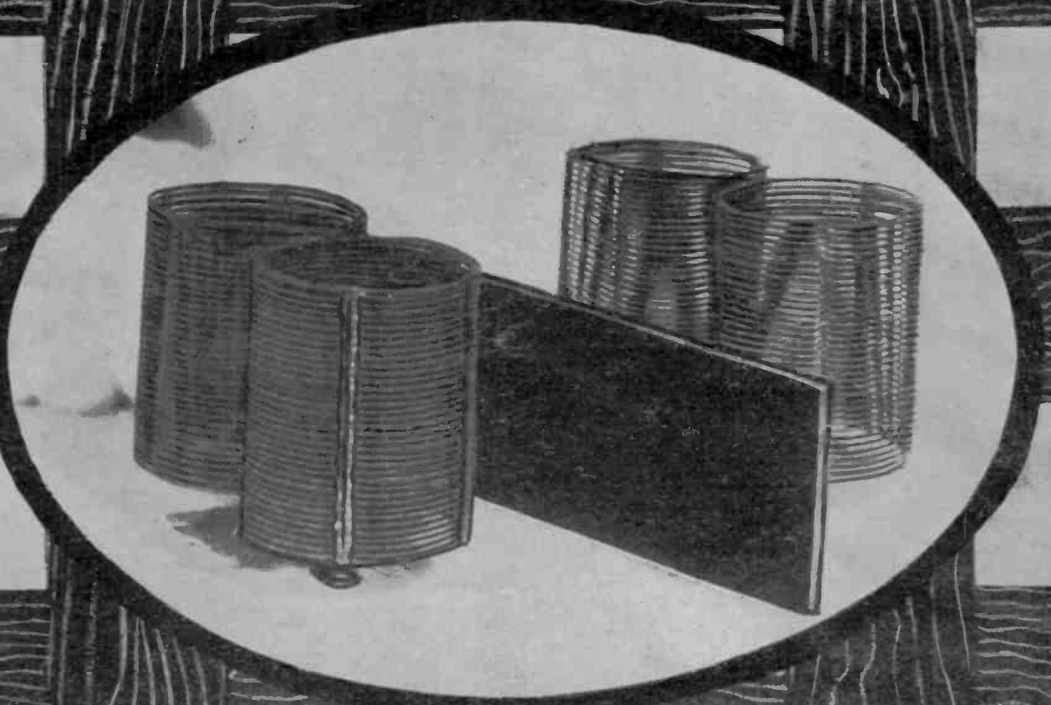
Feb. 26 15 Cents

RADIO WORLD

REG. U.S. PAT. OFF.



Insulation Tests
See Page 4

Vol. X
No. 23
Whole No. 257
FEBRUARY 26, 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 8558 and 0559

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

First Television Hookups
Elucidate Alexanderson and Baird Plans

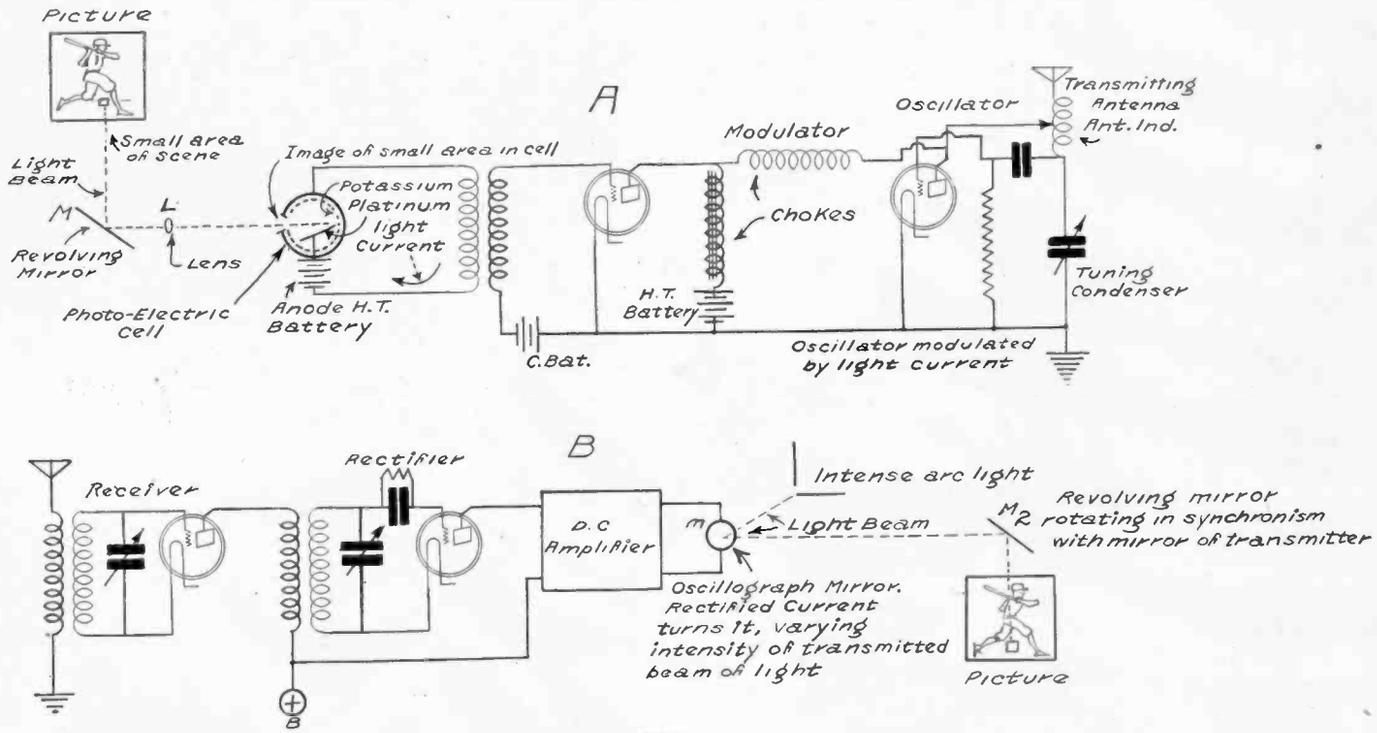


FIG. 1

(A) schematic diagram illustrating the method used by Alexanderson in transmitting a picture by radio waves at a rate of speed approximating that required for television. (B) schematic of the receiver used in Alexanderson's method for receiving and reproducing the picture.

By Hector Wall

AT THE rate at which television experiments are progressing and the keen interest manifested by the public in the progress in this new field, it will not be long now before the radio fan will be able to look in on an event transpiring at a distant point as well as to listen in. He will probably be able both to listen and to look in by tuning in with a single radio receiver. Not more than a year ago this seemed a long way in the future but recent progress in the art has so advanced the calendar that it is now not a matter of a long time, until refinements of technique are achieved.

There are several methods of tackling the problem of television, all fundamentally based on the transmission of still pictures at a very high rate of speed. The technique of transmission of still pictures has been worked out to a point where a picture may be transmitted in about ten minutes with a definition of the reprint almost identical with that of the original photograph. To make television practical the technique of transmission and reception of stills must be developed so that one complete picture can be transmitted with satisfactory definition in about 1/16 of a second. That is, the speed of sending and receiving stills must be increased about 10,000 times. This goal is now within sight.

Based on Unit Scanning

All the methods now used in television experiments are based on the unit scanning process of the picture to be transmitted. The picture is transmitted bit by bit and is reproduced in the same way. It is broken up into a very large number of small areas. Then all of these areas are given a chance to record their light on a photo-electric cell, successively and in regular sequence. The reproduction of the transmitted picture is done in the same sequence and is done synchronously with it.

There are four methods of scanning a picture which have been suggested and tried. One of these is the process used by Alexanderson. It consists of twenty-four mirrors mounted on the periphery of a rapidly revolving drum. Each drum covers a complete narrow strip of the picture. The twenty-four mirrors are so arranged that they cover the width of the entire picture and the entire picture is covered as many times per second as the drum revolves. Actually each mirror handles seven strips, side by side, instead of one, but that is merely to increase the speed. For a given rate of transmission the use of seven scanning strips with each mirror enables the speed of the drum to be cut down to 1/49 of its necessary speed when one mirror handles only one strip at a time.

Baird's Method

The second method is that employed by Baird in England. He uses a revolving disk having a number of lenses mounted on the periphery. These lenses are set at such angles that when the disk revolves the picture is covered by strips as in the previous case. Each lens focuses a certain area of the picture on the photo-electric cell, and as the disk revolves the image of every little area on the picture is sent into the photo-electric cell in turn.

A third method is that employed by Jenkins of Washington. He also uses a revolving disk for covering the picture, but instead of having lense he uses prisms set at appropriate angles. These prisms serve exactly the same purpose as the lenses.

A fourth method that has been suggested for scanning a picture is by means of two harmonic motions working at right angles to each other. One of these is to have a very high rate of vibration and the other comparatively slow. One of these causes the scanning line, or line of vision, to move across the picture in a vertical direction at a very high rate of speed, that is, it causes the line of vision to trace a strip across the picture. The slower harmonic motion causes the strips thus produced to travel over the picture in a horizontal direction.

An Old Idea

Comparing this with the revolving drum of Alexanderson, the higher frequency harmonic motion corresponds with the rate of revolution of the drum, and the slower harmonic motion corresponds with the angular setting of the twenty-four mirrors.

The idea of using two harmonic motions at right angles for tracing out a picture in connection with television is very old, yet it has not been tried out as thoroughly as some of the other methods. It would

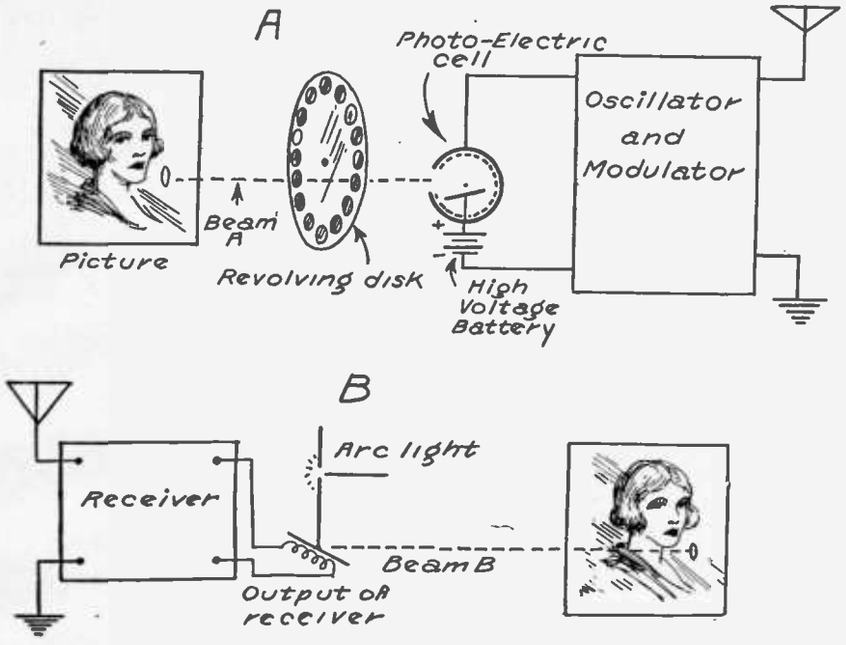


FIG. 2

(A) schematic of the transmitter and receiver used in the Baird system of television. A revolving disk of many lenses exposes the photo-electric cell to every small area on the scene in regular sequence. The oscillograph mirror actuated by the rectified light current varies the intensity of the light beam that reaches the viewing screen (B).

seem that experiments along this line would yield practical results more quickly than any other, in view of the ease with which harmonic motion can be generated at the present time, and the great constancy of the frequency.

In the harmonic motion method two vacuum tube oscillators, preferably crystal controlled, would be used. One of these would generate a current of high frequency with which to cause the line of vision to sweep across the picture in one direction and the other would be used to cause successive sweeps to move across the picture in the other direction. One complete vibration of the high frequency would cause a scanning line, or lines, and one complete vibration of the slower frequency would cause the scanning lines to cover the entire picture.

Has Advantages

The use of this method completely eliminates high-speed machinery and thus greatly simplifies the operation. One of the main limitations at present is the safe limit of rotation of drums or disks, and there would be no such limit in the case of electrical harmonic motion. The possibility of crystal control of the two frequencies would also simplfy the synchronization of the transmitting and receiving equipment. Some of the larger laboratories are working along this line at the present time and that success is not far off.

Some of the details of the method employed by Alexanderson may be more clearly understood with the aid of a diagram such as shown in Fig. 1. In the upper left corner of Fig. 1, is shown a picture of a ball player swinging his bat. In that picture may be seen a small square, which represents a tiny part of the total area of the picture. The light from this square falls on a revolving mirror M, which is one of the twenty-four mirrors on the revolving drum. The mirror reflects the light through the lens L into the photo-electric cell. This cell converts the light energy from the little square into equivalent electric energy. As the drum revolves, the little square covers in turn every small area on the picture and the intensity of the light beam varies in the same proportion as the light value of the picture. The equivalent current varies in exactly the same proportion.

The Modulation

The varying electric current from the photo-electric cell is made to modulate a high frequency current by one of the well known methods of modulation, that of Heising being shown in the diagram. The high frequency radio current modulated with the picture is transmitted by the antenna in the usual way.

At the receiving end the signal is tuned in just as if the wave were sound modulated. Then it is rectified by one of the well known rectifier circuits, or the signal is first amplified at radio frequency and then rectified. After rectification it is necessary to rectify the signal still further. Now, the rectified signal which has been modulated with a picture differs from the rectified signal modulated with a sound wave. The picture current consists of direct pulses of varying intensity and the rectified sound signal consists of alternating current of audio frequency. Since one is essentially DC and one AC, different types of amplifiers must be used. A DC amplifier must be used to amplify the picture current. This must essentially be a resistance coupled circuit without any choke coils or stopping condensers. Such circuits are used with success in the case of transmission of stills.

Controls Light Source

After having amplified the picture current adequately it may be used to control a very strong source of light, such as that from an arc light. The rectified current is made to actuate an oscillograph mirror (m) in such a manner that the intensity of the light beam that reaches the revolving mirror M2 is exactly proportional to the intensity of the rectified picture current. The mirror M2 is similar to the revolving mirror M and it rotates at exactly the same rate. The mirror M2 projects the light beam on a screen and the little area of the original picture is reproduced. As this area is made to travel over the original picture, a reproduction of it is seen on the screen.

The process used by Baird is almost identical with that of the method of Alexanderson, except for the manner in which the original picture is made to record bit by bit on the photo-electric cell. The revolving disk with the many lenses does the trick in this case. At the receiving end there is essentially no difference between the two methods. Baird's arrangement is shown diagrammatically in Fig. 2, A and B.

What Makes a Part Something 'Commercial'?

Many suggested cures for radio troubles have met with the objection that they are not commercial, meaning of course that they would cost too much to insure the manufacturers of a profit at the price which they could get for the parts. But a radio device that does not work is not commercial no matter how low a price it may be sold for. The effective cures will have to be made commercial gradually by educating the public to the necessity of paying an adequate price for the products that work in fact as well as in claims.

MONEY IN SIGHT

Now that the photo-electric cell is becoming valuable, lawsuits are being started, based on patents issued nearly thirty years after the principle of the cell was discovered and announced.

Insulating Material Tested by Tuning

By Herbert E. Hayden

A simple test of the insulating qualities of the dielectrics or insulators may be made by placing a piece of the material between two tuning coils in a radio frequency circuit. These coils should not be too far apart and they should form a part of a radio frequency amplifier. The receiver is tuned in and the strength of the signal is noted when the insulator is not between the two coils. Then the insulator should be placed between the coils. If there is a marked decrease in the signal strength it means that the insulator is not very good on the score of dielectric absorption. The hand absorbs some of the energy and reduces the signal accordingly.

Another way of testing the insulating qualities of a dielectric is to place it between two plates of a condenser which is connected across the main tuning condenser. In this case the placing of the dielectric between the condenser plates will determine the circuit to a great extent, depending on the value of the dielectric constant of the material. Before a comparison can be made it will be necessary to retune the circuit to exact resonance. If there is a marked decrease in the signal strength with the dielectric between the plates the insulating qualities are not good. The comparison must be made with the circuit tuned exactly in both cases, and therefore the test cannot be made very quickly, nor accurately without the use of instruments to measure the relative strengths.

The insulating test here mainly refers to the dielectric absorption of the material and not the direct current conductivity. Applied voltage is used for the DC test.

(Photograph on front cover)

Tubes Properly Chosen
For Efficient Five-Valve Receiver

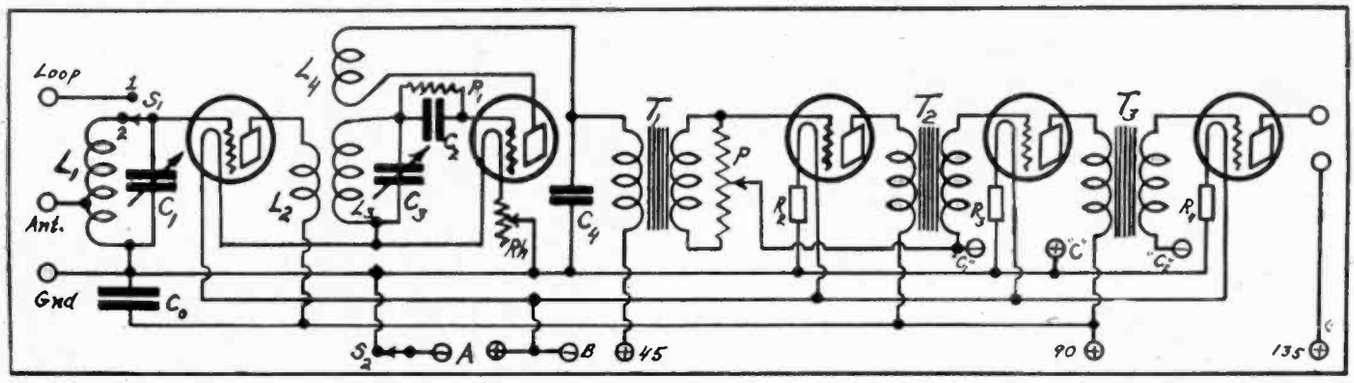


FIG. 1

The first two tubes, CX-299, are in series, the three others in parallel, in this five-tube receiver in which specially matched tubes are used to give maximum results.

By J. E. Anderson

Consulting Engineer

AT first we had tubes which required an ampere for heating the filaments; and sets were built with these tubes in which the total filament current was eight to ten amperes. There was only one tube to choose, and consequently this type of tube was used in every socket. Later smaller tubes made their appearance, which required one-quarter ampere each at 1.1 volt. All the tubes in the set, no matter how many were used in it, were of the same type. When different types of tubes came out the idea of using the same type of tube throughout the set persisted. It was only when power tubes were added to the list of types that a differentiation was made. But there is no good reason why we should not use a variety of tubes now that special purpose tubes are available. There is no more reason for using all large tubes in a set than for all men to wear No. 12 shoes. Just as shoes are made to fit different sizes of feet, so tubes are made to fit different load requirements. Let's be logical and use small tubes where small tubes will do the work, medium size tubes where medium size tubes are required, and large tubes where such are necessary to handle the load. The set described below was designed with this in mind.

Compactness was also one of the points considered in building the set. Compactness is a virtue in any receiver as long as it is not carried to the point where interlocking fields render the set unstable beyond control. It is a simple matter to so crowd the radio frequency parts that the set oscillates and loses both selectivity and sensitivity. And it is almost as easy to so crowd the audio frequency parts of the receiver that the set oscillates at audio frequency and completely spoils the quality which would otherwise would be excellent. Compactness with moderation and judgment should be the motto. This has been aimed at in the present set.

The Filament Circuit

Let us begin the description by following out the filament circuit. Observe that the filaments of the first two tubes are in series across the A battery. Each of these tubes is CX-299. These require a filament terminal voltage of 3 to 3.3 volts and they draw a current of 60 milliamperes. Since each will work satisfactorily on a voltage of 3 volts, the two of them in series will require six volts. Hence two of these tubes may be connected across a six volt battery, such as a three cell storage battery, and each tube will get about the proper voltage. Of course it will be necessary to keep the voltage of the battery up to six volts, otherwise the filament current in the tubes will not be up to the normal of 60 milliamperes. But the tubes will operate satisfactorily for all values of voltage from 5.8 to 6.6 volts, the range of the storage battery.

The first tube is called on to handle only very small voltages or signal intensities. Hence a small tube will do the work nicely. Also, this type of tube is a good radio frequency amplifier, and that is another reason why it may be used at this point. The detector tube may also be one of the same type(for the 299 detects well, and it will not become overloaded, provided there is a good audio frequency amplifier following it.

