to the plate post connection on the primary, then connect it to one terminal of the grid leak and condenser (note that the grid leak is not brought to the plus A, according to the diagram, it being shunted across the condenser instead), and also to the stationary plate post of the variable condenser. In other words, the low potential points of the primary and secondary winding are kept together, while the high potential points are kept furthermost away from each other and the low potential points. (3)—Keep the windings at least one-quarter inch apart. (4 and 5)—It can be used with success in the detector circuit, by inserting a tickler coil consisting of thirty-six turns wound on a two and one-half inch diameter tubing, using No. 26 single silk covered wire, in that portion of the radio frequency transformer, carrying the secondary winding, and being connected to the grid post of the detector tube socket. One terminal of this winding is brought to the plate post of the detector tube socket, while the other is brought to the P post of the audio transformer, AFT1. A .0005 mfd. fixed condenser should be connected from the plate post of the detector tube socket to the minus A post.

* * *

IN THE May 22 issue of RADIO WORLD there appeared in the Radio University columns, a circuit diagram of a five-tube receiver, with a one control feature. I note that there is no antenna connection. Is this correct?—Ronald Lonstrom, Pittsburgh, Pa.

The antenna should be connected to the beginning of the primary winding L1, as usual.

* * *

CAN A transformer of the tuned type be used instead of the untuned one, in the three-tube reflex, which appeared in the Radio University columns of the Sept. 25 issue of RADIO WORLD? (2)—I have a .000375 mfd. variable condenser. Can this be used? If so, I would appreciate the data on the tuned RFT. (3)—Can resistance coupled amplication be added to this set? What are the values of the various resistors? (4)—What size cabinet should I buy for this set? (5)—Will I get any better results if I use a baseboard or a subpanel for mounting the parts?—Jesse Samuels, Hartford, N. Y.

(1)—Yes. (2)—Yes. Wind ten turns on a three inch diameter tubing, using No. 22 double cotton covered wire. This constitutes the primary. Then leave some space and wind forty-five turns with the same size wire, as used on the primary. This constitutes the secondary. (3)—Yes. See the answer to Mr. Churchill's query in these columns. (4)—Use a seven inch high, twenty-one inch long and eight or nine inch deep type. (5)—It is immaterial, which you use, as long as you place the coils, in such a way as to prevent coupling.

* * *

ABOUT HOW much power is consumed by the average telephone microphone? (2)—Please explain the operation and construction of a watchcase phone unit.—Charles M. Lenard, City Island, N. Y.

(1)—The telephone microphone uses about two and one-half watts. (2)—Usually a hard rubber composition is used to house the parts. At the bottom of this case, a horseshoe permanent magnet is placed. Through some means of bolting, soft iron pole pieces are attached on each end of this permanent magnet. These poles are bent up in a right angle fashion. On each pole a winding, containing thousands of turns of very fine enameled wire is placed, these being connected in series. Above the soft-iron pole pieces, a diaphragm made of thin soft iron is placed. This distance is usually about .0025 inches. As to the operation of the unit, when current is varied in these windings, corresponding variations in the magnetic field of the soft iron pole

pieces are produced. The diaphragm varies in unison with the variations, and reproduces the applied voice currents.

* * *

I HAVE constructed the one-tube set described in the University department of the Sept. 18 issue of RADIO WORLD. The results are fine. However, there is not much volume. Could I add a couple of stages of transformer audio coupling to get louder signals?—Milton Kosnick, Chattanooga, Tenn.

Yes. Use a pair of low ratio audio transformers. The P post of one of them is brought to the terminal of the phones, which formally went to the base of the crystal detector, while the other phone terminal is brought to the B post of the transformer. Use —01A tubes, with the proper automatic filament controls, also B and C voltages. The B voltages for these tubes, should not be made common with that of the radio frequency tube.

* * *

WHILE LOOKING over the scraps in my workshop I found that I had the following parts: one crystal detector of the fixed synthetic type; two .0005 mfd. variable condensers; a fixed radio frequency transformer, (200 to 550 meters); a double circuit jack; three .1 megohm fixed resistors, and three .5 mfd. fixed condensers of the mica type. Please give me the circuit diagram of a five tube receiver, using these parts with automatic filament controls on all tubes. (2)—I have a baseboard, eighteen inches long and six inches wide. Could I place these parts on such a board?—Wesley Churchill, Atlantic City, N. J.

(1)—The circuit diagram of this set is shown in Fig. 516. Two stages of tuned radio amplification are used. The crystal is used in the detector circuit. The resistors are used as a portion of a three-stage resistance coupled audio frequency amplifier. The .0005 mfd. variable condensers are employed in the RF stages. L1, the antenna coil, consists of fifty turns of No. 22 double cotton covered wire, wound on a three inch diameter tubing. This winding is tapped at the tenth turn from the beginning. L2, the primary of the second RFT, consists of ten turns, wound on a three inch tubing. The secondary L3 is also wound on this tubing, with a space of one-quarter inch. It consists of forty-four turns. No. 22 double cotton covered wire is used. L4 and L5 indicate the primary and secondary windings of the fixed radio frequency transformer. The filaments of the two radio frequency tubes are controlled by one-quarter ampere ballast resistors. The filaments of the three audio tubes are controlled by a single ballast resistor, which will pass three-quarters of an ampere. The one-half mfd. fixed condensers, C3, C4 and C5, are used in the audio stages as blocking condensers. R4, R6 and R8 are the .1 megohm resistors. R5 is a one megohm resistor. R7 is a one-half megohm resistor, while R9 is a one-quarter megohm resistor. The double circuit jack is used at the output of the detector circuit. A single circuit jack is placed at the audio output. The plates of the first two audio tubes are supplied with ninety volts, while the plate of the last audio tube is supplied with one hundred and thirty-five volts. A four and one-half volt C battery is used in the grid return circuits of the first two audio tubes. A nine-volt C battery is used in the grid return circuit of the last audio tube. The dotted line in the radio stages indicates that both these variable condensers can be ganged up, e. g., controlled by a single dial, if desired. The plates of the tubes in this circuit are supplied with sixty-seven and one-half volts. A filament switch, connected in series with the positive post of the A battery, disconnects as well as connects the A battery to the filaments of the tubes. It should be connected as shown in the diagram, viz., one terminal to the A battery and one terminal to the plus filament post of

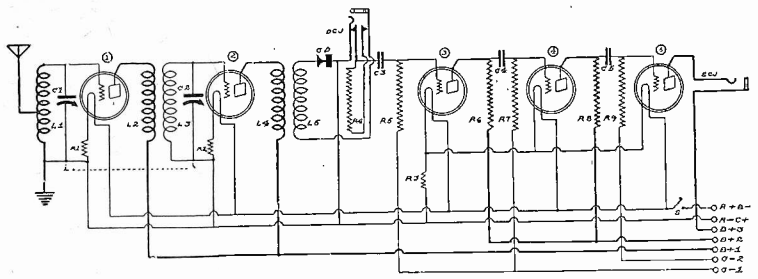


FIG. 516

The circuit desired by Wesley Churchill.

the last audio socket, all the plus filaments of the sockets being connected to this terminal. Be sure to connect the RF plate voltage to a separate post on the B batteries, as indicated in the diagram. The —01A tubes are to be used throughout the set. (2)—Yes, you can place the parts for this set on this board. You will, however, have to be very careful with the wiring, since the parts will be quite close. The variable condensers with the coils connected in these circuits are placed at each end of the board. The resistance couplers are placed in between. The sockets are placed in the rear of the board. The double circuit jack is placed in the left hand corner, of a seven by eighteen inch panel, while the single circuit jack is placed in the right corner of the panel. The filament switch is placed in the center, in between the two condenser dials. Flexible wire should be used in wiring.

* * *

TAKING NEW YORK City as a starting point, approximately how many air miles away, are the following places? (1)—Miami, Fla. (2)—Fort Worth, Tex. (3)—Spokane, Wash. (4)—Buffalo, N. Y.—Otto Faums, Seattle, Wash.

(1)—1,095 miles. (2)—1,398 miles. (3)—2,190 miles. (4)—291 miles.

* * *

WHO OWNS WBMS? (2)—Where is it located? (3)—How many meters do they use and what is their power?—Louis Gurrell, San Antonia, Tex.

(1)—Mack's Battery Co. (2)—60 South Cameron St., Harrisburg, Pa. (3)—360 meters, 500 watts.

* * *

WILL YOU please let me know if either of the following stations exist: WPAR, WEAR or WBAR, all operating on wavelengths between 250 and 265 meters?—M. Seldin, Flushing, N. Y.

The latest station lists do not show them.

* * *

MY FRIEND informs me that a Dublin newspaper back in 1898 received news of a Kingstown regatta in Dublin from the ship Flying Huntress via radio. Is this true? (2)—Can you give the exact dates?—Gerald Lesiworth, Jersey City, N. J.

(1)—Yes. (2)—July 20 to 22.

* * *

REFERRING TO the circuit diagram of the two-tube audio amplifier, using transformers, which appeared on page 18 of the Feb. 5 issue of RADIO WORLD (1)—Using two —01A type tubes, would it be all right to employ a rheostat having a resistance of six ohms; wound with wire having a carrying capacity of one and a half amperes? (2)—Would a four and one-half volt C battery suffice, when using ninety volts on the plates of both tubes? (3)—Would the insertion of a filament switch decrease the efficiency of the amplifier? (4)—Could this amplifier be built in a cabinet seven inches wide and about ten inches long? (5)—I have two, three to one ratio AFT. Can I use them? (6)—What is R2? What does it do?—James Franklin, Kansas City, Mo.

(1)—Yes. (2)—Yes. (3)—No. Place in either the positive or negative leg of the A battery. (4)—Yes. Place the transformers as far apart as possible. (5)—Yes, with very satisfactory results. (6)—It is a 50,000 ohm variable resistance. Control the volume.

* * *

IN THE Sept. 11 issue of RADIO WORLD, Radio University columns, page 13, there appeared the circuit diagrams of a two and a four-tube receiver, the two tuber employing a regenerative detector with impedance coupling, while the four tuber employed a non-regenerative detector, with impedance coupling and two stages of transformer audio frequency coupling. Now here's what I would like to do. Use the antenna stage system of coupling of the four tube set, with the regenerative detector of the two-tuber and the audio coupling of the four tuber. Could this be done with satisfaction?—Willard Johns, Passaic, N. J.

Yes.

THE RADIO TRADE

Patent Costs Called Serious Expense Item

Douglas Rigney Says Manufacturers, as a Matter of Prudence, Must Set Aside Reserve Fund to Take Care of Such Exigencies—Cites Garbled Situation in Courts

By Douglas Rigney

A. H. Grebe & Co.

Let us look with an entirely impersonal attitude on the patent situation as disclosed by actions now pending in the courts of this country. We have the Armstrong-De Forest feedback circuit situation, in which the courts themselves are not agreed as to who owns the invention. Suits are pending which will determine the patentability of the grid-leak and C battery under the Langmuir, Mathes and Lowenstein patents. The now popular tuned radio frequency type of receiver is enshadowed by the Alexanderson, as well as by the Rice, Hartley and Hazeltine patents, and the manufacturer of tubes, B battery eliminators, loud-speakers, each has his patent problem.

These are the patent rocks which are already charted and past whose dangers we radio manufacturers must steer our ships. Heaven and the Patent Office alone know how many sunken obstructions of this nature still lie in our path. You may well tell me that a problem of this kind is not a general one, that it is rather one specific to each business and changing with each business.

My point is not that the parties plaintiff in these patent suits are proceeding improperly in asserting what they believe to be their rights, nor do I assume that the parties defendant, in alleging that the patents in suit are worthless, are entirely without justification. What I do say is this:

As a general thing, the value of radio patents have been written up to such a point that it becomes a serious item in the cost of producing radio apparatus.