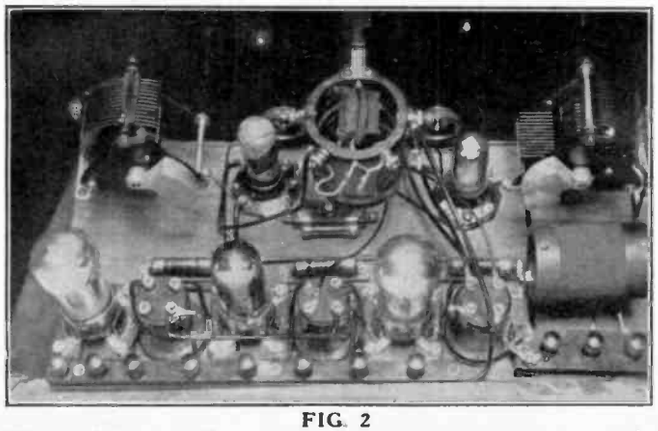


FIG. 2

The back view of the completed receiver, showing how neatly the parts are placed.

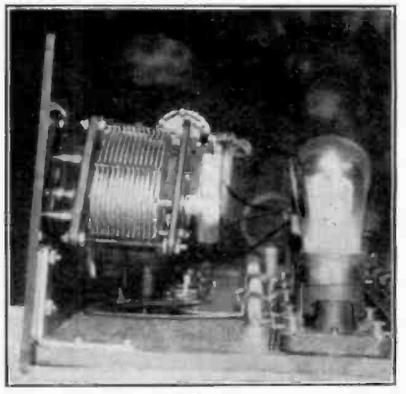


FIG. 3

A side view illustrating the use of a simple angle iron for mounting the baseboard.

Note that the radio frequency tube is placed on the positive side of the supply line and that the detector is placed on the negative side. The object of placing them so is to take advantage of the voltage drop in the detector tube filament to get a 3 volt grid bias on the grid of the first tube. That is accomplished by merely connecting the grid return lead from the first tube to the negative lead to the A battery. Since the detector tube requires a positive bias on its grid, this may be obtained by connecting its grid return lead to the junction line between the two filaments. The point is positive with respect all points on the detector tube filament.

The Other Tubes

The three other tubes in the receiver require a filament terminal voltage of either five or six volts, hence these are connected in parallel across the supply battery, Amperites being used to correct for excess

(*Continued on page* 30)

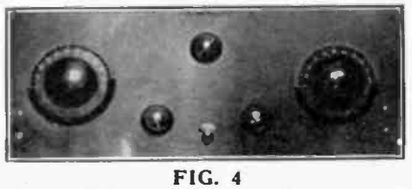
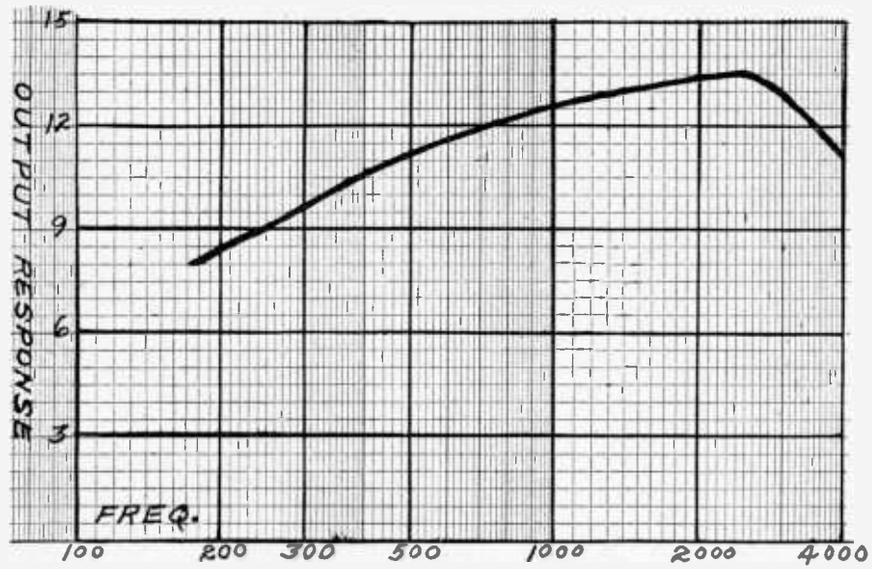


FIG. 4

The panel view of the set. The top center knobs controls the tickler.

How to Read Curves
So That Various Units May Be Matched



CURVE of an audio frequency transformer, output response compared with frequency.

By John F. Rider

Member, Institute of Radio Engineers

IN view of the increased demand by the vast radio fraternity for better designed audio amplifying units, manufacturers of transformers, resistance and impedance coupled audio amplifying units and systems are devoting more and more time to this phase of the radio art, and after having developed a unit, they acquaint the public with the operating characteristics of their device by an illustration similar to that shown above, which is usually captioned as the "frequency operating characteristic curve."

Prior to the careful distinction by the radio fan between good and bad quality reproduction and distortionless amplification such curves bore no significance, being viewed as technical data, of interest only to the technician. At present, however, the publishing of such curves is becoming conventional practice among all the manufacturers of audio amplifying systems, and if the constructively inclined radio fan desires to choose the equipment best suited for his needs, and obtain the most for his money in the audio amplification line, it is essential that he be able to read and interpret these frequency operating curves.

Of Great Utility

The data he obtains therefrom are manifold, and of great utility when real concentrated effort is given to the construction of the receiver contemplated, for it permits first, of the study of the frequency operating characteristics of the audio system, second, the selection of an audio system which will match the frequency operating characteristics of the radio frequency side of the receiver and, third, the selection of a loudspeaker which will function best with the radio frequency and audio frequency systems on hand.

The necessity of matching the radio frequency and audio frequency amplifying systems with each other and the combination with the loudspeaker, may not be obvious to many fans, but in the quest for fidelity of reproduction it will be found imperative to match the various amplifying systems with one another and the reproducer. To be able to match these units does not require a radio technician, if the frequency operating characteristics of the various units are available, and the time is not far distant when such curves will be available. As a matter of plain fact it is obviously only necessary correctly to interpret the various curves and to select units which are best suited to each other.

Where frequency characteristics are plotted against amplification, the curve means the same whether it alludes to radio frequency amplifying systems, audio amplification or loudspeaker operation.

Reveals Characteristics

The cure depicts the operating characteristic of the individual unit or of a complete system when signals of various frequencies are applied to it, showing how much amplification of response is obtained on the various frequencies. The formation of the ideal curve is dependent upon the subject matter. Since at present the most frequently appearing characteristic curve is that of an audio unit, we will consider such a curve at this time. Take, as example, the curve shown above. The curve shows how the particular unit measured will amplify different signals of different frequency.

To determine how an amplifying unit amplifies on the various frequencies within the audio band it is necessary to plot frequency against amplification. This means when arranging the graph, that an axis must be assigned to show the relative values of amplification. This axis is designated in various ways. Sometimes it is known as the amplification axis with a zero and an infinite sign at the base and top respectively. Other times it is marked voltage amplification, energy amplification, response in circuit, output response, output, etc. In the majority of cases numerical designations also are given, to simplify reading, as above. The ordinate is marked output response and is marked off 3, 6, 9, etc. This axis is the vertical axis, and is located at the extreme end of the graph.

Extent of Amplification

Since we are plotting frequency against amplification, an axis for the frequency gradations also is necessary. This is usually the horizontal axis and is known as the abscissa of the graph. The gradations on this axis are usually numerical, reading on audio frequency curves in hundreds and thousands of cycles per second. In radio frequency curves hundreds of thousands of cycles are used instead of thousands of cycles. As the numerical gradations on the ordinate show amplification, the figures are so arranged that at the intersection of the ordinate and the abscissa is located the zero point. The farther away from this point on both the abscissa and ordinate, the higher the gradation. In our case, the higher the amplification numeral, the greater the amplification.

As to the appearance of curves for similar units, the general appearance is dependent upon the way the curve is plotted, i.e., the type of cross-sectional paper used. For the plotting of audio frequency curves, two kinds of paper are used. They are the regular cross- sectional paper (shown) and the combination of regular cross-sectional paper and logarithmic scale paper. Of these two the latter is by far the better, since it will most readily bring out the required details and defects, if any. The use of cross-sectional paper as shown is conducive to miscomprehension, for it is not laid out according the laws governing the subject matter, and a radical difference between two units is much more readily disguised, when the curves are plotted on regular square cross-sectional paper than when plotted on a combination of square and logarithmic paper. As a matter of fact, if strict adherence is given to the laws governing the musical scale, the frequency axis should be plotted on a logarithmic scale, as the octaves are uniformilly divided, as they are on the piano. On logarithmic paper the octaves in the frequency scale are equally divided.

Valuable for Matching

As to frequency operating curves for transformers and impedances, the data given herein are equally applicable and the curves are read in the same way and should be plotted on a logarithmic scale. After all is said and done, a frequency characteristic curve is not as difficult to comprehend as one would imagine, after the first glance at the curve and a perusal of the figures.

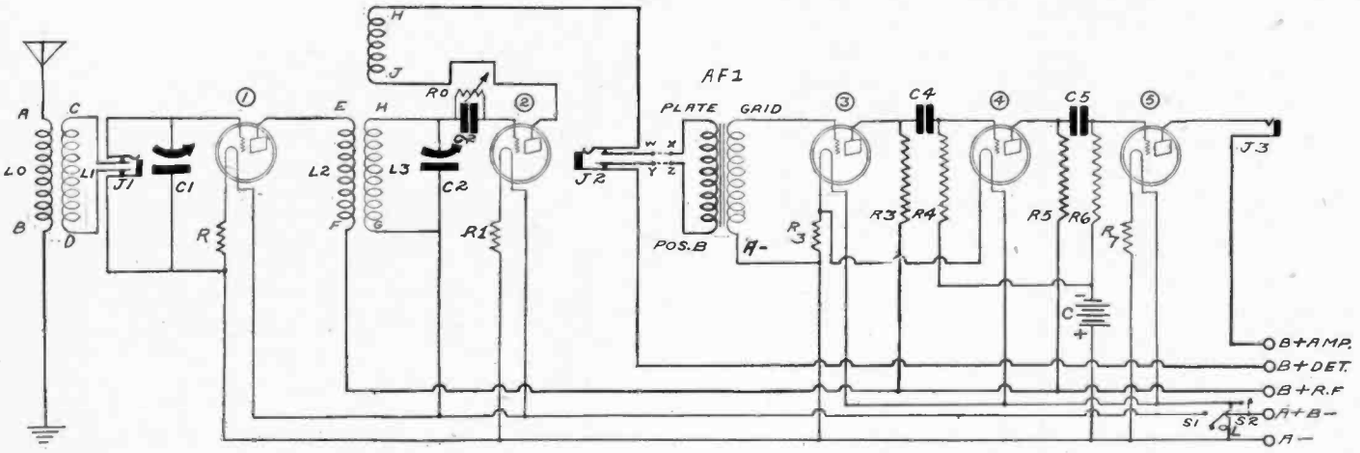
If various types of audio amplifiers are to be compared, and the frequency operating curves are on hand, the work is simple. Study the various curves, not so much the respective height of the complete curve, that is the numerical gradations, since these values are only arbitrary, but rather the contour of the individual curve itself. Does one give more uniform amplification over the entire band than the other? Which has a more acute peak? If the loudspeaker which will be used is known to be high pitched it is necessary to used an amplifier which accentuates the low notes more than the high ones. These data can be obtained by studying the curves of the different systems and selecting the one with the maximum amplification on the low notes and the falling characteristics on the high notes. Quantitative comparisons of different systems of amplification can only be made if specifications mentioning tubes, batteries, voltages, etc., are given with each curve. Such comparisons, however, are not essential to the selection of a unit, since the choice of the unit is not dependent entirely upon the total voltage or energy amplification itself, but rather upon the relationship between the amplification and the frequency of the applied signal.

WARNING ON LICENSES

Washington.

Aspirants for new broadcasting station licenses are warned that just as soon as a radio bill is signed by the President no further licenses will be issued by the Department of Commerce. Chief Radio Supervisor W. D. Terrell says all applications for licenses would then be referred to the Federal Radio Commission which would be created by the radio bill.

The Five-Tube Diamond
May Be Used With Phonograph Pickup



THE FIVE-TUBE DIAMOND OF THE AIR, the same hookup that won such great popularity, is adapted very easily to a phonograph pickup. The pickup is attached to the tone arm of the phonograph and its output to the input of the Diamond's audio channel. Switch S1 is turned to "off" position. The phonograph music then plays on the speaker. Note that the rotors of C1 and C3 go to grid. This applies only to Bruno condensers.

THE FRONT PANEL NEW of the five-tube Diamond of the Air.

By Hood Astrakan

WHEN the Diamond of the Air was originally designed a provision was incorporated making it possible to use the audio amplifier independently of the radio frequency end of the circuit, or vice versa. Many builders of the set included this feature, thinking it necessary to the proper operation of the receiver, and others excluded it, thinking that they would never have any use for it.

Experimenters who are continually trying out new circuits, both with reference to the audio and RF ends, found the feature of great value, as they could test out various radio hook-ups in a circuit which they knew the characteristics of. For example, if they wanted to test a new detector or a new set of tuning coils they did not have to build an entire receiver but only that part which they wanted to test, the radio frequency portion of the circuit. They could then hook the output of the detector of this new device to the input of the audio amplifier they already had. Much time and expense were thus saved. And they got a better idea of the device tested because they could compare it directly on the same audio frequency amplifier.

Works Both Ways

When they made the test in this manner there was no question as to the relative merits, but if they also employed different audio hook-ups they were not sure where any differences originated.

This, of course, also works the other way. When they wanted to test different audio frequency amplifiers, they did not have to build another radio frequency amplifier and detector. All they had to do was to hook up the various audio amplifiers they wanted to test to the same detector. The comparison thus made was more positive in that it eliminated one source of possible difference.

Those who installed the feature as recommended will have no reason to regret it even if they have not used it as yet, because the merits are worth new consideration. However, those who did not install the feature will probably soon regret the omission, because uses which not even the least experimentally inclined will pass up will soon be found for it, or more correctly, have been found.

The feature referred to in the above paragraphs is the switch S1, or the four binding posts marked WXYZ. When the receiver is to be operated as a unit W is connected to X and Y to Z by means of "straps" or short pieces of bus bar. If the radio section of the circuit is to be used independently of the radio, the "straps" are removed and the binding posts W and Y are used to connect to the earphones or to some external amplifier. When the audio amplifier is to be used independently of the radio section, the bindings posts X and Z are used for inputting to the audio amplifier.

The Phonograph Pickup

A recent development has been the tie-up between a phonograph and an audio frequency amplifier. That is, an electric pick-up is connected to the phonograph and this is connected to the audio frequency amplifier of the radio receiver, so that the music on the phonograph record may be amplified and put on the loud speaker. There is great advantage in this arrangement. The audio frequency amplifier in modern sets is capable of a high degree of fidelity, especially a circuit like the Diamond of the Air. Also when a good cone speaker is used in connection with a power tube, excellent quality may be reproduced. That the cone is superior to the horn in respect to quality is generally admitted. Here the feature of the Diamond of the Air comes in. All that is necessary is to connect the output of the electric pick-up to the input of the audio frequency amplifier, more particularly to the binding posts X and Z. The music on the record will come out of the cone plugged into jack J3 instead of from the sound chamber.

LIST OF PARTS

L0L1—One Bruno No. 99 RF coil.
L2L3L4—One Bruno No. 99 tuning coil.
C1, C2—Two No. 101 .0005 SF Bruno condensers.
C4, C5—Two .25 mfd. Aerovox by-pass condensers.
C2—One .00025 mfd. Aerovox fixed condenser.
R, R1, R7—Three No. 1A Amperites, mounted.
R2—One No. 112 Amperite, mounted (marked R3, tube 3, in diagram).
AF1—One 3½-to-1 Bruno Truetone Model D audio transformer.
R3, R5—Two .1 megohm resistors.
R4—One 1 megohm leak.
R6—One .5 megohm leak.
R0—One Bretwood variable grid leak.
J1, J2—Two double circuit jacks.
J3—One single circuit jack.
LS2—One Bruno light switch.
S1—One push pull battery switch.
WXYZ—Four Bruno binding posts.
Five UX sockets (1, 2, 3, 4, 5).
One 7 x 24" drilled and engraved panel.
One drilled socket strip.
Three Bruno Bakelite vernier dials.
One pair Bruno brackets.
One 5-strand multi-colored battery cable.
Five battery cable markers.
Two flexible leads for C battery.
Four mounts, bus bar, screws, spaghetti, etc.

Radio Ceiling Again Verified

Kennelly-Heaviside Layer Effects Tested

Washington.

ANOTHER verification of the existence of the Kennelly-Heaviside layer has been established, this time by the Carnegie Institution. The experiments were conducted by Dr. G. Breit and Dr. M. A. Tuve, of the Department of terrestial magnetism.

For nearly a quarter of a century it has been supposed that there is a layer in the upper air that is a good conductor of magnetic energy. It is believed that the layer contains free ions and electrons which may have emanated from the sun, and that it is the presence of these that makes it a good conductor. Dr. Breit and Dr. Tuve have not only experimentally demonstrated that such a layer exists, but they have measured its effective height above the earth and learned somewhat of how it affects transmission. Other investigators also have obtained good evidence of the existence of the layer, for example, Messrs. Taylor and Hulbert, in the United States, and Messrs. Smith-Rose and Barfield, in England.

The Assumptions

It had been suggested that if there were such a layer, the upper portions of a given radio wave would move through the earth's atmosphere at a greater velocity than the lower portions of the same wave where conductivity is not so good.

In consequence, it was thought, the top of the wave front would be accelerated beyond that of the lower part, causing the wave to bend forward, ultimately bringing it to the earth. Ocean waves toppling over forward as they approach the beach crudely illustrate what was thought to be one effect of this conducting layer in the upper air. According to theory, the layer acted as a "ceiling" bending or reflecting radio waves back to earth.

The investigators reasoned that if this theory were correct, then a receiver at a given point on the earth's surface would record at least two pulses for every pulse at the sending station. One of these would reach it by a direct horizontal path through the air; the other would travel by way of the "ceiling," reaching the receiving station as an "echo" or "reflection." They reasoned further that if this were the case then the reflected wave, since it traversed a greater distance, would reach the receiver a little later than the direct wave, and that this difference in time might be measured.

The Experiment

To test these assumptions the investigators set up a receiving station, eight miles from the transmitting station. Interrupted trains of waves were sent from the transmitter, each train having a duration of about 1/1000 of a second. At the receiving end the signals were detected, amplified and recorded by photographing the tracings made by an oscillating marker.

The photographic records showed conclusively that under certain circumstances each signal was registered twice, and that, in accordance with the assumption, there was an appreciable interval of time between them.

In this manner, through a series of experiments extending over many months, a technique was developed which enabled the investigators to demonstrate experimentally that a transmitted signal, depending upon conditions, reached the receiving station by two paths: the direct path, (transmitter to receiver) and the path by way of the "ceiling."

Fading Theory Expounded

Furthermore, knowing the distance between stations and knowing the retardation of the reflection and the speed of radio waves, the height of the layer was readily computed and found to be about 100 miles, though it appeared to rise and fall during the period observed within a range of from 50 to 130 miles.

Although these experiments do not tell whether radio waves are actually reflected or refracted by the layer, they do explain some of the peculiarities of transmission.

Fading, for example, one of the chief woes of the radio fan, is seen to be due not alone to interference between ground and reflected waves but to changes in the height of the layer and in its effectiveness as a reflecting surface. The measurements obtained by the investigators showed that these changes are often very sudden. They also indicated that variations may take place with the season and with the time of day, the layer probably being at a greater height in Fall than in Summer and in the afternoon than in the morning.

Progress Achieved

Again, the character of the reflecting or refracting surface would naturally affect the quality of the reflected waves. A bumpy or corrugated surface would tend to produce "multiple reflections," causing interference, confusion and even "fading" where waves happen to neutralize one another.

For a long time scientists have been trying to learn what the forces are which surround the earth, circulate within its interior, and penetrate its atmosphere. Gradually progress is being made. It is now clear, for example, that the earth itself is surrounded by a magnetic field. It has also been shown that the sun has a magnetic field similar to that of the earth. It is probable that all celestial bodies are surrounded by such fields. Indeed, it has been suggested that every large rotating mass, such as the earth, in a manner not yet determined, is an electro-magnet causing magnetic force. Verification of the existence of a conducting layer in the upper air is another notable step forward in man's effort to understand and master the titanic forces which surround him.

The existence of this layer has additional significance in the possibility that its movements in the earth's magnetic field may induce electric currents, which, in turn, may have far-reaching effects. Again, the motion of the layer as a whole may affect the condition of the lower atmosphere producing important changes in electric pressure. The department of terrestrial magnetism of the Carnegie Insitution of Washington, among other research of agencies, is vigorously attacking these problems in its laboratories at Washington.

The experiments described were made with the cooperation of the Naval Research Laboratory, the Radio Corporation of America, the American Telephone and Telegraph Company, the Westinghouse Electric and Manufacturing Company, and the Bureau of Standards. The possibilities of the importance of the ionization of the upper atmosphere were pointed out first by Professor A. E. Kennelly, of the United States, and later among others, by Oliver Heaviside, of England. For this reason the layer is frequently called the "Kennelly-Heaviside layer."