This item of cost must be taken into consideration, not only by the patent-owning manufacturer, who has set these extraordinary values on his books, not only by the licensed manufacturer, who can readily fix his patent cost, which, if he becomes licensed on any considerable number of patents, is extremely high, but also by the radio manufacturer, who, finding himself sued, is obliged, by reasons of business prudence, to set up on his books a reserve to take care of the possibilities of litigation.

Trade Notes

Norfolk, Va.

Archibald Hosier, prominently connected with the local radio industry for the past three years, recently took over his new duties as assistant to C. E. Card, manager of the radio and phonograph departments of Paul-Gale Greenwood Company.

Mr. Hosier is one of the best known radio engineers in the city being licensed radio operator and having served during the war as a navy operator. For the past few months he has been connected with the Radio Corporation of Virginia.

* * *

St. Louis, Mo.

Owing to an increase in the demand for radio accessories and sets, in the radio department of Barney's Army store at Tenth street and Washington avenue, this department has been enlarged. The radio department is under the supervision of Sam Wade, well-known St. Louis radio authority.

* * *

Kokomo, Ind.

The Wolf manufacturing industries of Quincy, Ill., recently purchased the former main plant used by the Apperson Brothers Automobile Company, for the purpose of increasing the production of phonograph and radio cabinets. About 250 people are employed by this company.

* * *

Elizabeth, N. J.

John M. Norr, Jr., has announced the establishment of a store at 1197 East Grand street, near Broad street, featuring radio and household electrical appliances.

A graduate of the Elizabeth schools, Mr. Norr attended Lehigh University, specializing in electrical engineering. For five years he was affiliated with the electrical service departments of several of the prominent plants in this city. For the past six years he has been allied with the retail departments of Elizabeth stores featuring radio.

Mr. Norr's experience in radio dates back to 1909, for he was one of the originators of the old Union County Wireless Club before the radio achieved its prominence of today. His knowledge of it placed him in a position to act as code instructor at one time.

Mr. Norr who is a son of John M. Norr, Sr., former merchant, will have associated with him in business, his brother, Martin F. Norr.

World A Power Unit Gives Steady Service

The new World A Power Unit manufactured by the World Battery Co., Chicago, Ill., consists of a combination trickle charger and a specially designed 60-ampere storage battery, which automatically supplies even, everlasting current for any set, up to a 10-tube set. It can be used on either a 25 or 60 cycle, 110 volt AC line. An automatic switch is installed on the unit. When this switch is thrown to the "on" position the set is connected, while the line is disconnected. When it is turned to the "off" position, the set is disconnected from the battery, the battery being connected to the charging unit, which in turn is connected to the line. The charger starts to charge at ½ amperes, but tapers down to ¼ ampere, so that as battery approaches full charge, the current is reduced accordingly.

Flanagan Succeeds Ruark as Secretary

The resignation of B. W. Ruark as executive secretary of the Radio Manufacturers Association, Inc., was presented and accepted, at a meeting of the Board of Directors held at the Cleveland Hotel, Cleveland, Ohio.

At that meeting Martin F. Flanagan was elected to succeed Mr. Ruark and immediately took over the duties of the executive secretary.

Manufacturers Carefully Set New Standards

By A. J. Carter

Chairman Standards Committee R. M. A.
President of Carter Radio Company

There has been recently a great deal of comment through the medium of the press regarding the need for standardization in the radio industry. It is apparent that the radio public does not realize what great strides already have been made. Neither do they appreciate what a vast amount of research is required.

Great care must be taken to prevent standards from being adopted that will limit or retard the development of new products and ideas. Consequently this is a task that can be done only by engineers who have had experience in every phase of the industry.

The Radio Manufacturers' Association is ideally equipped to carry out this work since it is composed of the principal and representative manufacturers of the Radio Industry, consequently having the support and co-operation of their engineering departments.

The work is being carried out systematically by means of sub-committees composed of engineers and representives of interested manufacturers. Public opinion and that of manufacturers is solicited by means of questionnaires. This information, supplemented, by the experience of engineers forms the basis of a recommended standard specification which is submitted at a regular meeting for final acceptance.

Sub-Committees have been formed to investigate the following subjects. Many of their recommendations have already been adopted; others will make their reports at subsequent meetings.

1. Wiring Devices (Cords, colors, cord tips, etc.).
2. Variable Condensers and Dials.
3. Rheostats.
4. Transformers.
5. Plugs, Jacks and Switches.
6. Sockets.
7. Receiving Sets.
8. Vacuum Tubes.
9. Test Instruments.
10. Arrestors and Aerials.
11. Panels.
12. Resistance Units.
13. Fixed Condensers.
14. Radio Wiring for Buildings.

New committees are being formed from time to time and this work will be carried on indefinitely. It is the aim of the R. M. A. eventually to standardize the entire industry.

The co-operation of the institute of Radio Engineers and the excellent support of the industry as a whole have resulted in bringing about, in two years, a degree of standardization that required from six to ten years in the automobile and other industries.

It would be too lengthy to give details regarding the benefits already derived from this work. One of the most important effects, however, has been the tendency toward stabilization, which is brought about in the following manner.

The raw material supplier is benefited because there is a greater demand for standard material. Consequently he can anticipate demands, carry a larger stock, and give better deliveries at a reduced cost.

The manufacturer having a ready source of raw material can keep his plant running constantly, make prompt deliveries, thus preventing cancellation of delayed orders.

Radio misfits have practically ceased to exist. Parts are interchangeable, therefore the dealer and jobber are not required to carry duplicate stocks of parts. The manufacturer has, in this way, earned the confidence of the trade. In view of this, the jobber and dealer are likely to order in advance of the consumer demand.