Woman Own Operator In Remote Control Work

Radio science has become so highly developed as to permit women to serve as radio operators, the extent of their necessary training being the ability to press a button.

Heretofore an especially trained radio operator was required to handle the amplifiers, batteries, microphones and receivers connecting the station with a person broadcasting from a remote point by telephone.

This intricate system has been eliminated by WAAM, which has installed equipment enabling Ada Bessie Swann, who conducts cooking lessons from the Public Service Building over WAAM on Tuesdays and Fridays, to do her own operating by merely pressing a button when her time comes to go on the air.

When she hears the announcer at the station say, "the next voice you will hear is that of Miss Swann", she depresses a button at the base of the microphone and begins to broadcast.

High and Low Potentials Distinguished

By Elmer Rabbit

IN radio articles one frequently sees mention of high potential and low potential. Thus one side of a condenser is at high potential and the other is at low potential. Likewise one side of a coil is at high potential and the other side is at low potential . Also one speaks of the high potential of the grid and the low potential of the filament. Again reference is made to the high or low potential of the plate of the tube. Some fans wonder how it is possible to have a low potential when the voltage on the plate is high enough to give a very unpleasant jolt.

One must distinguish between high frequency voltages and low frequency or steady voltages. The plate of a tube is always at a high steady voltage or potential. The filament is always at low potential as far as these steady voltages are concerned. With respect to the high frequency voltages the plate may be either at low or at high voltage. If there is a large by-pass condenser across the load of the tube, the plate is approximately at the same potential as the filament. Otherwise the potential of the plate is at high potential at both high frequency and at steady potential. The filament is at low potential at all times for high frequency and at steady potential. It is grounded and it is therefore at the same potential as the person operating the set. A test of whether any point is at low or at high alternating potential is to touch it. If there is a marked change in the signal strength the point was at high potential previously to touching the point. As soon as the point is touched it immediately becomes low potential. For radio frequencies the change in the signal is very great, but for audio frequencies the change is just barely noticeable. Of course, if there is no change in the signal sertngth when a high potential point is touched with the finger it means that the point remains at high potential. This can only happen in the case of low audio frequencies (steady potential).

Radiola III Runs a Speaker
When Special Purpose Tubes Are Used

By Barton Pearce

THE Radiola III is a well-known receiver, used by many thousands of listeners. It employs two tubes—a regenerative detector and one stage of transformer audio frequency amplification. It is an excellent receiver for local reception and gets some DX, too. However, it was originally designed for use with the WD11 tubes. With these tubes only earphone volume is obtainable. Upon the appearance of the special detector and power tubes, many owners of this set wondered if, with use of these tubes, one could work a speaker from the two-tube set. The 112 power tube and the 300-A detector tube have solved the problem. So that these tubes could be installed, only new sockets need be put in the set.

Using a 112 power tube in the amplifier portion and a 300A tube in the detector circuit, the signals could be heard on the speaker not only in a single room, but throughout the entire house, where locals were being received. How this change was made is explained in the photos and the following text.

Fig. 1—The receiver is equipped with WD11 sockets and these are removed from the cabinet. This is done by removing the two large screws, which are found in the right and diagonally left-hand corners of the panel. It will be noted that the entire set contents are mounted on this panel. The cable, which is attached to the instrument should be pulled out with the panel, slowly.

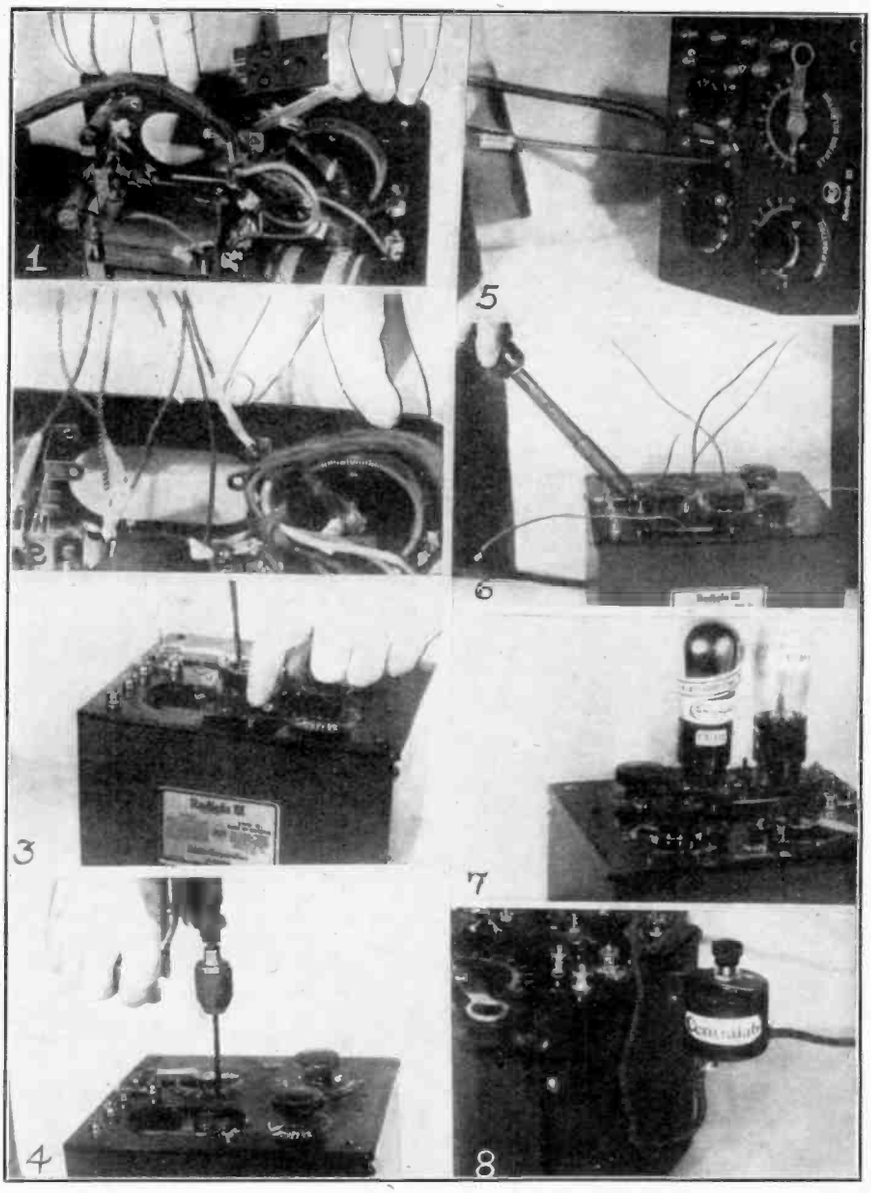
Fig. 2.—The little Bakelite socket strip, which is mounted directly under the cut out section, is then removed. Now procure some adhesive tape and cut up into eight pieces. Mark each piece according to the socket post markings. Then, before disconnecting the wires from the socket, place these markers on the wires. Also remove the metal strips holding the sockets, as well as the rubber bands, and discard. Solder eight pieces of bell wire to the eight flexible wires within the set. Tape these leads. Bring these leads up through the cutout portion, being sure that you can still see the markers.

Figs. 3 and 4.—Now place two X type sockets on top of the cut-out portion, allowing about ¼ inch between them. It will be found that they just bridge the gap. Mark the mounting holes with a scriber and drill holes right through the panel, using a No. 18 drill.

Fig. 5.—Place a long 6/32 machine screw through the socket and panel, securing the socket by tightening up this screw with a hexagonal nut on the underside of the panel. One screw will hold each socket.

Fig. 6.—Now bring the bell wire conconnections to their proper posts on the sockets. These posts are tightened down. Be sure that the proper leads are brought to these posts. The panel is now placed back in the cabinet, the screws also being placed back.

Fig. 7.—Be sure that the cable has been carefully pulled through the back of the cabinet. How the larger tubes appear in the newly installed sockets is shown here. The wire in the battery cable marked 22 volts plus, should now be connected to the 45 volt post on the B battery. The wire marked 80 volts should be connected to the 135 volt or 157 volt B battery terminal, this dependending upon the volume desired. The C battery, using the 135 volt B battery should now be increased to 6 volts. For 157 plate volts use 9 grid volts. The A battery leads are of course connected to the plus and minus of a 6-volt storage battery. The heavy-duty Everready Layerbuilt B batteries were used with great success.



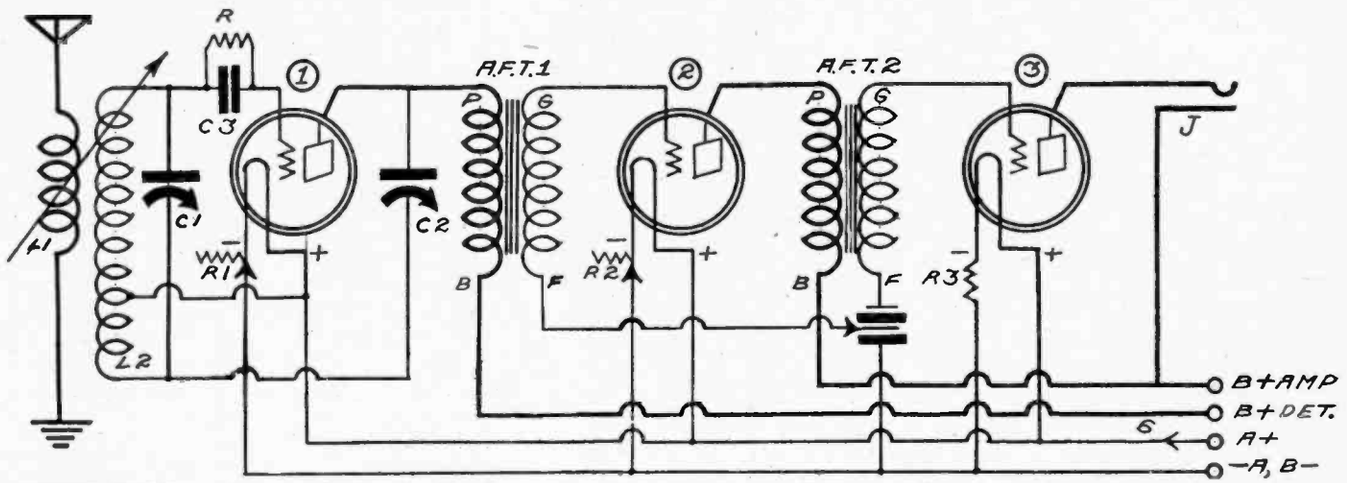
THE PHOTOGRAPHS illustrate how the Radiola III is made to operate a speaker satisfactorily, although only two tubes are used. One substitutes X base sockets for the WD11 sockets in the set, employs a CX-300A special detector and a CX-112 power tube, and heats the tube filaments with a six-volt storage battery.

Fig. 8.—The matter of selectivity on the lower wavelengths with this receiver is important. The Central Radio Laboratories have solved the problem, with their new device known as the "Short Wave Selector," which is small, compact and efficient. To install it on this set is simple. Secure a brass angle of the usual type used in radio work. Drill a hole about ½ inch in the center of the angle, on both sides. One hole should be about ½ inch in diameter, while the other should be large enough for a machine screw to pass through. The side with the smaller hole is placed up against the set, and screwed to the box. The device is mounted on the other portion of the angle iron. Connect the antenna to one post of the selector, the other post to any one of the antenna posts on the receiver. When you listen to the lower waves, snap on the selector switch. When on the high waves snap off.

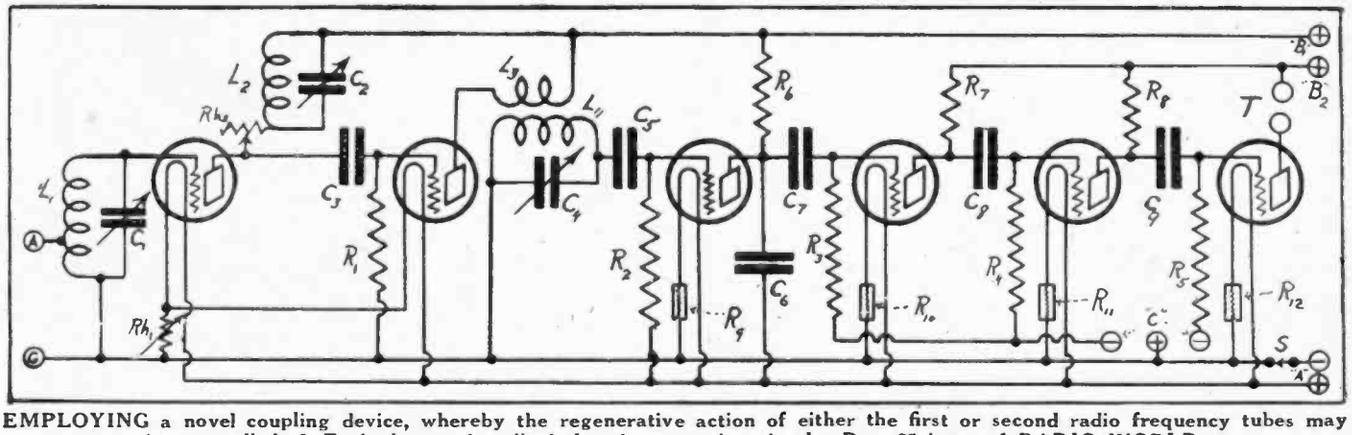
CONDENSER OF 10 MFD. RECOMMENDED FOR FILTERED OUTPUT

Some persons say that the condenser in series with the loudspeaker, when the AC is separated from the DC by means of choke and condenser, need not be larger than 4 mfd. Suppose that the telephone or speaker has had an inductance of one henry. This inductance resonates with the series condenser at about 80 cycles per second. At this frequency there will be a peak in the amplification which is likely to cause serious distortion and blasting of the speaker. Eighty cycles per second comes away up in the audible scale where some of the better class of amplifiers are still very effective. The series condenser should be much larger so that the peak falls at a frequency where the amplifier is down, say 10 mfd.

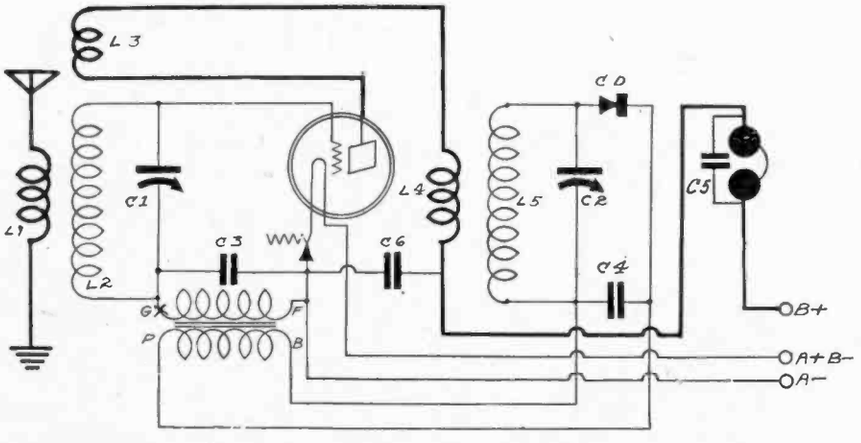
Hookups for the Experimenter



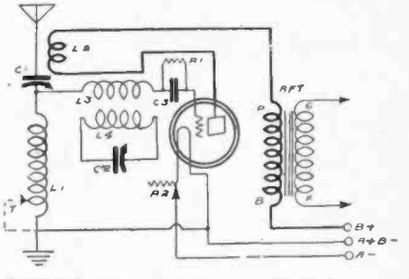
A THREE-TUBE receiver, employing the Hartley system of ge nerating oscillations, followed by two stages of transformer coupled audio amplification. The primary of the coil used in the detector is automatically varied with the movement of C1. How this can be done is described in the Dec. 18 issue of RADIO WORLD.



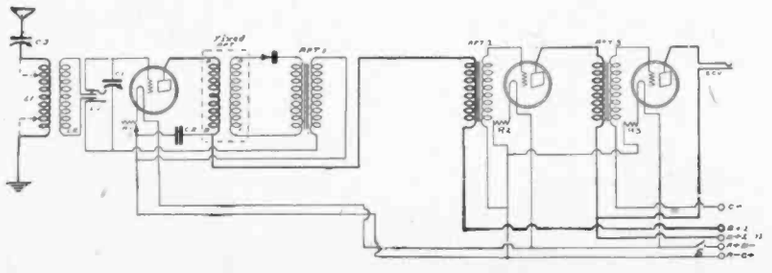
EMPLOYING a novel coupling device, whereby the regenerative action of either the first or second radio frequency tubes may be controlled, J. E. Anderson described the above receiver in the Dec. 25 issue of RADIO WORLD.



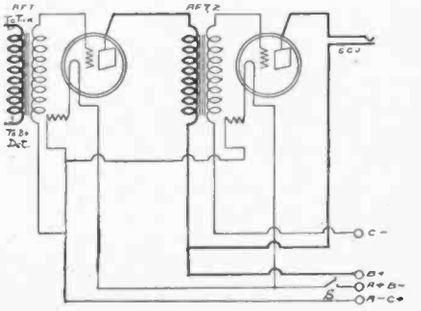
A ONE-TUBE receiver using a regenerative radio frequency tube and a crystal detector.



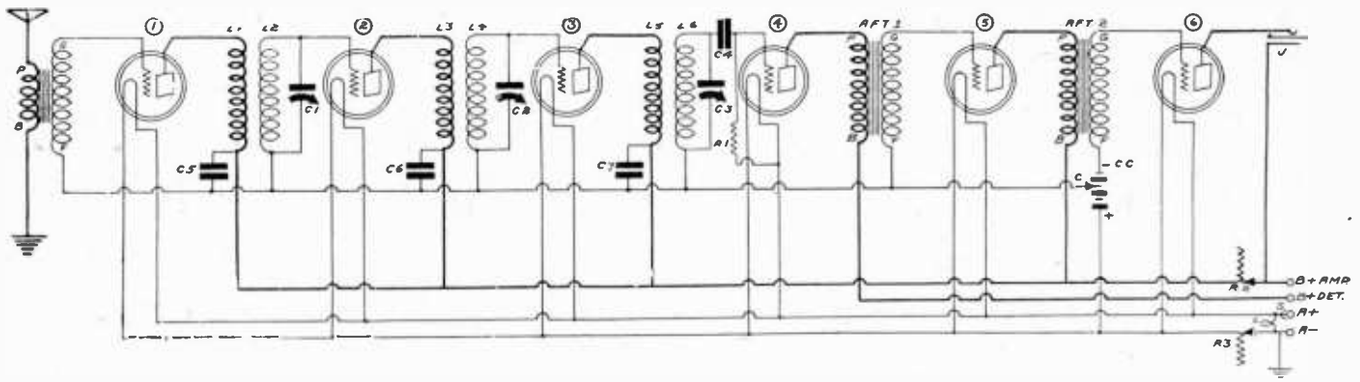
A GOOD circuit for people living very near to the broadcasting stations, is shown above. L4 in the trap circuit consists of thirty-five turns, wound with L3, which consists of twenty turns, on a three inch tubing, with No. 22 DCC wire. C2 is a .0005 mfd. variable condenser.



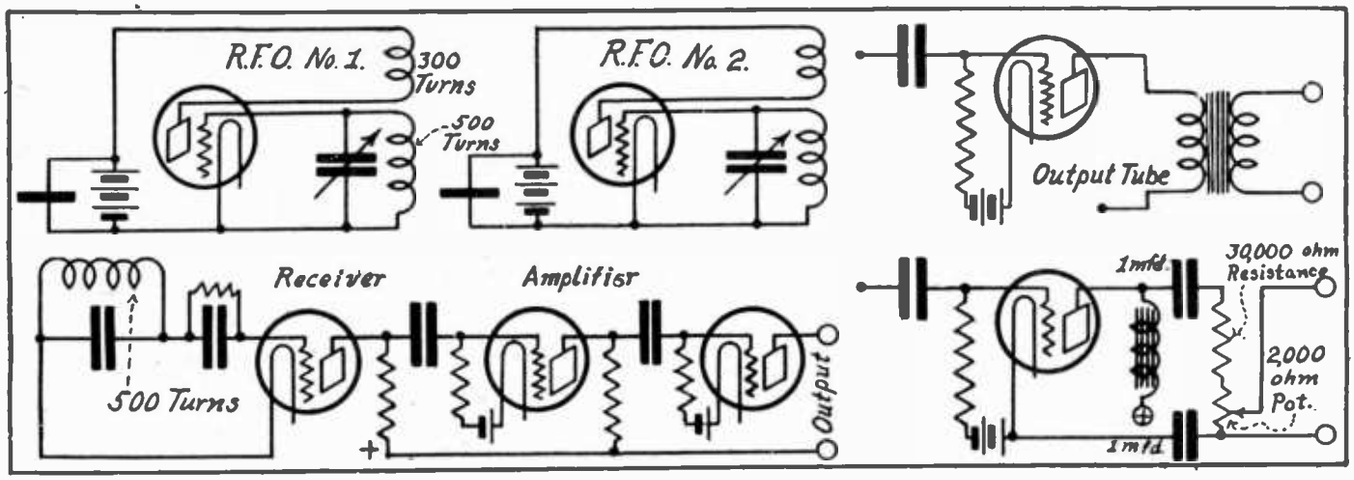
THE CIRCUIT diagram of a three-tube reflex receiver is seen above.