Kroblak Resistors Made for Heavy Duty

With the advent of socket power equipment, so popular this season, the demand for resistances to carry large currents was hard to fill. Manufacturers and jobbers, especially the latter, could not obtain material in sufficient quantities to fill their requirements quickly. As the sources of supply were few, this unexpected demand taxed the facilities of those factories which were equipped to manufacture such devices.

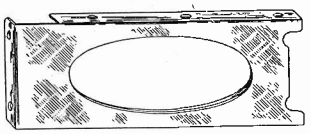
The announcement of the new Kroblak heavy current wire wound resistances, which are being distributed in the East by Tilson and Tilson of 154 Nassau street, New York City, should be of considerable interest to manufacturers and jobbers whose present sources cannot fill their requirements.

These units are designed to carry ten watts continuous load. The newly developed heat resisting Kroblak and the engineering behind these units make them a dependable device. Being specified on many of the new power amplifier and eliminator combinations, such as the new Thordarson compact, these resistances should prove interesting to dealers handling parts for these combinations.

Battery Cable Markers

Blan, the Radio Man, 145 East 42nd Street, New York City, has brought out and placed on the market a new and useful system of identification for all leads entering into one's radio equipment. Enough markers for a complete set are contained on a strip of tough, durable, muslin, specially treated, 7½ inches long by 2 inches wide. This is subdivided into ½ inch strips which fold around the wire or cable lead of any kind being securely gummed and forming a stiff marker showing marking on both sides, easy to read from any angle, flexible and avoiding any danger of short-circuiting or introducing losses where leads are fastened in set. Fifteen markers are provided, including ground and aerial and allowing for any system with or without power tubes. C battery voltages are provided for 4½, 9 and 40½ volts. The list price of these markers is very low and they provide a good means of insurance for the radio set. Blan is constantly bringing out new ideas and it is the boast of his army of customers that if there is anything new under the sun in radio, Blan has it.

Subpanel Bracket Is Sturdily Made



One of the neatest jobs in sub-panel brackets, sturdy, durable and adaptable to every bracket need is the American Sub-Panel bracket put out by the American Radio Hardware Company, 135 Grand street, New York City. This sub-panel bracket is constructed of aluminum and is so designed as to accommodate 41 different types of transformers underneath the sub-panel. While light in weight, it will stand the utmost in pressure and will carry the maximum weight superimposed upon any sub-panel. The metal of which it is composed is non-magnetic and it is designed to fit a 3", 5" or 7" sub-panel. It will find a wide use in radio receivers and battery eliminators of all types. It is sold complete with screws and nuts at a very low list price.

Victor Company Admits Its Big Debt to Radio

President Shumaker Says Broadcasting Art Prompted Development of Electrical Recording, and Cites $17,000,000 Sales of Combination Radio and Talking Machines—Sponsored Programs Prove Effective, He Reports

That radio and the talking machine are allied industries, rather than competitors, was the statement of Edward E. Shumaker, newly elected president of the Victor Talking Machine Company. This statement was made in connection with his announcement that during 1926 the Victor Company manufactured and sold combination radio-talking machine instruments having an aggregate value at retail of more than $17,000,000.

"Radio has a definite place in home entertainment today which improvements in receiving sets and broadcast programs are rapidly making even more secure," said Mr. Shumaker. "When I say that radio has made and is still making significant contributions to the talking machine industry I am only stating facts which are amply supported by evidence.

"In 1924, and the early part of 1925, when the talking machine industry was at a low ebb due to its failure to improve its products, the general impression was that recorded music was being replaced by radio broadcasting. Subsequent developments have demonstrated clearly that such was not the case. The other side of the picture is that radio pointed the way to the development of electrical recording, which made possible, for the first time, the engraving of the complete range of musical sound upon a record.

The United Interest

"When it was found that these new electrical records contained more music than existing talking machines could reproduce, scientists developed new instruments which immediately revolutionized the industry."

Anything that makes people listen to more music is of direct benefit to the entire musical industry, Mr. Shumaker contends.

"Newspapers and books may be used as an analogy for the radio and recorded music," he stated. "Radio furnishes a vehicle for something that is happening at the moment. The talking machine, on the other hand, provides a library of the world's best music, and makes possible the hearing of the desired artist or entertainer, and the desired musical selection at any time. It was upon this theory that we decided to produce combination instruments embodying radio receiving sets and talking machine reproduction. The fact that we sold $17,000,000 worth of such instruments last year, at retail value, seems to indicate that our theory is sound.

"It is also a fact that thousands of new talking machines which are not equipped with radio receiving sets are being sold annually in homes which also contain radio sets. I have stated that we did a business in so-called radio combination instruments equivalent to $17,000,000 at retail selling value. It is well to note, however, that this amount represents only a part of our business—in fact only approximately one-sixth of the total. The remaining five-sixth represents our sales in talking machine products.

The Economic Problem

"The question as to who is to pay for radio broadcasting appears to have been temporarily solved. The bills are being met by those who benefit directly from it. While I do not believe that the broadcasting of radio entertainment can be made to take the place of other established forms of advertising, it is an additional medium for creating demands for some products, and a good-will builder when properly used. We have found that the broadcasting of Victor recording artists results in an immediate and traceable demands for their records. We are convinced, also, that anything we may do to raise the standards of radio programs will be reflected in a healthier condition in our business and in other branches of the music industry.

"Radio and the talking machine may at times appear to overlap somewhat. In actual practice they do not overlap. Each has its own place as an instrument for home entertainment. This is borne out by the experience of more than 6,000 Victor dealers in the United States."

Mr. Shumaker believe that those who contend that radio interest is waning are thinking back to 1924, when there was a condition bordering upon radio hysteria. Today, he says, interest in radio has become something substantial, from a commercial standpoint. Cheap, unsatisfactory sets are becoming fewer, and the public is insisting upon radio receivers which provide good tone quality, just as they have insisted upon improved talking machines and records.

A Phonograph Pick-up

Concluded from page 7)

at the side of the turn-table of the phonograph, and the dowel must be long enough to reach over the record. The fork acts as a swivel so that the dowel may be rotated both in a horizontal and a vertical plane.