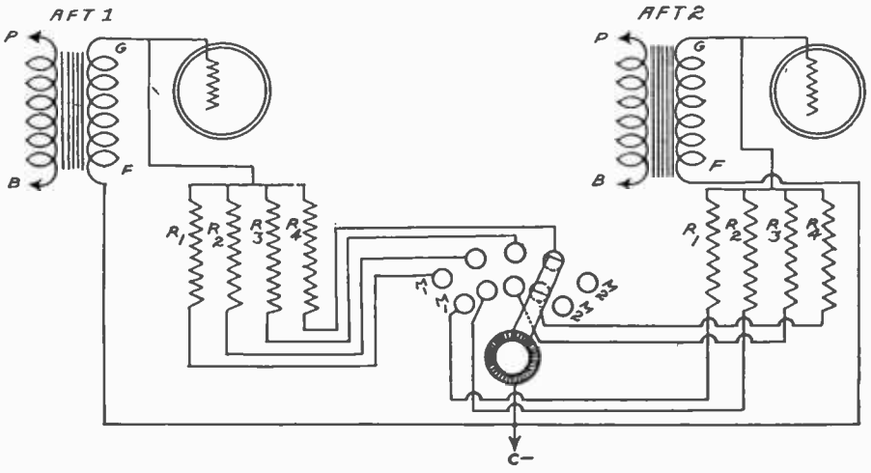
THE STANDARD circuit diagram of a two-stage transformer coupled audio frequency amplifier, using automatic filament controls.



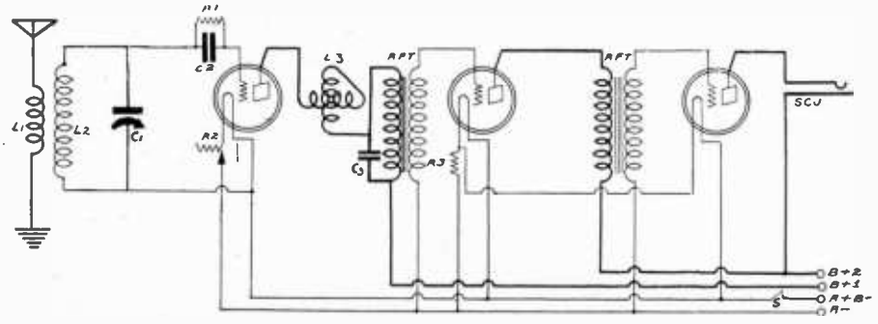
A SELECTIVE, voluminous and easy tuning six-tube receiver, w herein a single untuned radio frequency stage, two tuned radio frequency stages, a non-regenerative detector and two stages of transformer coupled AF are used.



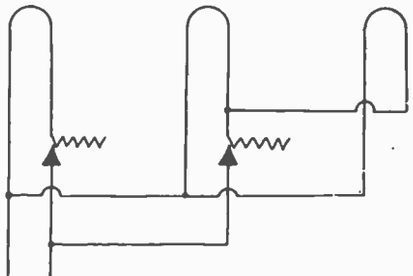
CIRCUIT DIAGRAMS illustrating how to make a beat note audio oscillator, also different methods of obtaining outputs with these oscillators. Full data on this system can be obtained from John F. Rider's article in the Dec. 4 issue of RADIO WORLD.



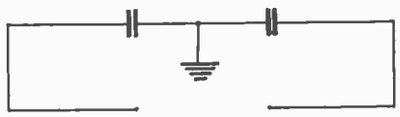
BY USING fixed resistors of various values, aided by a switch and tap arangement, as illustrated above, an excellent volume device can be made.



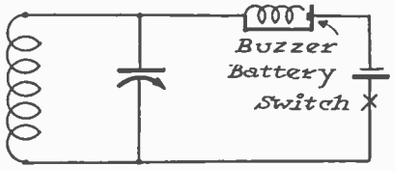
A SIMPLE, yet efficient three-tube receiver using a regenerative detector and two stages of transformer coupled AF amplification.



THE ELECTRICAL wiring of the filament circuit of a three tube set, using a twenty ohm rheostat for detector and a ten ohm rheostat for amplifier control.



LINE NOISES can be prevented by branching the line with a pair of 5 mfd. fixed condensers, grounding the center point.



AN EFFICIENT low power audio oscillator is diagrammed above. The condenser controls the frequency.

Talking Movies Perfected By General Electric Co.

Microphone Method of Recording Is Used, the Audio Imprint Being Put on Film Either Simultaneously or After Photography—Radio Acoustics Used

By W. T. Meenam

Talking motion pictures in which the simultaneous timing of action and sound is all times assured have been announced and demonstrated by the General Electric Company. The process, the result of several years of experimenting in the General Engineering Laboratory of the company, means but slight change in standard motion picture projectors, since it involves only the addition of a sound-reproducing attachment and a loud speaker suitable for auditorium use. Both the picture and the sound are recorded on the same film.

One of the demonstrations has been with music to accompany feature films, the music being by a full concert orchestra. Development of this field requires no change in the technique of making the original film. After the original picture film has been made and titled, the accompanying music is played by a concert orchestra and is recorded on a film. The picture and sound records are then printed on one film in the proper time relation.

Sound and Sight on the Spot

Another type has been the showing of singers and instrumentalists while they are presenting programs. Thus, when an orchestra is shown on the screen, it is possible to follow the playing of each musician, and see his actions on the screen and hear him. Even cymbals—among the most difficult to reproduce faithfully—sound like cymbals. Similar demonstrations have been made with vocal and instrumental soloists, with string and with vocal quartets, and with speakers.

To the casual observer the talking film does not differ from the usual motion picture positive. It is of standard width, but along the left margin there is a strip a small fraction of an inch wide on which is a series of horizontal light and dark bands and lines, of varying widths and intensities. It is this series of bands and lines which produces the sound. The film is passed through the reproducer at constant speed, and, as these light and dark bands pass rapidly before a tiny slit in an optical system, the amount of light is varied. The ever-changing amount of light is received by a photoelectric cell—the electric eye—which is extremely sensitive to any change in the amount of light striking it. The more light received, the more current it will permit to pass through its circuit. This current is amplified and changed from electrical to audible energy by an amplifier and speaker.

Fields of Application

At this early date it is not possible to define all the fields in which this new type of talking motion pictures will be of use. One of the first, however, will be in supplying a full orchestral accompaniment for pictures. The community picture house, accustomed to having a piano, or piano and violin, will be able to have the same music as the metropolitan theatre.

Another field is offered by the news reels. Not only will it be possible to show important persons, but they can talk to the audience, and visiting notables can extend their greetings.

It has not always been possible for famed musicians and orchestras to appear in small communities. The talking motion pictures will permit them to be both seen and heard throughout the country.

Educationally, there are also many ways in which the new apparatus will be of service. Many schools and colleges are already equipped with motion picture projectors as an aid in class-room work, and the new film will be found of even more assistance. In the case of professors from abroad, it will be possible to record their lectures and demonstrations simultaneously, and to give their lectures the widest possible use by circulation of the film to colleges and universities throughout the country.

Speeches by Noted Educators

Similarly, it will be possible to have an authority on the subject give a description to accompany any educational film for use in schools, the speech pointing out the important features of the picture simultaneously with their appearance on the screen.

These are but a few of the possible fields in which the new talking motion pictures will find applications. The list can, and will, be expanded.

Outstanding among the features of the new apparatus are that both the picture and sound records are on the same standard motion picture film, and that a standard motion picture projector, with an attachment for the sound reproducer, is used. Since the picture and sound records are printed side by side on the film, it necessarily follows that the two must be properly timed or or synchronized at all times—it is not possible for the picture to break and the sound to continue, or for the sound to stop and the picture to continue.

The Elements of the Device

There are three principal elements in the apparatus, including a standard motion picture camera, a sound recorder and a standard motion picture projector with a sound-reproducing attachment, all driven by synchronous motors.

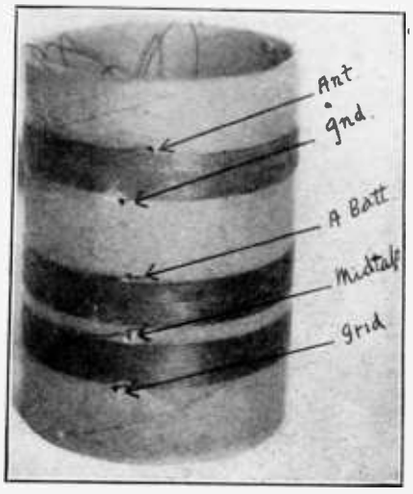
In recording the sounds, a microphone or sound collector of any desired type is employed, together with amplifiers. The microphonic system actuates a tiny vibrating mirror which records the sound on the film as light and dark bands, the light from a small incandescent lamp being reflected by the mirror through a tiny slit in the optical system in front of the film. The higher the pitch of note, the higher its frequency—and the greater the frequency of vibrations of the mirror which faithfully reproduces each sound vibration as a mark on the film.

The sound record can be made in different ways. Both the picture and sound can be simultaneously recorded on the same film by mounting the two recording elements as a unit, with the sound recorder uppermost. The two recorders can also be mounted separately and the sound and picture film negatives made as individual units, such an arrangement being preferable when the pictures are being made in studios and when the camera is being shifted constantly. Again, as in the case of accompanying music, the picture film can be entirely finished and titled, the record of the music then being made on a separate film and the two combined on the finished positive.

The Projector

The sound-reproducing attachment which is connected to the standard motion picture projector consists of a photoelectric cell behind the film and a small electric lamp with suitable optical arrangement in front of the film. As the film passes a small slit, similar to the one used in making the sound record, a varying amount of light is admitted to the photoelectric cell, the amount of light depending on the photographic density on the sound track. The result is that a very minute and varying current, an exact replica of the sound wave, is produced. This tiny current is amplified and led to a loud speaker which reproduces the sound in sufficient volume to fill the auditorium. Any suitable loud speaker may be employed. The one for large auditoriums which has been used in the demonstrations has been a Hewlett loud speaker, chosen because of its ability to give the necessary volume and because of the quality of tone reproduction of which the device is capable.

ANTENNA COUPLER



(Hayden)

AN ANTENNA COUPLER to supplant a mid-tapped loop, as in some Super-Heterodynes, may be wound on a tubing as shown. The diameter is 3 inches, the length 4½ inches. The primary has 25 turns. Leave 1 inch space. Wind the secondary, using 50 turns, mid-tapped. Use No. 22 or No. 24 wire.

"Ham," 1,700 Miles Off, Casts Vote Via Air

Although he was 1,700 miles away from the meeting, John F. Grinan, an American wireless amateur, on business in Jamaica, W. I., cast his vote as a director of the Radio Club of America while the board was sitting in New York.

The meeting was in progress at the home of C. R. Runyon, Jr., 544 North Broadway, Yonkers, when the need for Grinan's vote arose over a question. Runyon started his transmitter and connected with Grinan. The question was wirelessed and the vote came right back.

Cleveland Labor Will Erect a Station

Cleveland, O.

Cleveland Federation of Labor officials are planning the purchase and erection of a broadcasting station. Approval of the project was given recently at a meeting in Carpenters' Hall.

President Harry McLaughlin said negotiations were in progress for purchase of a 500-watt plant capable of reaching a radius of 50 miles. He said information of interest to labor will be placed on the air.

YORKTOWNE LAB MOVES

York, Pa.

The Yorktowne Radio Laboratory, which was conducted at 1499 Monroe street, West York, by Morris Gottlieb, moved to 144 South George street. Owing to the extension of this enterprise, Mr. Gottleib took into the business his brother, Louis Gottleib, 275 West Market street.

Broadcasters Artfully Atone for Invisibility

Use Ingenious Methods to Convey to Listeners Scenes and Emotions Difficult to Present When Not Accessible to the Eye

In every medium of entertainment, there is one primary requirement for success. Grand opera aspirants must have voices of great power as well as of good quality, actors and actresses of the legitimate, musical and vaudeville stages must possess good appearance under the lights before they can hope for worthwhile parts; screen players must photograph well.

The ear, the spotlight and the camera—these three have been the absolute rulers in the various entertainment fields. In their own kingdom, their sway has been supreme. Every performer who hopes to gain success in their realms has first to curry their favor. And although kings are going out of style in everyday life, in the world of entertainment their number is increasing. Witness the newest addition to the ranks of royalty—King Microphone, ruler of all who would be heard in the loudspeakers of the universe.

Discovering the likes and dislikes of the microphones has occupied the complete attention of a good many persons during the past four years. At WJZ and WEAF, the two New York stations managed by the National Broadcasting Company, constant experimentation is carried on in the development of all the possibilities of the newest entertainment medium, and the basis of the work is microphone study. Although broadcasting technique is still in its infancy, progress is being made continually. The elimination of eye-appeal, apparently a great limitation, has led to the development of other methods of approach to the listeners' sensibilities which take advantage of the fact that the source of the sounds can not be seen by the audience.

Atonement for Vision Absence

More nad more it is being recognized by the National Broadcasting Company's program builders that broadcasting is capable of just as great a development in technique as the stage and the screen ever were. Audible stimulations of people's minds, in other words, can be made just as effective as visual appeals.

In experimenting to discover how these appeals can be made most effective, the importance of King Microphone becomes more than ever paramount. Like the spotlight and the camera, the mike can be fooled into making things seem what they are not. But this fooling must be done in a most subtle manner, with a full understanding of the instrument, else the ire of the King will be aroused and he will refuse to carry out his share of the process.

Like the spotlight and the camera, the microphone's personal preferences can be ascertained only by actual test. Certain voices which possess every requirement for the concert and grand opera stages do not reproduce pleasantly over the air. On the contrary, program directors are discovering that many microphone voices are more agreeable than the same systems of vocal apparatus when heard directly by the ear. The only true test is an actual trial of the voice through a "monitor system"—a circuit including a microphone, an amplifier and a loud speaker.

Just as "try-outs" are held before members of the cast of a theatrical production are chosen, and "screen tests" when motion picture actors are to be selected, so do the program directors of WJZ and WEAF choose their talent by actual trial. The program director calls these tests "auditions." He conducts hundreds of them in the hope of discovering new broadcasting talent of real ability, and when he has finished, he continues with the same hope in his heart.

The Microphone Placement

He carries on with his search for the perfect voice with the same undying expectation that leads the others on in their attempts to locate the perfect face, the ideal manner for their mediums. Possibly he will never find it, still he keeps on hoping, he continues to hold auditions, and he does discover a certain amount of good microphone talent.

Beyond this, constant experimentation with microphones is carried on to make possible better pick-up. Placement of pick-up instruments is a complete study in itself, and it absorbs a good share of the time of the staffs of WEAF and WJZ, musicians and engineers as well. The quality of a microphone voice can be altered to a great extent by changing the relative positions of the microphone and the artist.

There are many claims as to the real discoverer of the "whispering" technique in broadcasting. It matters little who first found out that a new sound effect could be obtained very close to a microphone and singing and talking with very slight volume. To be successful, the "whispering" act demands excellent voice quality and that alone. Similarly, it has been found that voices which do not microphone well with an ordinary pick-up can be softened and made to sound much more agreeable by moving the artists farther away from the mike and then providing sufficient amplification to bring the volume up to standard.

With the double microphone pick-up, which is standard in WEAF's and WJZ's studios, it is possible to handle practically any number of voices or instruments or a combination of the two, leaving only two problems to be worked out for each group of performers—proper grouping of the artists and correct placement of the double microphone stand.

In picking-up music and speech from outside points, of course, many more complicated problems are involved. At large dinners, where the principal speakers are located at various positions along the speakers' table, it may be necessary to provide a separate microphone for every speech. In picking-up the music of large orchestras from the concert halls in which they are appearing, two, three or four microphones are usually used to insure good balance. In the recent broadcast of an act of "Il Trovatore" direct from the stage of the Auditorium in Chicago during a performance of the Chicago Civic Opera Company, 16 microphones were utilized to provide proper musical balance of the various portions of the vocal and instrumental music.

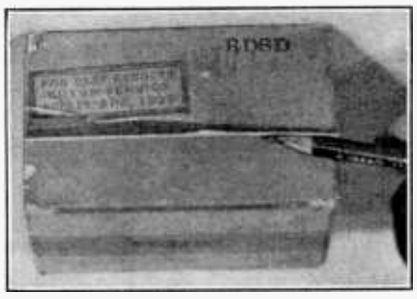
Greater Possibilities

Parallel with this development, other lines of experimentation are being pursued, with the view of providing sound illusions. Until this line of research can be developed, true radio drama is an impossibility. Drama in which the spoken lines are the all-important part, as in Shakespeare, and plays written with the purpose of expressing action in words have, of course, proved highly successful. But these barely scratch the surface of the possibilities of microphone drama.

Dramatic performances which make full use of sound illusions to speed the action of their plots and provide real suspense for their listeners are a certainty, although how soon they will be heard on the air is extremely questionable.

In the meantime, everyone connected with the program and technical activities of broadcasting stations continues his worship of King Microphone, getting to know the monarch better every day, looking forward to the time when, through the medium of the little disc, broadcasters will be able to provide their audiences with still more varied and better entertainment.

COSTLY CARELESSNESS



(Hayden)

ONE FAN complained that his B batteries ran down very fast. Investigation revealed that he laid his hydrometer near the B batteries and saturated the batteries with electrolyte. When he stopped doing this his B batteries lasted six months.

SAN ANTONIO STATION OPENS

San Antonio, Tex.

Using a wavelength of 315 meters, and a power output of 50 watts, WGCR, owned and controlled by Gene Roth and Company, 103 San Pedro Ave., this city, recently opened with elaborate ceremonies. Many letters and telegrams were received commenting on the excellent modulation and trueness as to wavelength.

WAHM Bought by Stromberg-Carlson

Rochester, N. Y.

WHAM, operated jointly by The Rochester "Democrat and Chronicle" and the Rochester "Times-Union" for the past five years, has been sold to the Stromberg-Carlson Telephone Manufacturing Company of this city. The station is located on the roof of the Eastman School of Music, most of the programs originating from the Eastman Theatre and School of Music.

At the present time no changes will be made in either the operating schedule, power, time on air, etc. Next fall, according to W. Roy McCanne, president of the Stromberg-Carlson Company, the power will be increased to 1,000 watts. The station will also be affiliated with the National Broadcasting Company. The programs from the Eastman Music School will be continued on a larger scale.

German 'Plane Uses Radiophone in Tests

Washington.

Telephonic communication was maintained by an airplane while flying from Berlin to Frankfort, Germany, according to a report to the department of Commerce. The microphone used in the test was supported on the breast of the pilot while the headphones were built into the flying helmet. The total weight of the plane's radio equipment was 48 kilograms. Power was taken from a small generator driven by a propeller. Although small tubes were used the power output was great, the quality being also good, according to those listening in.

Membership of Million Sought By New Society

United States Radio, Comprising Organized Listeners, Is Started with Idea of Keeping It Free of Commercialism—Only Fans Allowed to Join

Pittsburgh, Pa.

A campaign has been started for 1,000,000 members by the United States Radio Society, a national organization of radio listeners with headquarters at Cincinnati. Although the idea of such a nation-wide organization is not new, the Ohio organization appears to hold forth considerable promise inasmuch as it seems to be the intention to divorce it entirely from the radio industry.

No one interested in the manufacture or sale of radio receivers or appliances may be connected with the society. It was organized a year ago by prominent business men of Cincinnati, all radio fans. and subsequently received the indorsement of the Cincinnati better business bureau. The society's president is Fred G. Gruen, a watch manufacturer. After another year a national election will be held and fans will choose their own officers.

Paul A. Greene, for four years manager of WSAI, has been appointed managing director of the society. He is an experienced radio engineer, having installed 10 stations before going to Cincinnati.

The first concerted effort of the U. S. Radio Society in the enlarged program will be to take up the cudgel on behalf of the listener in a nation-wide fight on interference. All other phases of radio—the manufacturer, the broadcaster, the amateur, the inventor, the scientist, and the merchandiser—seem to be represented at Washington at the present time, excepting the listener. Therefore, an objective of the Society will be to represent the fans' interest in legislation about to be enacted. The assurance of future protection of listeners is expected to be accomplished by having a council of prominent citizen-listeners from all parts of the country.

The dues are $1 a year and it is announced that already three stations, WSAI at Cincinnati, WHT at Chicago, and WHAS at Louisville, are broadcasting talks in furtherance of the campaign. Mr. Greene will shortly visit 50 of the leading stations of the country in an effort to enlist further support.

He is meeting with success.

Fan 10,500 Miles Away Tunes in Football Game

Broadcast of Alabama-Stanford Contest, from Pasadena, Heard in South Africa "the Next Day," on Short Wave Sent from Schenectady

Did you ever get excited, at 1 o'clock in the morning, at a football game played 10,500 miles away?

It has been done.