Fig. 9—The phonograph end of the dowel is shown in this photo. The handle of the pick-up units is run through the dowel in a vertical direction, and the lead-in cord is tied to the dowel by means of thread.

Fig. 10—Now the pick-up unit must be connected electrically to the input of the audio frequency amplifier in some convenient manner. The two terminals from the pick-up unit must be connected to the grid and the filament terminals of the detector tube. In this case the detector becomes the first amplifier tube in the system. There is a very simple way of doing this. Take a burnt-out CX tube and break the glass off, or remove the base. Connect one of the leads of the pick-up unit to the grid prong on the base and the other terminal to the minus A prong of the base. Solder the terminals at the ends of the prongs and trim neatly. Now tape the base and lead-in cord so that the base may be used as a convenient plug. To connect the pick-up unit to the amplifier an additional socket will be required, room for which may always be found in the radio set. Connect the grid terminal of this socket to the grid terminal of the detector tube, without touching the grid leak and condenser and connect the minus A terminal of the new socket to the same terminal on the detector tube, or on any of the other tubes in the amplifier. Now to connect the pick-up unit to the amplifier just insert the plug just described into the new socket. This connects the proper terminals automatically and the detector tube in the set becomes the first amplifier. It is not necessary to touch the grid leak and condenser, because these have very high impedances for audio frequencies and will have no appreciable effect on the input. It makes no difference how the grid return is connected. The new connection is correct for making the detector tube into an amplifier. It will be observed that if the grid return is to the positive terminals of the filament the new connection will put the voltage of the A battery across the grid leak, but this will do no harm.

Fig. 11—This photo shows how the terminal plug is inserted into the auxiliary socket in the set.

Fig. 12—The pick-up from the phonograph record is likely to be too great for the loud speaker, especially if there are several stages of amplification. A volume control is necessary to control it. If there already is one in the audio amplifier, none other is necessary, but there are many receivers which do not have a volume control in the audio circuit. Hence a control may be installed in connection with the pick-up. The simplest is to connect a modulator plug across the pick-up terminals as shown in this photo. This picture also gives an idea of the finished arrangement and how to use it.

Fig. 13—This picture shows how the unit is placed on the record on the phonograph turn-table and how the anchor bottle is placed on the side, with the dowel connecting the two. See front cover.

Judge Heads Club for the Fourth Time

Butte, Mont.

For the fourth successive year, Judge W. E. Carroll, one of Butte's first radio enthusiasts, was elected president of the Butte Radio club at a meeting of that organization held recently. Judge Carroll was not a candidate to succeed himself but by unanimous vote he was requested to continue in office.

John R. Bartlett was elected vice president and re-elected chairman of the program committee.

The secretary treasurer is Moses R. Cooper, Mr. Cooper being elected to succeed himself.

Carl J. Trauerman was re-elected director of publicity. He appointed Ray Lomas as assistant director. Andrew Monroe and Oscar Stranstrum were appointed members of the committee seeking to eliminate interference with radio reception in Butte. Dan Georgevich was named as a member of the entertainment bureau.

It was announced that the club will take a census of receiving sets in Butte. Judge Carroll, is to name the census takers.

AT YOUR SERVICE

[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.]*

Transformer Action

Every radio fan knows what a transformer does, but few know how it is done. Perhaps a better appreciation of transformer design may be had if the action which takes place within a transformer is explained.

To explain this, we must go back to elementary physics. You have probably heard of the laboratory experiment in which the pole of the magnet is plunged through the center of the coil of wire, the ends of which are attached to a galvanometer. A deflection of the galvanometer needle will be observed. This is the simplest experiment to perform, and on it the action of the dynamo or generator is based.

Similarily, if two coils are placed in proximity to each other, so that there will be a coupling between their electric fields, and an alternating current is sent through one coil, a galvanometer attached across the terminals of the second coil will show that current is induced in that coil. If these coils are wound upon an iron core, which is common to both, the deflection of the needle will be greater, showing that the force which induces the current in the second coil travels better through iron than through air.

Now, a transformer is nothing more nor less than two coils of wire wound upon an iron core and closely coupled (inductively) to each other.

In the primary coil of an audio frequency transformer, there is a constant flow of direct current supplied by the B battery. This current pulsates, and these pulsations are transferred to the secondary. In a transformer which employs a 3-to-1 ratio the pulsations are stepped up to approximately three times their original magnitude, and so on for the different transformer ratios. The pulsation which is induced in the secondary of the transformer is impressed upon the grid of the succeeding tube and causes the grid to vary in potential, thereby controlling the electronic flow and plate current through that tube.

If the plate current through the primary of the transformer is quite great, and the transformer improperly designed with too small a core, the core will be constantly more or less magnetized, and the pulsations of the plate current will not so readily be transmitted to the secondary. Distortion will result. In cases of this sort the addition of a choke coil and condenser can be used to remedy the defect. Its connection may be described as follows: From the plate of the first tube a connection is made to one side of the choke coil, the other side of which is connected to the positive B battery. Another connection from the plate is made to one side of a 1 to 3 mfd. fixed condenser, the other side of which is connected to the plate terminal of the transformer. The B terminal of the transformer is run to the negative A battery and the secondary of the transformer is connected to the following tube in the usual manner. You will see from the description how the B battery current is kept entirely out of the transformer windings. The action is similar to that in the output impedance.

With a combination such as this, it is physically impossible for the transformer to be burned out. You who have burned out transformers, undoubtedly have found that the side which is damaged is almost invariably the primary. There is little or no current in the secondary.

A point which it might be well to bring out here is the fact that, although a transformer may step up voltage, it cannot step up wattage (watts equals volts times amperes). In fact, the number of watts which will be supplied by the secondary of the power transformer is never equal to the power consumed by the primary transformer. In other words, there is a loss. If there were no loss a 3-to-1 step-up transformer with 3 amperes at 100 volts on the primary would supply 1 ampere at 300 volts on the secondary. A step-down transformer with the same ratio and the same power applied to the primary would supply a secondary current of 9 amperes at 33 1-3 volts.