A radio listener down in Greytown, Natal, South Africa in the southeastern corner of that continent, admits that he did when he heard the play-by-play description of the Alabama-Stanford football game played in Pasadena, Calif., on New Year's day.

The South African's clock said 1 o'clock and it was the morning of January 2, when he picked up his receivers and heard a burst of cheers and yells coming almost half-way round the earth. He was tuned to 2XAF, the short wave transmitter of the General Electric Company at Schenectady, N. Y., and this transmitter with WGY, operating on 379.5 meters was in the wire network of the National Broadcasting Company. The reception was the more remarkable because, according to the South African listener, J. H. Belcher, reception of the local station at Durban, sixty miles away, was impossible because of heavy thunder storms. Part of Mr. Belcher's letter follows:

"I hardly know how to express my admiration of this piece of work. The reception here was the most wonderful I have ever heard. In the first place weather conditions, thunderstorms, etc., had made the ordinary 300-500 broadcast band impossible for even our local station, Durban, sixty miles away.

"I tuned in on a burst of cheers and yells and couldn't make out what was up at first. Then I got the announcements. The shouts of the crowd, excited screams of the fair sex and college yells came through in such strong and undistorted fashion as to make me almost feel I was on the ground, and then when Alabama was evidently trying hard to even up the score in the second half and time was getting short I confess I was getting as excited as some of them 'over there."

New Zealand Acts to Stop Radiation

Washington.

New Zealand has taken matters into its own hands to prevent troublesome interference to radio reception, according to a report to the Department of Commerce. New regulations have been made which require that direct coupling of the tube to the antenna shall not be made except in the cases of sets which do not radiate. They also provide that circuits of the Super-Herterodyne type shall not be used with an open antenna, but only with a loop, and that, where magnetic reaction is employed, it shall be capable of smooth and ready adjustment of control.

Squealing had annoyed many fans.

Filibuster On "Ether" Makes Savants Laugh

Washington.

Passage of radio legislation by the Senate was endangered by the desire of Senator Robert B. Howell, of Nebraska, to include in the bill a declaration of Government ownership of "the ether."

Scientists got a laugh out of Senator Howell's filibuster to prevent passage of the bill.

Most scientists do not recognize existence of the ether. Einstein in his theory of relativity offers proof of its non-existence. But those scientists who think it does exist, believe it has a drift equal to the speed at which the earth rotates on its axis. In other words, they think the ether remains stationary while the earth rushes through it.

It is pointed out that what Senator Howell really desires is Government ownership and control of radio waves and the media through which they travel. But they claim that even this has serious complications.

While it might not be particularly difficult to control the radio transmitting apparatus, the waves do not confine themselves to the wide-open spaces. They permeate the air, the earth and the sea. They travel through stone, brick, wood, iron and steel.

It is suggested that the elusiveness of the radio waves might even baffle the United States Secret Service should it attempt to keep a vigilant eye on them.

Senate leaders were determined to pass the radio bill despite objections of Senator Howell and Senator Key Pittman, of Nevada, and one or two others.

Most Senators were convinced of the necessity for legislation. They pointed out that broadcasting would receive a severe set-back if legislation failed of passage, and vested rights in wavelengths would be bound to follow; that the broadcasters themselves want to be regulated to prevent interference and confusion, and that the public is pleading for relief from present conditions.

Senator Howell's objection to the bill was based on his desire to obtain a declaration of Government ownership of the ether. Senator Pittman thought the bill should definitely allocate one or two wave lengths to each state. A few other Senators thought the bill is not strong enough in its anti-monopoly provisions.

The prevailing opinion in the Senate, however, was that the necessity for legislation outweighed minor objections to the bill; that if the present bill proved faulty it would be changed in the future.

Amateur Convention To Be Held in April

Hartford; Conn.

The American Radio Relay League's first and district annual convention is to be held in Hartford, April 15 and 16.

The general committee consist of A. A. Herbert, 1ES; A. C. Page, 1BBQ; C. E. Rosen, 1FH; H. M. Marcus, 1CHA; R. B. Bourne, 1ANA; K. A. McLeod, 1CUP; E. Clavez, 1BUE, and F. P. Huntington, 1ACD.

The above committee was arranged at the recent meeting of the Radio Transmitter's Association.

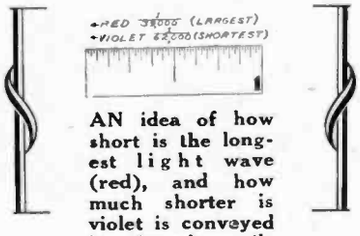
FANNY BRICE BROADCASTS

Los Angeles.

Fanny Brice, well known stage comedian, made her bow before the radio audience, when she apeared before the microphone of KNX.

Atom is the Smallest Broadcaster in World

Sends Out Light Waves So Short That They Defy Description to Layman—Length of Color Waves All Less Than 1/39,000 of an Inch



AN idea of how short is the longest light wave (red), and how much shorter is violet is conveyed by the above illustration. The comparison with one inch is shown on the ruler.

The smallest broadcasting station on record is the atom with its infinitely short wavelength, according to Dr. Willis R. Whitney, director of the research laboratory of the General Electric Company at Schenectady.

The radio waves received in the home receiving set are exactly the same character as light waves, the only difference is one of wavelength. The statement of Dr. Whitney was made to Harry A Stewart whose article on "Conquest of Night" appears in the March issue of the "American Magazine." Continuing, the articles quotes Dr. Whitney as follows:

"You know that one radio station broadcasts on a wave of 400 meters, another on a wave of 360 meters, and so on. But if a broadcasting station were able to send out waves short enough, you would see them in the form of light coming from the antenna, instead of hearing them, as you now hear the longer waves after a complicated apparatus has picked them up.

"As every radio fan knows, the length of the wave sent out by a broadcasting station is governed, to a certain extent, by the length of the antenna; the shorter the antenna, the shorter the wave.

"The shortest antenna ever used to propagate radio waves was composed of two pieces of platinum wire sealed in opposite sides of a glass tube less than a millimeter —or about four hundredths of an inch— apart. You can compare this with the wavelength of light, which is one thirty-nine-thousandth of an inch for the red waves, which are the longest, and one sixty-two-thousandth of an inch for the violet, which are the shortest in the spectrum.

"The radio station in the atom which sends out light waves, is indescribably small. I can best give you an idea of how small it is by an illustration: Suppose we take a cubic inch of air and enlarge it until the molecules of which it is composed are the size of grains of sand. How big a beach would these sand-sized molecules make? Why, we would have to have one a thousand miles long, a mile wide and three feet deep. And there are several atoms contained in each molecule.

"To sum it all up, light is produced by a radio wave almost infinitely short, propagated from an electron which has been electrically kicked away from the nucleus of the atom, and which sets up the electro-magnetic waves by its return to its place, just as the much larger group of electrons forced into a wireless antenna produce the much longer wireless electro-magnetic wave."

Light, therefore, being a radio wave, travels at the same speed as a wave from a broadcasting station, or 186,000 miles a second. This enormous speed is, of course, practically instantaneous, so far as distances on earth are concerned.

A radio or a light wave would circle the globe seven and one-half times in a single second.

Licenses Are Awarded to Eight More Stations

Licenses have been issued by the Department of Commerce to eight more stations, one of which will operate with sufficient power to be heard throughout the United States, in Canada, Mexico and Japan.

The new stations follow:

	m.	kc.	wts.
KGFJ—Northwest Radio Service Co., Spokane	340.7	880	20kw
WMBX—Crystal Oil Co., Columbus, Miss	265.3	1,130	100
KGFI—M. L. Eaves, Ft. Stockton, Texas	220.4	1,360	15
WNBF—Howett Wood Radio Co., Endicott, N. Y.	205.4	1,460	50
KOLO—G. K. Hunter, Durange, Colo	355.1	844	5
WMBY—R. A. Isaacs, Bloomington, Ill	291.1	1,030	15
KGFJ—B. S. McGlashan, Los Angeles, Calif	218	1,375	100
KGA—Northwest Radio Service Co., Spokane	340.7	880	20kw
WNBA—M. T. Rafferty, Forest Park, Ill	238	1,260	500

Here are the changes among stations: KWWG, Brownsville, Texas, has increased its power from 500 to 750 watts; KGBY, Shelby, Mont., has increased its power from 10 to 15 watts; the call of WLBA, Philadelphia, has been changed to WPSW.

VICE MEASURES QUALITY

Motorboating in a receiver is really some measure of the excellence of the audio frequenecy amplifier. The harder it is to stop the low frequency oscillation, the better the amplifier is likely to be. It was not until the design of audio frequency circuits had attained excellence that the trouble was even discovered.

WHERE REMEDY WAS EASY

A high-pitched squeal in many receivers, notably reflex circuits, was caused by the same thing that causes motorboating, but it was relatively a simple matter to stop it in most receivers because bypass condensers of reasonable value are effective at high frequencies.

At low frequencies remedies vary.

READING FOOLS YOU

(Hayden)

THE USUAL POCKET TYPE of voltmeter does not give a fair reading of battery voltage. The meter's resistance is likely to be so low (perhaps only 75 ohms) that the meter draws much more B current than the set and produces an effect in the nature of a short circuit.

Thomas, of KFKX, Gets Higher Position

Pittsburgh.

Lloyd C. Thomas, of Hastings, Nebraska, has been appointed commercial manager of broadcasting for the Westinghouse Electric and Manufacturing Company. The company operates three stations, KDKA, Pittsburgh, KYW, Chicago, and WBZ-WBZA with studios and simultaneous transmitting equipment in Springfield and Boston, Mass.

Since 1923, Thomas has been director of Station KFKX, formerly operated by the Westinghouse Company, but recently taken over by the National Broadcasting Company for agricultural program work.

In his new work Mr. Thomas will have general supervision of program work concerning the three stations, including programs sponsored by advertisers. A lifelong resident of Nebraska, Thomas has been a commercial secretary and legislator. He was born in Elwood in 1889; bought a country newspaper in Alliance in 1908, which he published for 14 years; served in the state legislature in 1917 and 1918; was secretary of the Alliance Chamber of Commerce from 1922 to 1923, and went to Hastings in the latter part of year to take charge of the Chamber of Commerce.

A few months later, the operation of station KFKX was placed in Thomas' hands. In addition to building up the commercial organization and gaining a national reputation for the broadcasting station, Thomas found time to manage the Hastings Civic Auditorium, a municipally-owned convention hall, and to serve as field secretary for two highways traversing Nebraska. He is first vice-president of the Nebraska Volunteer Firemen's Association and a member of numerous fraternal orders.

Big Chain Broadcasts for Beethoven Centenial

In connection with the observance of the Beethoven Centenial, a radio program will be broadcast through many stations of the Red Network of the National Broadcasting Company on the evenings of Saturday, March 19, and the following week, March 26, bringing to the radio audience Walter Damrosch and assisting vocal and instrumental artists. Their tribute to the memory of the great Beethoven is designed to be of especial interest to radio listeners. These two programs will be broadcast through WEAF, WEEI, WJAR, WTAG, WFI, WRC, WCSH, WCAE, WTAM, WWJ, WSAI, WGN, KSD, WOC, WCCO, WDAF, WGY, WHAS, WSM, WSB and WMC.

Arctic Clocks to Be Set By KDKA Broadcast

Final Tests for Benefit of Frozen Fastnesses to Be Conducted on Large Scale—Cheering Messages to Be Sent to Eskimos and Others

Pittsburgh.

Arctic clocks and calendars will be set by radio Saturday night (February 26) for possibly the last time in the long dark Winter which blankets the north country four months of the year. At 10:30 o'clock (Eastern Standard Time) Saturday Westinghouse station KDKA will commence its pre-arranged broadcast to the Far North, bearing personal and business messages; an address in Eskimo, French and English by Bishop A. Turquetil, of the Oblate missionaries in the Canadian Northwest; news and cheering bits of information for the dwellers in the listless north.

Throughout the lonely spell of darkness, the inhabitants of remote posts and settlements frequently lose all track of time. Days blend one into one into the other in the unabating darkness, and, except for the Westinghouse special broadcasts, the sole means of correcting clocks and calendars is by word of mouth from the occasional traveler. Travelers are few and far between in the Arctic; none but the hardiest and most adventurous fares forth along the blind trails of snow and ice, save in the direst of emergencies.

Humanizing Contact

So it is that the pre-scheduled broadcast from KDKA carries more than cheering messages to lonely outposts of humanity deep within the fringe of the Arctic; it bears the humanizing contact of time and the sound of the human voice—veritable evidences of the civilization of milder climates.

It carries also a message to the people from one of their own brothers—Bishop Turquetil's talk, in Eskimo, French and English. The priest has spent virtually a lifetime in the Arctic regions; he knows and loves the country. He speaks Eskimo as fluently as French and English. A trip to the United States during the last two weeks made it possible for the bishop to come to Pittsburgh especially for the Far North program tomorrow night.

How System Began

The first half hour will be entertainment, with songs and piano music, by the Ray-O-Vac Twins, a recent addition to KDKA'S program. The messages will be started at 10:30 o'clock.

Three years ago KDKA began its Arctic broadcasts. At first, they were extemporaneous; given on short notice in an effort to dispatch important messages and information to some lonely worker in the land of the Eskimo. Radio experimenters in the outposts of the Royal Canadian Mounted Police, flung as they were throughout the Northwest Territories, from Baffin Island, Ellesmere Island, to the Yukon, picked up the powerful waves from KDKA, and indicated their pleasure in the reception through letters brought down by supply steamers each summer. From that time, the other Westinghouse stations joined with KDKA to make life more bearable for the isolated northerners, by broadcasting messages from friends, relatives and government agencies; by extending on radio carrier waves a warm handclasp that defied the rigors of the Arctic in its swift unerring flight.

San Francisco Seeks First 1927 Show Honor

San Francisco.

San Francisco will hold the first 1927 radio exposition of the United States, according to an announcement of officials of the Pacific Radio Trade Association. At a meeting of the exposition committee held recently under the chairmanship of Leo J. Mayberg, arrangements were made to hold the exposition in the Civic Auditorium from August 20 to 27, inclusive.

Anthony A. Tremp, well known for his management of the San Francisco Industries Expositions, and who managed the 1926 Radio Exposition, has been reemployed to manage the 1927 Radio Show.

Although early in the season, plans are already well under way to make this the biggest radio show which has ever been held on the Pacific coast. At this early date more than 50 per cent of the entire space has already been contracted for.

CRITICAL FILAMENTS

The —99 type tubes should never be overheated. The limit is 3.3 volts.

Parsons To Study in New York

Pittsburgh.

A fine tenor singer has departed old friends and old ways here. He is Chauncey Parsons, and he has gone to New York to study under William S. Braden, famous as a teacher of voice.

Parsons bade farewell to Pittsburgh, and radio station KDKA, in a recital. For more than six years he has contributed largely to KDKA's programs—either in solo, or with one of many musical organizations. He was soloist for the Shadyside Presbyterian Church, whence the Sunday vesper services are broadcast through KDKA; he was a member of the Chamber of Commerce chorus, the Pittsburgh Apollo Club, the Lions Club quartet and the Fellows quartet. The rather notable display of talent for music which latterly has shown such development in Parsons, had its inception in Boulder, Colorado, his former home. There, at the age of 12, he sang as tenor soloist. Removing to Pittsburgh some years later, he continued the study of music and singing. The nature of his business, manager of the phonograph department of a large department store here, has blended smoothly with his singing.

In going to New York, however, Parsons has given up business to devote his time entirely to music and musical study. His is an extremely pleasant voice, of broad range and fine shading.

NEW SONG

(Foto Topics)

MAY SINGHI BREEN and Peter piano duo, cor

21,000,000 H Ha

Frank A. Arnold, director of developm of the National Broadcasting Company, t members of Kiwanis Club at their week luncheon at the Hotel McAlpin recently t within six years, from 1920 to 1926, t radio business developed into a billion dol industry, totaling about $1,492,000,000.

Annual sales mounted from $2,000,000 1920 to $500,000,000 in 1926, Mr. Arn said and so far only 6,000,000 of the 2 000,000 homes in the United States ha been supplied with radio receiving sets. the 950 broadcasting stations in the wor 678 are operated within the United States

As indicating the immensity of the ind try, Mr. Arnold declared there was a

Gen. Lord H Fears

Washingto

General Herbert M. Lord, director the budget, who gave a talk over radio recently about the financial affa of the Government, does not own a r receiver. He says he is afraid of b sides of radio—talking and receiving.

N. Y. Censorsh

Washington

Government officials and Congressio leaders have evidenced great interest in bill introduced in the New York Legislat to give the state government authority regulate and censor radio within the st

Acting Secretary of Commerce Step Davis, official spokesman for Secret Hoover in radio matters, expressed opinion that the State has not the pov

UNDER WAY

De Rose, popular broadcasting banjo-ukulele- aposing a new song.

omes ve No Receivers

ent tential audience of 30,000,000 in the United
old States within reach of a single human voice.
ily Directly and indirectly the industry gives
hat employment to 300,000 persons, working for
the 3,500 manufacturers, jobbers and distribu-
lar tors. Last year $20,000,000 was spent on
in advertising by radio in this country through
old 400 stations accepting paid advertising, and
7,- twelve New York City newspapers carry-
ve ing 3,500,000 lines of radio advertising.
Of The surface of the broadcasting field has
ld, barely been scratched he said, and that with-
in a reasonable period broadcasting will be
as- so perfected as to make possible the inter-
lo- national exchange of programs, thus bring-
ing the civilized world closer together.

as No Set; Its Fascination

n. "Its a queer feeling," says he, "to
of realize that you're talking to millions of
he people.
irs "I don't have a radio set because it
io would take up too much of my time. I'm
th sure I'd be fascinated by it and would
neglect a lot of more important things."

ip Power Doubted

to regulate radio because of its interstate
nal character.
he "The new Federal law under considera-
ire tion is a measure for complete Federal reg-
to ulation of broadcasting," says Acting Sec-
ite. retary Davis. "In so far as broadcasting
en is interstate in commerce, any state action
try for its regulation would seem to be pre-
the cluded by the assumption of control by the
ver legislation of the Federal Government."

Radioed Medical Advice In More Demand by Ships

Public Health Service Provides System — One Station Alone Handled 57 Cases During 1926, Assistant Surgeon General Smith Reports

One of the services rendered by the United States Public Health Service, in providing medical advice by radio to vessels at sea, has been steadily increasing in volume since its inauguration about four years ago, the Public Health Service announced.

During 1926, said Assistant Surgeon General F. C. Smith, of the Public Health Service, one station of the Service handled 57 such cases. Among the cases handled by this station, he said, were:

"Blood poisoning, severe rheumatic symptons, appendicitis, swollen glands, stomach trouble, conditions causing delirium, chills and fever, toothache, high fever accompanied by vomiting, infected wounds, severe bleeding following a tooth extraction, obstinate constipation, injuries caused by accidents including a probable fracture of the base of the skull, unconsciousness due to oil fumes, acute indigestion, electric shock, severe burns and asthma."

Many Express Thanks

"This medical advice to vessels at sea is greatly appreciated by seafaring men and many letters and radiograms thanking the Public Health Service for the advice given have been received," Dr. Smith stated.

This work is carried on in accordance with the authority granted in Bureau Circular No. 331, promulgated February 4, 1922, which, with amendments, reads in part as follows:

"Subject: Free Medical Advice by Radio to Ships at Sea.

"1. You are advised that arrangements have been made with the Radio Corporation of America and the Independent Wireless Telegraph Company, whereby the Public Health Service will furnish free medical advice to ships at sea through the coastal stations of these companies. Each of these companies operates several coastal stations on the Atlantic Coast, which stations are connected with the New York City offices of the companies.

Calls Must Be Answered

"The only station on the Pacific Coast is located at San Francisco, and is operated by the Radio Corporation of America. That station will make calls direct to the Service hospital, whereas messages received by other stations on the Atlantic Coast will be relayed by the New York offices. However, it may happen that calls will be made direct by the latter stations in case of emergency.

"2. Other stations will likely be established, and if the hospitals indicated below are not accessible to such new stations, the stations will call upon the nearest Service hospital for the advice. All Service hospitals and relief stations receiving requests for medical advice from the main offices or coastal stations of these companies, for transmission to ships at sea, must respond to the call without delay.

"3. The following hospitals are hereby specifically designated to furnish the service in question in the regular course of events:

"Atlantic Coast: New York, N. Y., U. S. Marine Hospital No. 70, alternate, U. S. Marine Hospital No. 21, Stapleton, N. Y.; Key West, Fla., U. S. Marine Hospital No. 10.

"Gulf of Mexico: New Orleans, La., U. S. Marine Hospital No. 14.

"Pacific Coast: San Francisco, Calif., U. S. Marine Hospital No. 19.

"Great Lakes: Chicago, Ill., U. S. Marine Hospital No. 5; Cleveland, Ohio, U. S. Marine Hospital No. 6; Sault Ste. Marie, Mich., Relief Station No. 327.

"Philippine Islands: Manila, P. I., Relief Station No. 270.

Advice in Lay Language

"4. Upon receipt of a request for medical advice in any given case, you are directed to furnish promptly whatever advice seems indicated (calling upon your consulting staff if necessary), couched in language intelligible to a layman.

"5. These requests will, in most instances, be made by vessels and carrying physicians, although consultations may be requested by ships' physicians.

"6. A record will be made of all such advice furnished, the same to include date furnished, name of ship, and other pertinent data. Until an official form for this record is provided, this record will be made on blank paper, in duplicate, one copy to be filed in the hospital and one forwarded to the Surgeon General (attention: Hospital Division. This record will be headed "Medical Advice Furnished by Radio to Vessels at Sea" (Bureau Circular No. 331) with the name of the station following, but separated from the heading."

No Jazz Sent From Haiti Station

Those who tune in on Station HHK, at Port au Prince, Haiti, will hear music of French origin, but no jazz, for jazz is virtually unknown in Haiti. Apart from music the program includes educational features, such as lectures on agriculture, hygiene, public improvements, telephones, etc. Interest in foreign radio reception, especially from the United States, is great.

Station HHK is a 1,000 watt station and operates on a wavelength of 361.2 metres. It is of Western Electric design and was installed last year by the International Standard Electric Corporation, beginning broadcasting in August. It has been frequently heard in Colorado, Georgia, Florida, Connecticut, Porto Rico, Venezuela and the Dominican Republic.

The station stands adjacent to the President's palace and concerts are frequently broadcast by the palace band and also by the band of the Gendarmarie, the armed forces of the country.

The morning lectures are generally given in Creole and to these many of the natives listen with great interest by means of Western Electric Public Address systems which the Government is placing in open spaces in cities and towns. Private receiving sets, are of the vacuum tube type,

A THOUGHT FOR THE WEEK

AN untruth over the air in effect is not unlike an untruth printed in a newspaper. In each case the original lie or libel is multiplied many thousands of times. Hence the moral obligation of station owners to prevent broadcasters making statements contrary to well-established fact.

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, 3⅛" 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 R. O. W. one year	15%
4 consecutive issues	10%

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

CLASSIFIED ADVERTISEMENTS

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

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

Spokane Delighted with Chain Tieup

Spokane, Wash.

Good news for Spokane and Inland Empire radio listeners, even users of crystal sets, was contained in an announcement made recently from New York by M. H. Aylesworth, head of the National Broadcasting company, that the WEAF, WJZ, "blue" network chain, would be brought to the northwest and Spokane on telephone wires for broadcasting over KHQ.

"The Pacific coast stations to receive the hookup with the east are KFI, Los Angeles, KPO, San Francisco; KOMO and KFOA, Seattle, KGW, Portland; KGO, Oakland, and KHQ, Spokane," said Louis Wasmer, owner of the Spokane station. "This plan has been under way for months and confirmation by Mr. Aylesworth is surely gratifying. Spokane listeners will hear over $2 and $3 sets such stars as John McCormack, Damrosch's symphony orchestra, and Madam Schumann-Heink."

The first chain hookup featured President Calvin Coolidge when he delivered his Washington's birthday address on February 22. It is probable that the first chain entertainment program will be received in Spokane early in April.

Much More Religion to Go Over the Two Big Chains

N. Y. Church Federation to Send Two Extensive Programs a Week and Eight Shorter Ones From Waldorf-Astoria—Business Men Join Committee to Enlarge "New Form of Worship"

Working in cooperation with the National Broadcasting Company, the Greater New York Federation of Churches is planning for the rest of this year a program of religious broadcasting larger in scope than anything heretofore attempted. Being one of the first religious broadcasters of the country, the Federation has had an experience in broadcasting over 1,200 services during the past four years, a record probably unprecedented in the United States. The aim of the Federation from the first was to send out to the people of the country, via radio, a helpful noncontroversial message and sacred music that could be accepted by an audience made up of men and women of all religious faiths.

During the past two months prominent business men in many parts of the country have been invited to join the National General Committee and give to this unique and important development in religious work the benefit of their own experiences and religious convictions. This committee will sponsor all the religious broadcasting of the Federation and will aid in creating a program that will be the best in religious thought common to all beliefs.

A Big Service

Thousands of letters from people, from over 2,000 cities and towns, representing all faiths, have been received during the past four years commending the programs. Recently many letters have shown apprehension lest, due to the combining of radio interests, the religious part of radio programs will be curtailed.

The National Broadcasting Co. and the Federation realize that radio is reaching thousands unable to attend religious services, including the sick, in home and hospital, the blind, the aged, the deaf, country people, and those in remote places shut off from others, and is now planning with the committee of laymen to enlarge the program.

The Hotel Waldorf-Astoria, in New York, through its managing director, Augustus Nulle, has placed at the disposal of the committee its Empire Room, from which will be broadcast programs over the Red and Blue circuits. At 3 to 4 o'clock each Sunday afternoon a program known as the "Young People's Conference" for the youth of the country, will go on the air through WEAF, and at 5:30 to 6:30 each Sunday evening a "People's Radio Vespers" will reach the radio audience through WJZ. To both of these broadcasts the public is invited to attend personally, and the Waldorf-Astoria management is making every effort for their convenience.

Members of Committee

The commitee that will sponsor these programs, in addition to eight other services during the week, consists of J. C. Penney, merchant and philanthropist, chairman; George U. Tompers and Major Edward Bowes, the vice-chairmen; Henry Fletcher, Nicholas M. Schenck, William M. Calder, Clarence C. Stoughton, A. H. Diebold, E. W. Samuels, Elwood G. Lewis, Edwin Markham, Dr. George Mord, Ralph W. Gwinn, E. C. Sams, George Arnold, Homer A. Rodeheaver, James N. Jarvie, Charles H. Strong, Demetrios Callimahos, Mark W. Allen, Judge Thomas C. Brown and Anton L. Schwab.

In addition to sponsoring the above broadcasts, the committee will be the executive body of the Church Radio League, which is being formed in answer to the call for a tangible contact between the thousands of radio listeners and the Federation. The aim of the league is to bring about a closer and more helpful relationship between the broadcaster and the listener, and to develop and maintain the highest possible standard of radio programs, both religious and secular. It is learned from letters received from all parts of the country that a new form of worship is being raised and maintained by radio broadcasting. Church loyalty has been stimulated and people are taking a new interest in religious and other wholesome entertainment.

Monopoly in Rumania Requested by Firm

Washington.

Minister W. S. Culbertson, at Bucharest, recently sent in a report to the Department of Commerce stating that a Rumanian company has been established to procure a monopoly on radio broadcasting and the manufacture of radio apparatus and possibly telephone and telegraph apparatus. The International Radio Broadcasting Commission of Geneva has assigned a wavelength of 236.2 meters for the broadcasting station, while the local director of communications has asked for a wavelength of 460.5 meters.

Crystal Wave Control Vitiated By Laxity

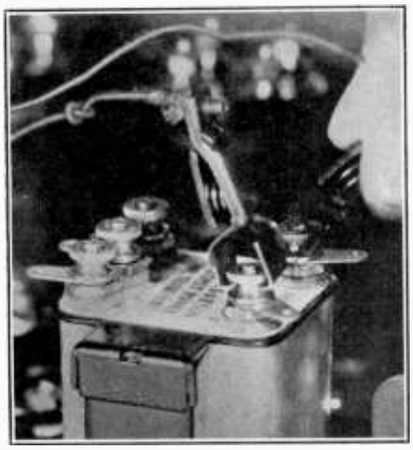
Washington

Dr. T. Crossley, of the Naval Experimental Laboratory, at Belleveu, D. C., believes that most of the deviations from waves by crystal controlled broadcasting stations would be eliminated if the crystals were properly used.

"If the piezo crystal control is properly installed and properly maintained," says he, "there should be less than one per deviation. I know of a number of crystal controlled broadcasting stations which are puzzled because of deviation from their frequency. If they will check up, they will probably discover that their piezo crystal wasn't properly installed or else it isn't being given proper attention."

Dr. Crossley has given considerable time to piezo crystal study because of the Navy's need for absolute constancy of frequency by transmitters of the battle fleet.

TEST THE PARTS



(Hayden)

MANY CONSTUCTORS are so anxious to finish building a set, to hear it perform, that they omit the precaution of testing each piece of apparatus. Such precaution is cheap insurance, as it is difficult to trace trouble in a completed set. Use test clips connected to one phone cord and one post o fa small C battery. The strong click designates a continuous metallic circuit, and silence a non-inductive condition.

Stage Satires On Reception Hinder Selling

Washington.

So-called satires on radio reception by theaters and motion picture houses are responsible for the determination of thousands of people not to own radio receiving equipment, according to Chief Radio Supervisor W. D. Terrell.

Many of these prospective set owners have been led to believe by listening to the efforts of their friends to bring in distant stations that the set is capable only of producing weird noises. They are convinced by the take-off by the theaters on the efforts of the DX-ers seeking distance.

"Instead of reception and reproduction being as bad as it is misrepresented to be," says Mr. Terrell, "the very opposite is more generally the case. I have heard the very finest Victrolas which are claimed to give perfect reproduction. I can always get several stations well enough to enjoy their programs. My set isn't any better than the average good set on the market."

Youthful Girl Violinist In A. K. Hour

SYLVIA LENT, young Washington violinist, played before her largest audience, when she appeared before the microphone in the studio of WEAF, which was tied up with the Red network of the N. B. C.

Sylvia Lent, the twenty-year-old violinist of Washington, recently broadcasted in the Atwater Kent concert, with Armand Tokatyan, Bulgarian tenor of the Metropolitan Opera.

Miss Lent is the most youthful artist so far admitted to the galaxy of world famous artists of the operatic and concert stage who broadcast regularly over a hook-up of nineteen stations, in the Atwater Kent Hour.

She began her study under the direction of her father, a cellist of note, and later studied with Franz Kneisel. She was the first pupil accepted by Professor Leopold Auer when he came to this country. At his suggestion she made her debut in Berlin, in 1922, and played in concert at Dresden, Leipzig and Munich. Returning to this country, she appeared with the New York Symphony, New York State Symphony, and the Chicago Symphony Orchestras. She toured in recital and concert, and appeared in many spring festivals, notably at Cornell University, Ann Arbor, and Newark.

Tokatyan is a native of Philippopoli, Bulgaria. His parents removed to Egypt when he was four years old, and there he received violin and piano instruction. While attending an Italian school in Alexandria, his voice was discovered. He was given a place in the chapel choir and urged to pursue his study in Italy.

He went to Italy in 1918 to study under Maestro Cairone, and in 1921 made his operatic debut as Des Grieux in Pucinni's Manon Lescaut, at Modena's Teatro Storchio. Following his American debut with the Scotti Opera Company, May, 1922, he signed a one-year contract with the Metropolitan Opera, New York, which was in force but a day. Immediately following his initial appearance with the Metropolitan, a five-year contract at a higher figure was substituted.

Miss Lent played songs composed by Kreisler, Brahms, Hochstein, Chopin, Spalding, MacDowell, while Mr. Tokatyan sang songs composed by Del Riego, Lacelle, Donzetti, Tosti, etc.

Educators of Country Hail Broadcast Lessons

Use of Receivers in Classrooms Discussed by Association at Annual Convention in Dallas Recently— Atlanta's Success Cited

The use of radio in schools, as a means of giving new scope and interest to educational instruction, was discussed by educators attending the annual convention of the Department of Superintendence of the National Educational Association, at Dallas, Texas.

Professor Willis A. Sutton, superintendent of schools at Atlanta, Ga., will tell how Atlanta has utilized radio to stimulate new interest in school work, not only among the pupils but among teachers and parents as well. Other phases of radio use by schools were presented by Professor Nicholas Bauer, superintendent of schools in New Orleans, and Sam Pickard, director of radio for the U. S. Department of Agriculture.

Professor Sutton claims for Atlanta the distinction of being the first sizeable city to adopt radio as a definite part of its school equipment. Through the cooperation of A. Atwater Kent, the radio manufacturer, Atlanta school authorities were assisted in working out a city-wide school installation. A schedule of radio classes broadcast through WSB, the station of the "Atlanta Journal," gives each grade, both in the elementary and high schools, one radio period weekly. A special radio hour, for pupils and parents alike, also is provided each evening.

As a means of broadening the school horizon, of stimulating new interests and promoting teamwork throughout the whole school organization, Professor Sutton says the radio has proved of inestimable value.

"Radio is developing a new life," he declares. "It gets hold of that ethereal element known as the imagination. Curiosity is aroused. More information is sought. Purpose is strengthened and life ennobled by radio lectures and instruction. Life and thought are no longer circumscribed by narrow local limitations. Direct vocal, audible contact is established with the outside world. Great educators, statesmen, captains of industry, speak their messages directly to the student. Ambition is stirred. Brain cells previously dormant begin to function. A new growth and understanding result. Thanks to radio, this has been the best year in all Atlanta school history."

Two Embezzlers Seized in Cairo on Broadcast Tip

Cairo, Egypt.

The broadcasting of a message, regarding some bank frauds in Hungary sent by the Budapest police, led to the arrest of the persons responsible in this city. A local police officer, acting on the information, arrested two men sitting on the terrace of a hotel. They offered no opposition and when taken to the station house they confessed to the frauds.

New Orleans, La.

Louis M. Johnson and Henry A. Johnson, two well known radio men, have opened up a radio and electrical supply and repair shop, under the name of Johnson Brothers, at 1609 Dryades St.

San Francisco, Cal.

After ten years as United States radio inspector in the Bureau of Navigation, D. B. McGown resigned recently from the Government service to establish a radio testing laboratory.

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.

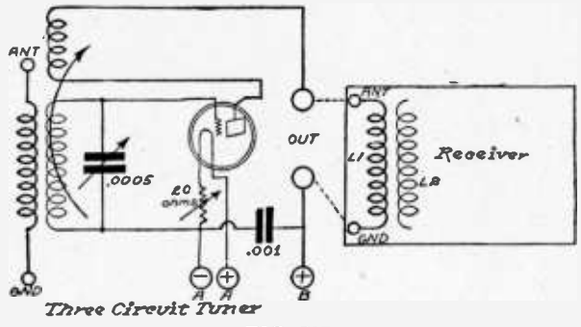


FIG. 517
The circuit diagram of a trap unit sent in by James Wallach.

I OWN a five-tube receiver, containing two stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer coupled audio frequency amplification, which until the installation of a broadcasting station about ten blocks away, recently, gave very satisfactory results. Now, whenever this station is on the air, I can receive nothing else, except very powerful stations, which drown this station out. This, of course, is not pleasant to the ear I have a three-circuit tuner, containing a ten turn primary and a fifty turn secondary, both wound on a three-inch diameter tubing using No. 22 double cotton covered wire, with a one-half inch space between the primary and secondary windings. The tickler consists of thirty-seven turns of No. 26 single silk covered wire, wound on a two and one-half inch diameter tubing. Could I use this tuner in the circuit diagram, enclosed, to trap out this station? L1 and L2 in the receiver indicate the primary and secondary windings of the radio frequency transformer respectively.—James Wallach, San Francisco, Cal.

Yes, this is a good stunt. Be very careful in tuning this circuit, since it oscillates, and if allowed to do this consistently, will interfere with your neighbor's reception.

* * *

PLEASE GIVE me the circuit diagram of a four-tube receiver, employing two stages of tuned neutralized radio frequency amplification, using resistors, and midget condensers for neutralization, a non-regenerative detector and a single stage of transformer coupled audio frequency amplification, with a variable resistance across the secondary of this transformer to control the volume. State the constants of the coils, condensers, etc. —Herbert Elwood, Brooklyn, N. Y.

Fig. 518 shows the circuit diagram of such a receiver. The primary L1 consists of eight turns, while the secondary consists of seventy turns, both of which are wound on a tubing, three inches in diameter. The secondaries L4 and L6 consist of sixty-five turns, while the primaries, L3 and L5, consist of five turns. Each primary and secondary is wound on a tubing which is three inches in diameter. The latter secondary windings are tapped at the twenty-second turn from the beginning. The secondary winding of the first radio frequency transformer is tapped at the thirty-fifth or center turn. In winding all these coils, use No. 22 double cotton covered wire. Space each primary and secondary winding, one-quarter inch. R1 and R2 are one-quarter megohm fixed resistors. C11 and C12 are .00004 mfd. variable condenser. C5 and C6 are one mfd. fixed condensers. C1, C2 and C3 are all .00035 mfd. variable condensers. C4 is a .00025 mfd. fixed condenser, while R3 is a 2 megohm grid leak. C8 is a .00025 mfd. fixed condenser. C9 is a .006 mfd. fixed condenser. C7 and C10 are .001 mfd. fixed condensers. R7 is a 50,000 ohm variable resistor, used to control the volume. The arm of this resistor is brought to the G post on the socket. DCJ is a double circuit jack, while SCJ is a single circuit jack. R4 is a ten-ohm rheostat, which controls the filament temperature of both radio frequency tubes. The filament of the detector tube is controlled by a 20-ohm rheostat. The filament of the audio tube is controlled by a 10-ohm rheostat. The —01A type of tubes should be used throughout, except in the audio stage, where a power tube may be employed, if desired. A six-volt negative bias is placed on the grids of the radio tubes. The bias on the grid of the audio tube depends upon the E and C voltage, as well as the tube used. Be sure to break B plus 2 lead, and insert another binding post, if more than ninety volts B are used. The plates of both RF tubes are still left connected to a common B connection, e. g., sixty-seven and one-half volts.

* * *

WHAT ADVANTAGES are there, in using the Twinchoke system of amplification?—Roy S. Scotter, Hollywood, Fla.

The advantages of this system are best described by Kenneth Harkness maker of the chokes used in this system.

"The voltage amplification of the Twinchoke amplifier is considerably higher than that of standard resistance and impedance-coupled amplifiers and its three stages give very much greater amplification than a two-stage transformer-coupled amplifier with modern type transformers. The choke coil grid leaks are also responsible for this characteristic. The ordinary impedance amplifier (which gives greater amplification than a resistance-coupled amplifier) limits the voltage amplification by the use of grid leaks with a comparatively low resistance. To prevent tube blocking and rectifying distortion and permit the handling of a fair amount of volume it is necessary to use grid leaks with a resistance of 100,000 ohms or less. The input resistance of the tubes is thereby lowered and the voltage amplification greatly reduced. On the other hand, the average audio frequency impedance of the choke coil grid leaks of the Twinchoke amplifier is about 1,000,000 ohms. Consequently, the amplification per stage is very much greater and closely approaches the amplification constant of the tube."

* * *

WHAT IS meant by humming of a transformer? (2) The diagram on page 9 of the Sept. 4 issue of RADIO WORLD, illustrated how to hookup a choke coil and condenser in the output of a set to keep the DC out of the speaker winding. No mention was, however, made of the value of the choke. What is this?—Morris Sintler, Bronx, New York City.

(1) It may be described as a noise made by an AC transformer or choke, due to the mutual repelling of the iron-clad laminations in the core, or mutual attraction of the windings. It can be cured by tightening the grip on the laminations, as well as placing the coils, in such a way, that they may not be easily or at all moved about. (2) About thirty henries. A choke such as used in B eliminator circuits, can be used.

* * *

I HAVE frequently heard the terms "line wire," and "magnet wire." What is the difference between the two?—Leonard Meier, San Francisco, Cal.

Line wire is heavy hard drawn copper or aluminum wire. Magnet wire is soft copper wire. Line wire is used in power transmission work, as well as telephone lines. Magnet wire is usually used for winding coils used in armatures of motors, generators, electro-magnets, coils, etc. The covering on magnet wire is very thin, and usually consists of a layer of enamel and a single layer of cotton. The coating on line wire is heavier and consists of cotton impregnated in tar, covered with parafin, or some such heavy substance.

* * *

WHAT IS an inch equal to, in centimeters and millimeters? (2) In regard to the circuit diagram of the three-tube reflex which appeared in the Radio University columns of the Oct. 9 issue of RADIO WORLD. Can a three-circuit tuner be used in the radio frequency stage, instead of the variable primary method in the radio frequency transformer coupling the radio freqquency tube to the detector tube? This tube contains a ten-turn primary, a forty-seven turn secondary and a thirty-two turn tickler. The primary and secondary is wound on a tubing which is three inches in diameter, while the tickler is wound on a tubing which is two and

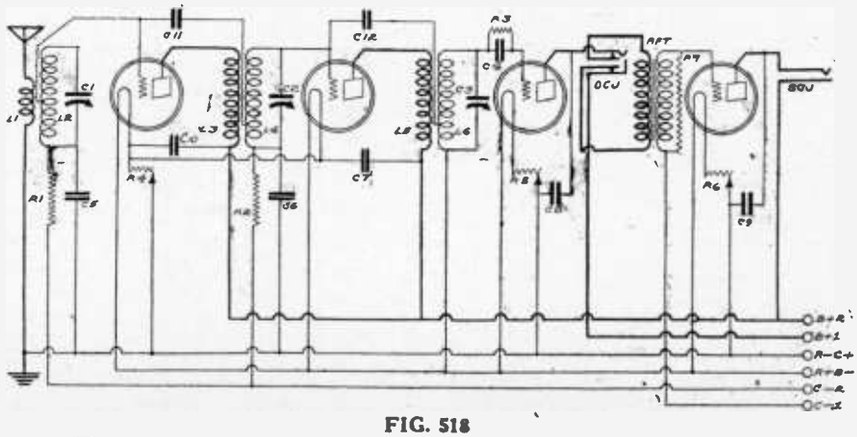


FIG. 518
The circuit diagram of a four-tube set, requested by Herbert Elwood.

one-half inches in diameter. No. 22 double cotton covered wire is used in winding the primary-secondary windings, while No. 26 single silk covered wire is wire in the tickler windings. (3)—How many turns would it be necessary to wind on a tubing which is three and one-quarter inches in diameter, to constitute the primary and secondary of the radio frequency transformer coupling the RF and detector circuits to match the tuner? What size wire should be used? (4)—What capacity variable condenser should be used?—Arthur Tillingast, Jersey City, N. J.