QUESTIONS AND ANSWERS

I AM herewith enclosing a diagram of a five-tube set which I have built, but which does not work satisfactorily. It looses volume on the lower wavelengths. Also when a station is tuned in with VC2 which shunts the three-circut tuner then VC1 is changed it also changes the setting on VC2. I have had to place resistances and condensers at various places to cut out howling. The regeneration was very critical until I placed .5 meg. resistor across the tickler coil.

I would also like to do away with the variable condenser VC1, which is from the grid post of the Acme R3 to the grid post of the three-circuit tuner, but this causes a howl and distortion.

I have tried various hook-ups, some

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similar to this with a stage of tuned RF ahead of the detector, and the untuned stage first. Also have tried leaving off the untuned stage, but all in all when I get the set to a point where it is not distorted, there is hardly enough volume to work the speaker.—C. E. Anderson.

In the diagram which you sent, you state that VC1 is a .0005 SLF variable condenser and the connections shown indicate that a neutralizing condenser is what should be used. I believe the connection of VC1 is to a tap on L2, about fifteen turns from the filament end. It would work somewhat better, also, if you were to replace the antenna coil you are now using with a more usual type of antenna coupler, shunted by a .0005 variable condenser. Were you to run the grid lead to the negative A rather than to the negative C, you would probably get more volume.

* * *

IN YOUR article in RADIO WORLD of Jan. 1, in column two, tenth line down, it reads, "are run to the negative B battery terminal." Should it not read "C battery terminal"?

I have much pleasure in letting you know that I enjoy your articles very much. They are just what is needed for the radio "bug".

In an ordinary three-circuit regenerative set with tickler coil, is it possible to tune the secondary with a 43-plate variable condenser and what number of turns would be necessary on a 4 inch diameter tubing using number 22 DCC wire?—Wm. Blake.

The line you mention was a mis-print. It should read "negative C battery terminal." In regard to your other question I would say that you would have considerable difficulty in tuning with a 43-plate variable condenser. As you will realize, a slight change in the dial setting will give a greater capacity change than would a corresponding movement if a 23-plate condenser were used. The only table I can find for the inductances you would have to have with a .001 mfd. variable condenser, is for honey-comb coils. It says that a 35 turn honey-comb coil wound with No. 24 SCC wire will cover the band from 200 to 515 meters when used with a condenser such as you have. These coils have an inside diameter of 2" and are 1" wide. I would suggest that you acquire a condenser with the proper capacity to work with your coils rather than trying to change your coils to match your condenser. If you do this you will also have to change the primary and tickler coils correspondingly.

* * *

I HAVE read with interest your article in RADIO WORLD and allow me herewith to present to you for your convenience the troubles arising from a set I built for a friend of mine about a month ago:

TYPE OF SET—The Diamond of the Air four-tube model. This set was built in a humidor, 10 inches high, 8½ inches wide and 7 inches deep, a CX-112 tube being used in the last stage with 135 v. B and 9 v. C, the remaining tubes being 301-A. Also an output transformer (Pacent) is used to protect the loudspeaker.

Trouble 1—The set worked well as far as the the first stage of audio. The last stage of audio emitted a high pitched, continuous whistle such as you described in your article in RADIO WORLD. As soon as I put my finger on the grid of the transformer, the whistle stopped. I therefore put a fixed condenser .002 across the secondary of the transformer. The whistle stopped, but the volume was decreased. Putting this fixed condenser across the primary of the transformer had no effect. It had only effect when put across secondary or from grid to plate of transformer.

2—I noted that when I tried to vary the detector voltage, in the process of taking the wire from the 45 tap to 22½ tap, that is after I had already put the wire on the 22½ tap, the music stopped and a loud knocking was heard in the loudspeaker which I could not stop unless I turned the set off and on again or turned the tickler over the point of oscillation and back. I also noted that this happened only when using 135 v. of B on the last tube.

3—Some time ago a friend told me that his set stopped suddenly one night and nothing could be got out of it although my own set was working fine. My set is of the same type. He also told me that he tried varying the voltage of the detector tube when this happened and when the wire was taken off the tap, he heard a hum in the loudspeaker.

I would appreciate it very much if you would enlighten me as to the causes of the above troubles and the remedy for them.—Hyman Sobel.

Trouble No. 1. Try putting a .5 or 1 meg. grid leak or a .001 mfd. fixed condenser across the secondary of that transformer. Also try using a .002 mfd. fixed condenser across the primary or secondary of the first transformer.

Trouble No. 2. You do not say if, after the set had been turned off and on again, the knock was eliminated. Does this happen after you turn the set on or just that one time when you varied the voltage? I would suggest that it may be caused by an open grid circuit in any one of the stages. This also applies to trouble No. 3, and the remedy for this, if it is the trouble, is to repair the grid circuit.

* * *

I HAVE just built a Victoreen two-dial set and wish to use a power tube in the last socket audio. I have a UX-171 for this purpose and Majestic B. Can you please tell me what changes to make in wiring or will an adapter socket do as well as a change in the wiring.

I am a subscriber of RADIO WORLD and think it the best weekly I have found yet.—Dale Slack.

An adapter socket will enable you to use a CX-371 or UX-171 in the last stage successfully. If you do not want to use an adapter, you will find that by disconnecting the grid lead of the last transformer and run it to the higher voltage C battery, and by disconnecting the B battery lead to the loudspeaker and inserting the additional battery needed to raise the voltage your object will be accomplished.

Thus, you see, the higher B and C voltage which your tube requires will not affect any of the other stages.

Variable Resistor Aids In Achieving Quality

Use a Power Tube in Final Audio Stage and Connect the Resistance in Series with Speaker Lead and an Output Post of Set

By William H. Fine

Sound is a sensation received by means of the ear and is produced by the vibrations of the air or other medium with which the ear is in contact.