(1)—2.540 centimeters equals an inch, while 25.40 millimeters equals an inch. (2)—This tuner can be used. (3)—Ten turns on the primary and forty-two turns on the secondary. No. 22 double cotton covered wire is used. (4)—Use .0005 mfd. variable condensers.

* * *

MY BROTHER recently gave me three .0005 mfd variable condensers; one .001 mfd. variable condenser; two, four to one audio frequency transformers, and five tubings, three inches in diameter and six inches long. Could I have the circuit diagram of a four-tube set using all these parts?—Irwin Malmar, Jersey City, N. J.

The circuit diagram of such a set is shown in Fig. 519. The three .0005 mfd. variable condensers are used to tune the secondary windings of radio frequency transformers. L1 consists of sixty turns, wound on one of the three inch tubings, tapped at the fifteenth turn. L2 and L4, the primaries of the second and third RFT, consist of ten turns. The secondaries, L3 and L5, consist of forty-five turns. Each primary and secondary is wound on a 3-inch tubing. No. 22 double cotton covered wire is used, in all cases. The .001 mfd. variable condenser is used to tune the antenna, which is shunted across a thirty-turn coil, also wound on a three-inch diameter tubing, using No. 22 double cotton covered wire. The filament of the first RF tube is controlled by a twenty-ohm rheostat. The filament of the second tube is controlled by a one-quarter ampere ballast resistor. The filament of the detector tube is also controlled by a twenty-ohm rheostat. The filament of the last tube is controlled by a one-quarter ampere ballast resistor. A .00025 mfd. fixed condenser with clips, in which a 2-megohm grid leak is inserted, is used in the grid circuit of the detector tube. One of the audio frequency transformers is used in the reflex stage, while the other is used in the straight stage of audio frequency. SCJ indicates that a single circuit jack is used in the output of the amplifier circuit. The beginning of the L1 winding is brought to the ground, while the end is brought to the grid post on the first socket. The tapped portion of this winding is brought to one terminal of the condenser-coil combination in the antenna circuit. A filament switch, connected in series with the positive leg of the A battery, is used to connect and disconnect the A battery. B plus 1 equals forty-five volts. B plus 2 equals ninety volts. A four and one-half volt C battery is user. The antenna tuning combination can be placed inside of the cabinet, since this is not a critical combination, requiring very little attention.

* * *

CAN ANOTHER stage of audio frequency amplification be added to the two-tube receiver shown on page 11 of the July 31 issue of Radio World, using a ten-ohm rheostat to control the filament of the audio tubes? (2)—Can a variable grid leak be used across the grid condenser in the detector circuit?—Milton Fletcher, Atlantic City, N. J.

(1)—Yes. Be sure that the wire used in the rheostat is heavy enough to pass the amount of current drawn by the tubes. (2)—Yes. When hooking up this leak, be sure to connect the arm or that portion of the leak with which the adjustment is made, to the coil, not to the G post on the socket.

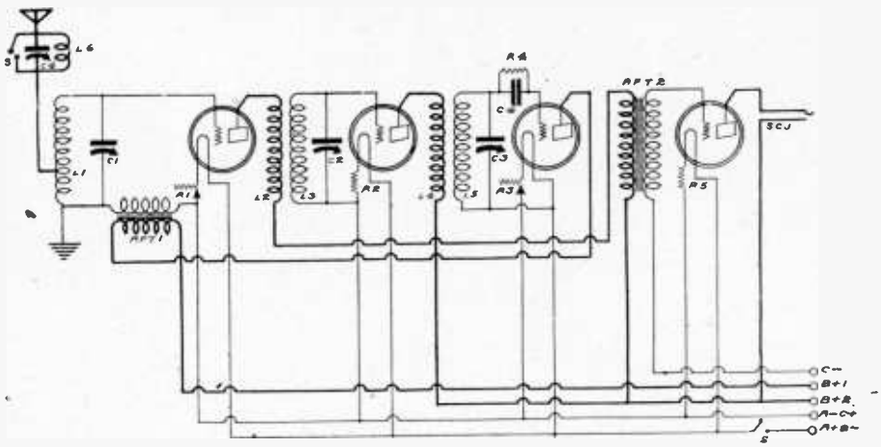


FIG. 519

The four-tube reflex receiver, using a tuned antenna system.

* * *

I WOULD like to have some information on storage batteries. (1)—Is basswood better than white cedar for use as separators? (2)—When a battery is on charge and starts to gas, what is the approximate peak voltage at this moment? (3)—Some of the batteries I have had, when on charge, give me only a reading of 1280 on the hydrometer, while others give me a reading of 1325. The results I had with both types have been the same. Is it true that one type just contains a stronger percentage of acid, than the other? (4)—The plates in one of my batteries are sulphated. Could I use this method of cleaning them?: "Dissolve about one-half pound of ammonium acetate in a quart of water, which has been placed in an earthenware bowl. Immerse the plates in this solution and leave there for about three-quarters of an hour. Take the plates out and wash in clear water. Then allow to dry." I obtained this information from a battery handbook. — James Martin Wallace, Tarrytown, N. Y.

(1)—Yes, this is the best of its class. (2)—About 2.3 volts per cell. (3)—Yes. (4)—This is a good system. You will have to be very careful in tearing down the battery, though, being sure not to loosen the material in the grids of the plates, etc.

* * *

I WISH to build a three-tube receiver shown in the Radio University columns, page 15, of the Oct. 2 issue of Radio World. Could the parts for this set be placed on a baseboard which is fifteen inches long and seven inches wide? (2)—Could I use a power tube in the last stage of audio frequency amplification, by inserting a ½ ampere ballast resistor in the filament circuit, and connecting the F post of the last audio transformer to a minus post of a C battery?—Francis Keston, Providence, R. Is.

(1)—Yes, this board should give you ample space for wiring and placing of all the parts. Do not place the variometer very close to the radio frequency transformer, a distance of about six inches being allowed. (2)—Yes.

* * *

COULD TWO stages of resistance coupled audio frequency amplification be added after the single stage of transformer coupled audio amplification in the four-tube receiver shown in the Radio University columns of the Jan. 15 issue of Radio World, disregarding the second transformer audio stage? (2)—What value resistors and condensers I use?—Charles Murchell, Meriden, Conn.

(1)—Yes. (2)—Suggest you see the article on the Diamond of the Air in this issue.

* * *

I HAVE a three-stage resistance coupled audio amplifier. Could I add it to the Super-Heterodyne described in the Radio University columns of the Feb. 5 issue of Radio World? (2)—Is the fixed condenser C6, hooked up O. K., in the detector output circuit of this set? In many receivers, I have noted that the condenser was connected to the P post of the audio coupler, after the radio frequency choke, instead of to the P post of the socket before the radio frequency choke as is done here.—Lester Pesters, Chicago, Ill.

(1)—Yes. (2)—The method used in this receiver is correct. The other is incorrect.

THE RADIO TRADE

Bakelite's Case Against Substituters Reaches End

Testimony Completed in Tariff Commission Hearing On Complaint That Importers Use Unfair Tactics in Capitalizing American Firm's Reputation—Patent Has Expired

Thomas O. Marvin, Chairman of the United States Tariff Commission announced that the hearings in the Bakelite case have been closed. The bearings attracted wide attention, particularly in the radio industry. It was charged some imported material was sold wrongfully under the Bakelite name.

The case had been reopened on appliation of Meyer Kraushaar and W. Lee Helms, Jr., counsel for a group of importers named in a complaint filed by the Bakelite Corporation of New York City for alleged infringement of patents and unfair trade practices in the sale of certain products known to the trade as "Bakelite." Albert MacC. Barnes, Jr., Samuel M. Richardson and John R. Brickenstein represented the Bakelite corporation as counsel.

Hearings Completed

Hearings in the case centered around the allegation by the Bakelite Corporation of infringement of certain patents which counsel for the importers argued were invalid because the statutory limit placed upon them had expired. Mr. Barnes, principal spokesman for the corporation, not only upheld the validity of the patents but charged the importers with having engaged in unfair trade practices.

Court decisions touching upon the validity of patents were read into the record by both sides. Mr. Kraushaar's contention was that a patent became public property after its expiration, but Mr. Barnes argued that it was the custom and good will built up by a trademark that the courts have upheld in preventing the palming off of goods under misrepresentations. The uses to which Bakelite are put include radio to a large extent.

Mr. Barnes characterized the situation affecting the industry he represented as a built up system of unfair competition. He called to the stand to substantiate his argument of unfair competition Francis Hoyt, who had been employed by his firm to make a survey of unfair trade practices in the sale of articles trademarked as "Bakelite." Mr. Hoyt's testimony consisted of the identifying of samples that had been sold to him as imported Bakelite.

Seeks to Strike Out Testimony.

Mr. Kraushaar made repeated efforts to strike his testimony from the record.

Mr. Kraushaar and Mr. Helms contended that there had been no infringement of patents or trade marks and indignantly insisted that the importers were not "thieves," and had not engaged "in a crooked business." Both Mr. Helms and Mr. Kraushaar questioned the right of the complainants to commercialize on a patent that had expired. The patent involved, expired in December, 1926, and the purchases made by Mr. Hoyt were subsequent to that time, and according to Mr. Kraushaar was irrevalent, incompetent and immaterial. Mr. Marvin overruled the motion of counsel to strike out Hoyt's testimony.

Joseph Luvhs appeared as a witness for the corporation and James W. Berans, representing the National Council, American Importers and Trades, Inc., defended the position taken by counsel for the importers.

TRADE NOTES

Sioux Falls, S. D.

The Radio Dealers' association of Sioux Falls was recently formed, at a meeting of the local dealers at the Chamber of Commerce. The following retail radio stores were represented: Radio Store, George Wheeler; Independent Radio Sales, G. I. Morgan; Universal Barber Supply, Oscar Hanson; Markell Tire & Accessory Co., G. Markell; The Sport Shop, R. Herning; and Weber Bicycle Co., by C. L. Warne. Mr. Morgan was selected as chairman of the association.

The object of the organization will be to foster and help retail radio business in general, to help the listener-in by checking over interference troubles and also to cooperate with the local power companies in the elimination of interference. A definite schedule of charges for installation of aerials, demonstrations and services were adopted.

It is planned to establish several listening posts about the city so that accurate information can be obtained each day on the radio reception both local and long distance. The reports from these posts will be published each day in the Argus-Leader, thereby giving the radio owner the information relative to reception of the programs the night before. All persons engaged in the radio business are eligible for membership in the association and may obtain information from Mr. Morgan.

* * *

Boston.

The Dewey Radio Company has recently opened an additional store at 22A Brattle street.

The Dewey chain now consists of three radio stores, and according to Eli Berman, the president of the company, will carry a complete line of popular radio receivers and their policy of service, which has been responsible for their success in the past years, will be very much in evidence in their new location.

* * *

St. Paul, Minn.

The Northwest Radio Dealers' association was organized by a group of radio men at the Saint Paul recently. The association was formed to render service to dealers throughout the Northwest. A radio show at the St. Paul auditorium in October will be the first big project of the group.

The following officers were elected: Theo. Hohtanz, Peyer Music Company, president; E. O. Borglin, Howard-Farwell & Co., vice president; R. F. Smith, Golden Rule, treasurer.

C. J. Otterholm was named managing director of the proposed radio show.

Literature Wanted

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

RADIO WORLD,
145 West 45th St., N. Y. City.
I desire to receive radio literature

Name .....
Address .....
City or town .....
State .....

A. A. Dill, P. O. Box 520, Walla Walla, Wash.
A. N. Dahlgren, 20 Mamm St., Bradford, Pa.
M. L. Hurston, 726 College St., Stuttgart, Ark.
J. W. Fidler, 551 Century Bldg., Pittsburgh, Pa.
Milton Robbins, 254 Kings Highway, Brooklyn, N. Y.
Frank Atwell, Dixon, Mo.
J. B. Clarke, 434 Buchanan St., N. W., Washington, D. C.
James Sharp, Gates Mill, O.
Frank J. Tagliani, 300 10th St., Brooklyn, N. Y.
Felix A. Bonilla, San Pedro Sula, Honduras, Central America.
Dr. R. A. Gamble, Petersburg, Va.
H. T. Doeren, 1537 Republic St., Cincinnati, O.
Frank Finn, 448 Maple Ave., Elizabeth, N. J.
G. A. Hunt, 35 Beacon St., Woburn, Mass.
Leslie J. Smith, Byron Hotel, Portland, Ore.
C. H. Friedlin, 317 5th St., Portsmouth, Va.
Alf. Candy, 33 Chester Ave., Toronto, 6, Canada.
Woodrow Gibbs, 5B North St., Asheville, N. C.
Smith's Radio Service, 3714 S. Gallatin St., Marion, Ind.
F. J. O'Toole, 168 East 82d St., N. Y. City.
J. H. Eigher, P. O. Box 181, New Orleans, La.
James Rennie, 3056 Third Ave., N. Y. City.
Cecil Jones, 113 De Sota St., Fayetteville, Tenn.
William Arnold, 400½ South 8th St., Quincy, Illinois.
A. B. Wagner, 1105 Baxter Ave., Superior, Wisc.
David Kupperberg, 1122 Westchester Ave., Bx., N. Y. City.
Arnold H. Hill, 414 Sherman Ave., Flint, Mich.
Horace C. Hyde, Box 92, Longworth, Texas.
Joseph Levine, 446 Powell St., Brooklyn, N. Y.
Oscar Herbert, Box 448, Bunkil, La.
D. Terry, 567 6th St., Richmond, Calif.
R. W. Johnson, 1546 Sandy Boulevard, Ore.
Glenn Walls, 406 Ann St., Pendleton, Ore.
A. R. Moffitt, 321 Voorhis St., Council Bluffs, Iowa.
Chas. Kenney, 3821 8th Ave., Brooklyn, N. Y.
Karl Williams, South Pardee St., Wadsworth, O.
Homer Morris, 293 Union St., Blue Island, Ill.
Sidney Greenstein, 828 Dawson St., Bronx, N. Y.
Bertram Reinitz, 127-A Clarkson Ave., Brooklyn, N. Y.

NEW INCORPORATIONS

Graymore Radio Corp., N. Y. City; $15,000; W. B. Spiegel E. Rosenbaum. (Atty., E. Heyman, 291 Broadway, N. Y. City).

Arrow Electric & Radio Corp., Jersey City, N. J.; $10,000; Al. Levine, Sophie Levine, Jersey City, N. J., Irving Freedman, Bayonne, N. J. (Atty., Irving Meyers, Jersey City, N. J.).

United Independent Broadcasters, N. Y. City, radio programs, 1,000 common, no par; F. C. Delaney, E. C. Kerr, W. C. Fleming. (Atty., Compton-Delaney, 501 5th Ave., N. Y. City).

R. & S. Sales Co., N. Y. City, radio; $25,000; D. McLanahan, C. U. Carruth, Jr. (Atty., C. C. Webster, 30 Broad St., N. Y. City).

Fort Orange Radio Distributing Co., Albany, N. Y.; $10,000; E. H. and S. and I. Markowitz. (Atty., M. A. Jeneroff, Albany, N. Y).

Eleo Sales Corp., N. Y. City, electrical and radio goods; $25,000; L. G. and S. M. Friedman, M. Berk. (Atty., M. Hotchner, 225 West 34th St., N. Y. City).

The Braun Co., 32 South Clinton St., Chicago, Ill.; 500 shares, no par value; conduct and carry on business of manufacture, buying, selling, assembling and otherwise dealing in radio and automobile supplies and equipment, etc. (Attys., Harding, Sherman & Rogers, 137 South La Salle St., Chicago, Ill.).

Apexeen Co., Boston, Mass.; phonographs and radios; $250,000 and 250 no par value shares; Frank H. Thayer, Boston, Mass.; Charles Tibbetts, Brookline, Mass.; John C. McPhail, South Weymouth, Mass. (Incorporated under the laws of Massachusetts).

Radio Cycle Corp., Newark, N. J.; $75,000; Louis Richter, Jacob Feinstein, Ella Feinstein, Newark, N. J. (Atty., Alexander Bassin, Newark, N. J.).

Flatbush Radio Laboratories, N. Y. City; broadcasting station; $10,000; R. M. Lacey, H. S. Byam, S. I. Gellard. (Atty., S. D. Levy, 302 Broadway, N. Y. City).

Green-Cort Radio Corp., N. Y. City; radio parts; $30,000; H. Forstenzer, I. E. Fromer, L. Pantell. (Atty., H. Bregman, 285 Madison Ave., N. Y. City).

Crosley Announces Low Wave Adapater

Cincinnati.

The Crosley Radio Corporation announces a new product in the form of a unit designed to adapt any receiving set to the reception of short waves. This product will be known as the "Lowave."

At present practically all receiving sets are built to tune in only on stations broadcasting on wavelengths in the band from 200 meters to approximately 550 meters. In the meantime experiments in short wave broadcasting have been conducted and several stations, including KDKA at Pittsburgh and WGY, Schenectady, are broadcasting on short waves as well as their standard wavelengths.

WLW, the Crosley station at Cincinnati, will begin broadcasting almost immediately on a supplementary short wave of 52 meters in addition to its regular wavelength of 422.3 meters.

The new device makes it possible for radio listeners to use their old sets to hear the new short wave broadcasts. There is every reason to believe that short wave broadcasting will become general in the near future.

The new Crosley product looks like a small radio set, about one third of standard size. When it is connected with the receiving set it enables reception between 20 and 80 meters and does not in any way interfere with reception of longer waves. It is simply necessary to connect it to the set and then by the push or pull of a switch the fan may receive on either short or long wavelengths.

The device consists of a short wave receiving set connected with a little oscillator tube. The signals from the short wave set are made to control the oscillator tube and this in turn sends out signals at ordinary broadcasting wavelengths which are fed into the regular receiving set. In other words the unit is a miniature receiving and broadcasting station, which picks up short waves and rebroadcasts them at ordinary wavelengths.

RADIO MEN UNITE

Spokane, Wash.

The Eastern Radio Service, a new radio company organized by F. L. Sims and W. J. Stewart, has recently located at S163 Lincoln street. The new firm will specialize on the erection of aerials and made-to-order sets. Mr. Sims has been managing his own company, the Sims Radio Service, and Mr. Stewart was formerly employed in the electrical department of the Spokane and Inland Empire Railroad.

Wave Traps Made By Powertone Co.

The Powertone Electric Co., 221 Fulton Street, New York City, has placed on the market a very effective wave trap, that is not only highly efficient but a beautiful job that will harmonize with any radio set. The demand is so great that the factory is turning out these wave traps at the rate of more than 1,000 per day and they are being sold as fast as they are made. The Powertone Wave trap is circular in shape, made of the best materials, and the circuit is of the most improved type. The coil is a solenoid, housing a variable condenser which is tuned by a knob on the top panel. Handy binding posts are provided and the installation can be made in a few seconds.

Every trap is carefully tested and calibrated before leaving the factory and satisfied users report wonderful results attained by its use. Dealers all over the country are taking territories on this trap and the fan demand is growing daily. Intensive and thorough laboratory tests have proved that it is all the manufacturer claims for it. The Powertone Wave Trap is also handled by the B. C. L. Radio Service, 223 Fulton Street, New York City.

THE wavetrap consists of a solenoid coil and a variable condenser.

Altoona, Pa.

The Altoona Radio & Electric Co., 1318 Twelfth avenue, J. E. Blatchford, manager, celebrated its second anniversary.

The firm has been very successful since the opening two years ago and recently established a branch store at Eleventh avenue and Fourteenth street.

* * *

Somerset, O.

Ralph Smith has sold his interest in the Thornville Electric and Radio Shop to his partner, Homer Begle, who will continue the business there.

Showers Brothers Use Plant for Cabinets

Eighteen months ago Showers Brothers, with headquarters at 914 S. Michigan Blvd., Chicago, entered the radio cabinet business. During this period the results were so unusually satisfactory that they have now decided to set plant No. 4 in Bloomington aside for the exclusive manufacture of radio cabinets.

Plant No. 4 is one of Showers Brothers largest factories. It is 1,700 feet long, 90 feet wide and two stories high, allowing a minimum capacity of 50,000 pieces.

Showers Brothers are the largest furniture manufacturers in the world and by placing one of their largest plants at the disposal of the radio industry they are expected to become the leaders of the radio cabinet business.