In analyzing sound, it is found to possess three distinct characteristics, namely:—quality, pitch and volume. Quality denotes whether or not the sound is pleasing to the ear; pitch, whether or not it is high or low in tone, while volume signifies whether it is soft or loud.

Sound is therefore a deciding factor in the general usefulness of radio as a satisfactory medium for entertainment. In other words, the complete value of radio in the home is dependent upon the extent to which the receiving set's capability is reflected by the quality of reproduction.

While all present day improvements in amplification, tone quality and loud speaker construction are marked advancements toward perfect reproduction, however, the average radio fan of limited means, who has either built his own receiver or possesses a medium-priced factory-built set, does not, a rule, feel inclined to spend an additional large amount of money for new transformers or special power amplifiers in order to bring his set up to present day efficiency and as a matter of fact, as explained in the following text, it is not absolutely necessary.

Quality Improved

For increasing quality, a CX-112 tube can be used in the last audio stage of practically any receiver without the necessity of making any radical changes in the present circuit wiring. While the 112 type of tube requires at least 135 volts on the plate for maximum efficiency and a small C battery for grid bias (9 volts negative) one will feel amply repaid for the small expense involved by the results obtained. In some instances a slight change in the wiring of the last audio stage may be necessary in order to accommodate the C battery but this should not prove a difficult task for the average radio fan.

For improving tone quality, eliminating distortion and refining the reproduction in general, numerous methods have been suggested from time to time, all with equally varying results. However, regardless of the kind of audio amplifier used in the receiver, whether it be transformer, resistance, or impedance coupled, and without laying special stress on any particular type of loudspeaker, a tried and proven method which is simplicity itself and can therefore be tried by every radio fan at small cost with positive assurance of highly satisfactory results, follows: Get a variable resistance of ap-

HOW THE TRANS-OCEAN PHONE WORKS

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

proximately 75,000 ohms and connect it between one tip of the speaker cords and one of the output terminals of the receiver. This method will be found to prevent distortion due to overloading the loudspeaker and improves tone quality to a marked degree by helping to match the impedance of the loudspeaker to the output impedance of the set. It also materially reduces interfering set noises and acts as an additional volume control, this last feature being particularly desirable when loudspeaker is placed some distance from the receiver.

A device that serves the purpose well is a Centralab Modu-Plug, a small, compact, variable resistance of just the right ohmage for maximum results and which, due to its construction, can be connected into the circuit by anyone without tools. As a matter of fact, this special unit is made in two distinct types:—one for use with receiving sets employing a standard loudspeaker jack on front of panel and a cord type for use with pin type jacks or where the loudspeaker is attached directly to binding posts inside of set.

40-M. Messages Sent By General Motors

Using a wavelength of 40 meters, the General Motors Export Company is constantly in communication with its branches in Valparaiso, Buenos Aires, Montevideo, and Soa Paulo in South America. The engineers of this company have found this wavelength to be the most efficient, the static and commercial code interference being at a minimum. Reports on the fluctuation of the market are sent to and from these posts. This is the first time a company has used radio for communicating with its posts in distant points. The cost, the officials say, is very low and is efficient. They expect this method to decrease the cost of cables and telegrams.

Radio Church Sends Sermons to Shutins

So that New Hampshire aged and shutins may hear services in the morning and in the evening, a Radio Church, call letters WBRL, has been established by the Congregationalists of Tilton and Northfield, N. H. The Rev. Marshall Dawson, formerly of Brooklyn, N. Y., is the minister. He serves without salary. Through subscriptions, mony is raised to pay for music, telephone and other running costs. Representatives of other religions are being invited to appear before the mike of this station.

Letters received from many invalids prove that this station is a very popular one, many of these folks appreciating religious sermons of the simple style only, jazz and other types of popular music being greatly denounced.

Coupling Terms

The term capacity coupling is not a suitable one, though it is almost universally used. Likewise the term inductive coupling is not used with 100 per cent. correctness. Instead of using the term capacity coupling it would be better to use the term electric coupling. And instead of using the term inductive coupling for the coupling between two coils, it would be better to use the term magnetic coupling. Inductive coupling may be either electric or magnetic. But the term inductive coupling has become established through inductance.

Amazing New 5-Tube Radio At Very Small Cost Improves Reception 100%

New York City, N. Y., (Date .....)—Lieut. Sterling G. Sears of the U. S. Naval Reserves has perfected a marvelous new 5-tube Radio that improves average home reception about 100%. Due to special features, this Radio is extraordinarily selective and powerful, easy to operate, very economical on Battery consumption—and costs only about one-third of the usual price of 5-tube machines. Perfect satisfaction absolutely guaranteed, and a 10 day Free Trial offered to all who wish to try it. Full information together with reports of tests made by experts will be sent FREE to all who write at once to Geo. W. Naylor, Jr., Dept. 315MA, 161 Chambers St., New York City. Write today—no obligation!

The Choking Effect of a Filter Coil

The degree to which a filter coil suppresses the ripple voltage on AC depends very largely on the resistance into which the filter works. A choke coil working into a very high resistance such as a grid leak has no appreciable choking effect, that is, it is not really working. If the coil works into a very low resistance, or negligible resistance, the choking effect is very great. Also if the coil works into a large capacity condenser, the choking effect is very great.

The choking effect of a coil may be shown very easily by means of Ohm's law. Suppose that there is voltage E (on AC) in series with a choke coil of inductance L and resistance R and a load resistance of resistance r. The AC voltage across the load resistance r is then by Ohm's law equal to E divided by the square root of $[(1+\frac{R}{r})^2+\frac{L^2w^2}{r^2}]$. The first term of this quantity is the loss part and the second is the reactance part. The first part does not contain the frequency w and hence that term is the same for all frequencies. The second term contains the frequency and this then varies with frequency. The larger this term is the bebtter is the choking effect. But it cannot be large if the load resistance r is large. Suppose that the frequency is 60 cycles, that is, w equals 377. Also assume that the choke coil has an inductance of 50 henrys and a resistance of 100 ohms. Now assume a load resistance of 100 ohms. The voltage across this resistance then becomes very nearly E/128, or it has been reduced to less than 1 per cent. of the input voltage. Now suppose that the load resistance is 10,000 ohms. The voltage across the load resistance then becomes E/2.14. The voltage across the output is about 50 per cent. of the input voltage, which is not a very great reduction.

Again suppose that the load resistance is one megohm. The voltage across this resistance becomes E/1.00018, that is, the voltage has been reduced by only about 2 per cent. of 1 per cent.

Wired Radio Planned By Phone Company

Sidney, O.

The Western Ohio Radio Equipment Company was recently incorporated. It is a division of the Sidney Telephone Company. The new company was organized for the purpose of buying, selling, manufacturing and leasing radio equipment.

The company will lease complete radio outfits to subscribers that can be operated by them or it will lease, at a cost of two dollars per month, radio equipment that is operated for them through the wire system of the Sidney Telephone Company.

On this latter system, an attendant will be on duty twelve hours a day from ten o'clock in the morning to one o'clock in the afternoon and from three in the afternoon to eleven in the evening. This service will be extended after eleven o'clock if the request is made before eight o'clock of the same evening. An installation charge of ten dollars will be made.

The leased service has been in operation for quite a while and over one hundreds sets have already been installed and have proven very satisfactory.

BROADCASTS INTERFERENCE TALKS

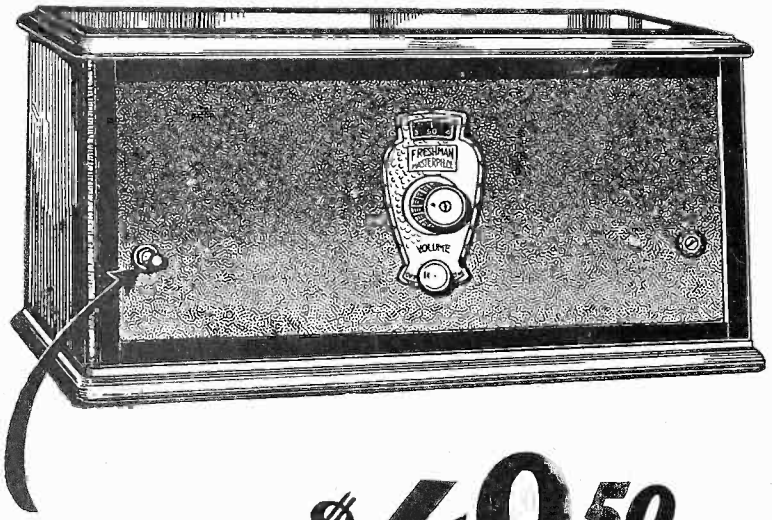
Fans will be particularly interested at this time in an interesting series of talks on interference problems being radiated by WAAT, Jersey City, New Jersey, every Sunday evening from 7 to 7.15. These talks are given by Frank B. Brenner.

THE 4-TUBE DIAMOND

How to build this very efficient circuit described by Herman Bernard in the November 20, 1926, issue of RADIO WORLD. Send 15c for a copy. Blueprint of 4-tube Diamond, $1.00 extra. Send $1.15 and get both. Or send $6 for a year's subscription to RADIO WORLD and get both the blueprint and the Nov. 20 issue FREE. RADIO WORLD, 145 West 45th Street, N. Y. City. —Advt.

a NEW radio that "gets" everything!

Six tubes ~ One control



MERELY turn the dial from point to point and station after station comes in separately, clearly and distinctly. The one dial is the only tuning device on this new Freshman Radio. Its amazing power allows stations from a great

Distance

to be tuned in right through the locals. Its superior construction and efficiency separate the different wave-lengths and tune out the undesired stations with startling

Selectivity

allowing you to listen to exactly the station that you desire without bother or interference and with fine

Tone Quality

which is the result of scientifically constructed audio transformers perfectly designed and co-ordinated to match this powerful radio.

$49.50

Distance

Distant stations often broadcast on exactly the same wavelength as locals. This new Freshman set is so powerful that it brings in stations from all over the country. Sometimes it is desirable to cut out the distant station broadcasting on the same wavelength as the local to which you are listening; if so, just pull out the distance switch indicated above..

Six tubes ~ One Control

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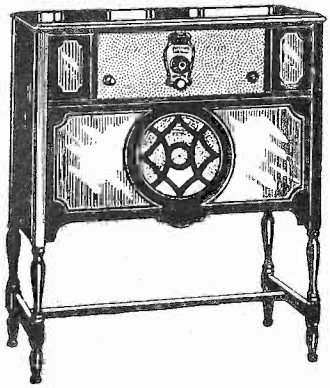
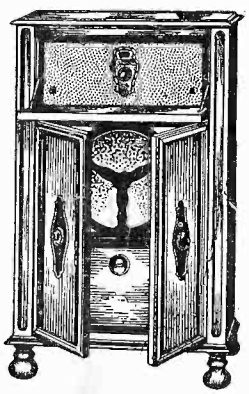
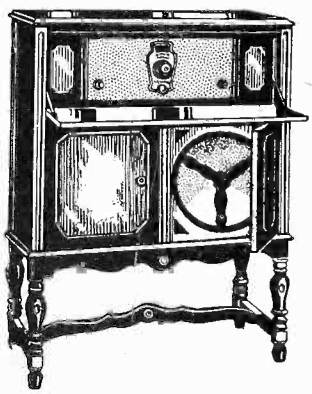


Panelled in genuine mahogany. Built-in cone speaker. Spacious battery compartment **$79.50**



A distinctively beautiful radio panelled in genuine mahogany. Large built-in cone speaker **$99.50**



This massive consolefis panelled in genuine mahogany. 12-inch cone speaker..... **$109.50**

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