Besides making elaborate plans in the radio cabinet business, H. T. Roberts, who directs the entire radio activities of Showers Brothers cabinets and radio receivers, states that the Showers receivers will experience an enormous year in 1927. Showers did not place their sets on the market until late in September, 1926, and because of starting so late, and with 1927 in mind, they devoted their entire sales efforts toward building up an exceptional dealer organization.

Their restricted policy is only one dealer to a town.

Showers Brothers have been in the furniture business for 58 years.

IN CHARGE OF RADIO

Sparta, Ill.

W. O. Bethel of this city has entered into an agreement with Lynn Brothers to have charge in a supervisory capacity of the radio department of that store. Mr. Bethel will inspect and supervise the installation of all receiving sets sold and will also do repair work.

SAVES SPACE

(Hayden)

ONE PAIR of screws may be used to mount two by-pass condensers to a sub-panel.

Chicago Trade Show Stirs Wide Interest

Held in conjunction with the annual convention of the Radio Manufacturers Ass., the first annual Radio Trade Show on June 13 at the Stevens Hotel in Chicago will draw radio manufacturers from every State in the Union with buyers present from all parts of the world, according to advance information received by the management of the exposition.

Held in the largest hotel in the world, this exposition will present the newest in radio exclusively to the radio trade, giving jobbers and dealers several months of summer season to prepare for the fall lines that will be announced for the first time at this strictly trade showing. Only those manufacturers who are members of the Radio Manufacturers Association will be permitted to exhibit at this show, insuring the displays being representative of the best in radio, with practically every leading radio concern represented among those showing their new lines.

G. Clayton Irwin, Jr., general director of the Radio World's Fair and Chicago Radio Show, will have charge of the management of the trade show.

A complete program for the Radio Manufacturers Convention will be announced about March 15, with meetings calculated to interest the visiting jobbers and dealers as well as session of the Manufacturers Association as usual. Advance information as to the attendance at the show and convention indicate an attendance of several times as many radio tradesmen as have ever been together before.

Civil Service

The United States Civil Service Commission announces the following open competitive examination:

RADIO ENGINEER, $3,800
ASSOCIATE RADIO ENGINEER, $3,000
ASSISTANT RADIO ENGINEER, $2,400

Applications for these positions must be on file with the Civil Service Commission at Washington, D. C., not later than March 22. The examinations are to fill vacancies in the Signal Service at large, War Department, and in positions requiring similar qualifications.

The entrance salaries in the District of Columbia are indicated above. A probationary period of six months is required; advancement after that depends upon individual efficiency, increased usefulness, and the occurrence of vacancies in higher positions. For appointment outside of Washington, D. C., the salaries will be approximately the same.

The work of radio engineers is in connection with the development, design, construction, installation, and standardization of, and the writing of specifications for practical and special radio apparatus and methods of radio communication, such apparatus to include sets for land use for more or less permanent stations, also for portable land stations, and for airplane and ship sets.

Competitors will not be required to report for examination at any place, but will be rated on their education, training, and experience; and publications, reports, or a thesis to be filed with the application.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. Civil Service Examiners, at the post office or customhouse in any city.

AT YOUR SERVICE

Burned Out Loud Speakers and How to Avoid Them

[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.]*

* * *

Every now and then we get a letter from some down-hearted fan, telling us that his loudspeaker, which formerly produced sweet music, has become totally inoperative. In each case, so far, this has been due to a break in the winding of the loudspeaker magnet. Such breaks are sometimes caused by rough handling of the loud speaker, though with loudspeakers commanding the prices which they do we believe that they generally receive rather gentle treatment. The wires are usually damaged because they were not wound with wire heavy enough to carry the plate current of the last tube, or, rather, the fan failed to protect the speaker windings where the final AF tube drew heavy current. Many of the old type speakers will not safely carry the larger plate currents provided for the new models of power tubes, but are likely to burn out. On the other hand, many of the better loudspeakers, such as the Radiola Model 100, are designed to withstand the increased plate current which the lower resistance and higher B battery voltage of the power tubes make possible. The speaker mentioned includes a device which keeps the comparatively heavy DC out of its windings, which are actuated only by an audio frequency pulsation.

A device of this sort may be made for use with any loudspeaker, and besides avoiding damage to the hair-like wires with which the magnets are wound, one will often improve tonal qualities. The cost of parts is not large and many times they may be found among the apparatus which you already have.

Incidentally, we might mention that many of the retail radio stores which construct the sets they sell are including devices of the type described in all the sets which they build.

The only parts needed for the construction of such a device are: A 1 to 4 mfd. fixed condenser and a 80 to 130-henry choke coil. If you are unfortunate enough to have burned out an audio frequency transformer, you may, as a makeshift, use the undamaged winding in place of the choke coil, provided its DC resistance is not too high. The apparatus is connected in the following manner: First, you disconnect the last tube from the output jack. You then connect one terminal of the choke coil to the plate of the last tube, the other terminal of the choke coil being connected to the positive terminal of the high voltage, amplifier B battery. This provides a continuous circuit in which the plate current can flow. You then connect one terminal of the fixed condenser to the plate of the output tube. The other terminal of the condenser is connected to the output jack. There remains the second terminal of this jack, which is finally connected, preferably to the negative A battery. If you find that this cannot be conveniently done, it may be connected to the positive B battery, but better results will be had if the former connection is made.

Consideration of this circuit will reveal the fact that the plate current is effectively blocked out of the loudspeaker as the condenser will not pass DC. As the pulsation has what may be termed an AC affect, it is therefore freely passed. The point to watch is that the choke coil used is less likely to burn out if it is wound with a comparatively heavy wire, and the average transformer will stand the current and is less likely to burn out than is the loudspeaker.

There are now a few concerns manufacturing 1-to-1 ratio transformers for use in the output. These transformers serve the same purpose and work with about the same efficiency as the impedances mentioned. They are especially designed to handle the augmented plate current and to transmit the necessary impulse to the loud speaker. These devices are very simple to install. One winding should be connected in the plate B battery circuit and the other winding to the two terminals of the loudspeaker cord. An output transformer cannot be built in the average home or workshop.

SELECTIVITY AND QUALITY

There are certain definite limits within which selectivity must be held if radio reception is to be enjoyed, although it would seem to one who had not considered the phenomenon of broadcasting that a set could be made to tune just as sharply as its operator desired. The difficulty is not so much in obtaining sharper tuning, for it is possible to get a set that will "split the meters," as a problem of getting as much selectivity as possible, while still getting undistorted tone. You see, a station transmits a certain wave length or frequency, which is the frequency allowed it in its broadcasting license. However, in order to produce a modulated wave, another frequency must be superimposed upon this fundamental. This imposed frequency is that of the voice or music or other sound being modulated. In the case of voice, it may vary 5,000 cycles on each side of the allowed frequency, while in the case of orchestration it may be considerably less than this.

Now, if a receiving set is tuned too sharply, these additional frequencies or "side bands" as they are called, will be cut off, and distortion will result. For this reason, regenerative sets usually have poor tonal qualities. This is because they tune very sharply when considerable regeneration is being employed, and the side bands, previously referred to, have their peaks cut off. High notes and low notes are usually distorted if not lost entirely.

By controlling regeneration in the type of set just described and oscillation in tuned radio frequency sets, distortion of this kind can be reduced or eliminated. In the three dial set, some manufacturers even recommend that whenever signal strength is sufficiently great, one of the dials be slightly detuned to provide clearer reception.

Owners of regenerative sets will usually notice that if the detector is brought to the point of oscillation, distortion increased. Therefore, when tone quality is not satsifactory, experiment with tuning before blaming the audio amplifier.

QUESTIONS AND ANSWERS

THROUGH a notice I saw in RADIO WORLD, I am enclosing a circuit taken from another radio magazine which has one stage of radio frequency connected to a 3-circuit tuner. I can get reception all right, but cannot get any volume. Reversing the tickler does not seem to have any effect. In fact, the tickler coil does not have any effect in increasing volume, what little volume I get. I can decrease, but not increase. Tubes, batteries and etc.; are all O. K., as I use them in another set. Can you see any change I could make in the hook-up? How many turns of 26 or 30 wire should I use on the

radio frequency choke?—C. N. Christenson.

I am sending you another circuit using one stage of radio frequency and regenerative detector. I believe that you will find that it will work considerably better than the old one.

* * *

I WISH to take advantage of the kindness of RADIO WORLD to its readers by getting some reliable information, which I feel sure of from you.

I get very unsatisfactory results from an LC26 which I have, and would like your advice as to which of the following circuits would give the best all-round reception, distance, volume, quality and tune sharp enough to cut through a local station (the LC26 does this last O. K.)

1—Daven 6 Tube Bass Note Circuit.
2—Alden Somerbridge Set.
3—Sterling Five—by Naylor Radio Corp, N. Y.
4—KH-27 by Kenneth Harkness.

Or some you may know of better than these.

Your advice will be greatly appreciated as to what you consider best.

Also is the Victoreen Super Heterodyne considered the best 8-tuber? And are dry cells any good in it? Is it possible to get any distance with less than eight tubes? —Wm. F. Grimes.

The four circuits which you mention are all good. You will probably find that the first one will give you quite clear reception as to quality. Not knowing your location or your aerial system, I cannot tell you what degree of selectivity you will be able to obtain. The Victoreen Super is very good indeed.

Dry cell tubes may operate satisfactorily in it, but you will probably get better results from storage battery tubes.

As to the possibility of getting distance with less than eight tubes, I would like to remind you that the first set to get transoceanic reception was a single tube Reinartz.

* * *

I OWN a DeForest type D-10, using Priess's Reflex circuit with a crystal detector and four tubes and operating on a loop. Never got good volume since I got the set. Of course, I get WJZ with plenty of volume and used to get KDKA and WBZ good, but can't depend on anything but WJZ now. Tubes and batteries O. K. and have a good location. Can't afford a new set at present, so if you can suggest any changes that will help me, they will be very gratefully received. Would changing to outside antenna help? If so, how is best way to make change?—Irwin Trout.

It is rather a difficult matter successfully to repair one of these D-10's to take a tube detector, although this has been done. You can add an outdoor aerial very easily by making a coil of 5 to 10 turns of wire about 10 inches in diameter, connecting one end of it to the aerial and the other end to the ground. This coil should be hung on the loop with its turns wound in the same direction so that there will be coupling between the two coils. This way you should be able to increase your range considerably, though you will find tuning broadened.

* * *

I HAVE a five-tube tuned radio frequency set using three .0005 straight line frequency condensers and three Bremer Tulley coils (AC 1). When our local station, sending on 417 meters is on the air, I cannot get any other station within 5 degrees on either side of the point where WCCO comes in the loudest. We have several local stations around the 250 meter wavelength. When two or more are on the air at the same time, I get them all at once and cannot tune them apart. I took off all the primary windings on the coils except four. I also tried three .0003 variable condensers, but nothing seemed to help. I cannot get any low stations either, only about to 240 meters. I get WCX Detroit on 72 degrees on my dials, I do not care to have a wave trap, as three dials are about all one man can handle. Any information you could give me I would greatly appreciate.—Henry Van Bebber.

My advice to you would be to replace your .0005 condensers. You will not be able to cover the wave band, as you have no doubt found out by experience, with the condensers which are not matched to the coils.

You did not state in your letter what sort of antenna system you were using, but I assume that it is too long. That is usually the case when a correctly built set lacks selectivity. I suggest putting a .00025 fixed condenser in series with the aerial. Fasten one end of the condenser to the aerial binding post of the set and the other to the lead-in wire.

* * *

I HAVE a three tube set (the hookup of which is on the opposite side). It has a tuned aerial and has three controls. Now what I would like to know is how can I add a stage of radio frequency without adding an extra control and without reflexing?

Also where would the .0005 condenser go? Between the aerial and beginning of the coil, or leave it where it is now?

Using three tubes, this set has brought me in Mexico City and KFI on ear phones, while Cuba and Haiti has been brought in on the speaker.

I have built three "Diamond of the Airs" and must say they work great (in fact I am using one myself at the present time) but I have had so much pleasure out of this three-tuber that I hate to part with it. Do you think if this is made into four tubes it would equal the Diamond?—Wm. M. Eastwood.

In the diagram which you sent me there are several errors in the addition of the stage of tuned radio frequency. You can add a stage of radio frequency as I have indicated on the diagram I am sending you, but, when a man living in Boston can get Mexico City, KFI, Haiti, and Cuba, I do not believe that there is very much cause for complaint. If you make that set into a four-tuber, it may not even equal the three-tube one which you now have.

* * *

I AM in the possession of a Western Electric tube 216A, but have no directions for its use. I do not know how much B voltage and how much C voltage the same should have. I do know it is for the last audio stage. I have a Majestic Super B supply.

Would be very much obliged if you could give me any advice regarding this matter. I am a constant reader and read all your answers in each publication, which are each time very interesting.—John Uhlemann.

I am informed that a Western Electric 216A tube will work satisfactorily as an amplifier with 7½ to 12 negative volts on the grid and approximately 135 volts B battery on the plate. This tube will stand much higher voltages than the above.

* * *

I HAVE another question to ask you regarding radio. I have the Diamond of the Air now so that I can receive, but not satisfactorily. There is so much interference from other stations, when I tune in WWJ, I think it is WLS that bothers. When I tune in (or try to) WLW, WCCO interferes with a continuous whistle which rises and lowers. Can you suggest anything that will remedy this? WCX is about the only station that is away from the others, as far as interference is concerned. I have shortened the aerial and the only thing that will do is weaken the signals, but the whistle continues, only weaker as are the broadcast signals.

I am using Veby AF 20 tubes in sockets 3 and 4, and Daven Mu-6 in socket 5, and C 301-A in sockets 1 and 2. What

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

B voltage do you suggest for detector RF and amp.? I am using 45, 90 and 135 respectively, and 4½ v. C. It does not make any difference with volume or tone with it connected or disconnected. You cannot hear in receiver when you make or break the C battery circuit. When I built this receiver I intended using CX-301-A tubes throughout, and later decided to use Mu-tubes. Are the Amperites for CX-301-A correct size for the Mu tubes?—H. L. Fuller.

You are not using enough voltage on your Mu-6 filament. That tube requires ½ an ampere and needs no filament resister.

I am going to advise you to check over your leads from the C battery and see that none is shorted out. It may also be that you are using too much resistance in the grid circuits, if you are using resistance coupled amplifications. Also make sure that your positive C battery runs to the negative A lead. It sounds to me as if you probably have both your audio grid return leads, and negative C battery connected to one of your power leads. You might also try using 9 volts of C. Your B voltages seem O. K.

In regard to the interference which you are experiencing, I would say that this is quite a common occurrence recently. However, when radio legislation is passed, we hope for improvement. In the meantime I would suggest that you try using a .00025 mfd. fixed condenser in series with your aerial. This will sharpen tuning somewhat, but I doubt if it will clear up everything for you. Also if there is any way that you can loosen coupling between the primary and secondary of both coils, you should try this.

* * *

AS I AM a reader of RADIO WORLD, and as I have run across an article pertaining to your servicing of radio questions, I will take the liberty of giving you one of mine.

I have a six tube Air-Way receiver which is made by the Air-Way Electrical Appliance Corp. of Toledo, Ohio. The set is mostly resistance coupled throughout, or five tubes are so, and the negative lead of the filament of four of the tubes are conected to resistors, that is the grid of the tube is also connected to the grid leak and negative filament, and then it is passed over a wire to the switch, which I think is the filament switch. After it connects to the switch, there is another connection to the negative side of the tube that is run onto a little strip mounting with 20 turns of bare wire and then passed to the tube. Now I would like to connect a C battery to the set, and after several tries, I have not been very successful. The last connection I made to the last tube onto the grid leak, from the negative end of the grid leak, and I broke the connection with the negative lead and grid leak and connected the negative side of the C battery to it, and the positive to the negative A binding post. It does not produce much volume with a 171 tube, and I tried different resistors, that is values, and the same with the C voltage. Would I have to connect the resistors to the negative connection on socket to get results? I used 150 volts on the last tube.—Andrew Tomechko.

It is probable that you are not using the proper resistance in your last stage. Quite often a .1 to .2 meg. in the plate circuit and a .25 to .5 meg. in the grid circuit will be all right. However, you do not specify the resistances. From the description you gave, it would seem that you have connected the 171 correctly, but I am enclosing a diagram anyway.

Another thing, are you using the right voltages? They are:

With 90 volts B ....16.5 C
135 volts B ....27 C
157.5 volts B ....33 C
180 volts B ....40.5 C

* * *

IS STATION KFYO, Texarkana, Tex., still on the air?—Henry McDonough, Portland, Me.

This Buchanan-Vaughn station has discontinued operation.

* * *

IF CONSISTENT please furnish me the following information on a Crosley Super Trirdyn, manufactured by Crosley Radio Corporation. I cannot get good speaker volume on wavelengths higher than 400 or thereabouts. The set is equipped with an antenna coupler. By adjusting same to maximum capacity, coupling does not increase volume to maximum. Have had long and short antenna and cannot get desired results with either. Can you suggest a method that could be put on as a switching arrangement, I would not want to impair efficiency on lower wavelengths. In making this request I am accepting the courtesy of RADIO WORLD.—T. H. Nuckles:

The set which you have is of standard make, and is produced by a thoroughly reliable concern. The fault of which you complain would indicate one of two things. The first is that your antenna and ground connections are not made as the instructions recommend. The set should work well with about 70 feet of aerial. This is preferably an outdoor antenna, although a wire stretched along the hall or around the picture molding of a room will serve. The ground connection may be made to a steam or hot-water pipe, but a cold water pipe is best. If the antenna system is correct, the trouble probably lies in the set. Do not try to repair it yourself, as most manufacturers guarantee their products only when the apparatus has not been tampered with. This does not apply, in most cases, to repairs made by service men or authorized representatives. I would suggest that you consult the dealer from whom you bought the set.

* * *

I HAVE constructed the Diamond four-tube set as per enclosed blue print. I receive very fine volume on all locals, and fair selectivity; but am unable to receive any distance, even after locals are signed off.

I am using a 200-A tube in the detector and 112 in the last stage, 9-volt C battery, 135 volts on amplifier, 45 on detector, 90 on RF tube.

Could you mark any changes on the enclosed blue print and return.

Perhaps I am expecting too much from this set, but I have heard so much about the distance it could bring I am wondering why I can't get DX.—H. A. W.

This circuit, if properly constructed and connected to a good aerial and ground, will produce quite remarkable results. I am, therefore, going to suggest that you go over your set carefully, and see that every wire is run exactly as shown in the schematic diagram. Pay particular attention to the leads on the radio frequency and detector coils, making sure that they have the correct polarities. It is easy to go wrong. If you find these to be all right, check up on your aerial and ground. A cold water pipe makes the best ground, but a steam pipe will usually serve nearly as well. From the symptoms you mention, I would judge that there is a high resistance joint somewhere in the antenna system, or possibly a poor connection in the radio frequency jack (J1). Clean and tighten its joints, if necessary. Perhaps your lack of selectivity is caused by too long an antenna system. Figuring from the extreme end of the aerial wire to the point where the ground connection enters the earth, it should not be over 125 feet long. If it is, connect a .00025 mfd. fixed condenser in series with ant. and set.

Matching of Impedances Vital Only At the Output

By Sylvan Cross

The subject of matching impedances has been discussed a great deal in radio articles. Usually it has been discussed from the viewpoint of necessity of matching for getting maximum signal strength. Now it may be shown mathematically that the greatest amount of energy that can possibly be obtained from any source, such as a generator, battery, relay, vacuum tube, etc., is obtained when the internal impedance of the source equals the impedance of the load, that is, the device which uses the energy. In many cases it is desirable to get the most out of a device irrespective of how much it costs to get it out. Under those conditions the thing to do is to match impedances.

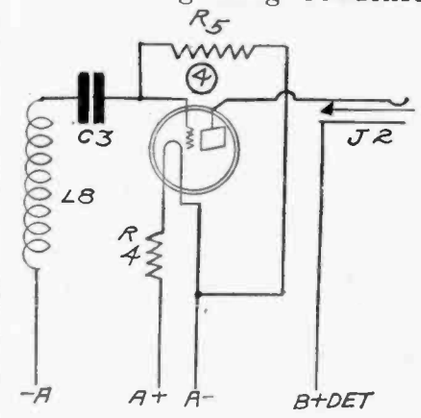
When electrical power engineering first started, the same mathematical deduction was used in the design of motors and generators. Impedances were matched so as to get the most out of the new devices. But it soon developed that efficiency was a greater factor from a commercial viewpoint than greatest output. When impedances are matched the efficiency is only 50%, and therefore electric energy cost twice as much when impedances were matched as it would have cost could the devices have been operated at 100% efficiency. Power engineers therefore began unmatching in the direction of making their devices more efficient. At the present time some electrical equipment used for power purposes is 98 to 99% efficient. The unmatching of impedances is almost complete, yet power engineers are still trying to increase efficiency.

In radio the same old matching formula came into use and it is profusely quoted. Matching is the magic word. Matching, so it is claimed, will increase the efficiency of the set because it is the condition for greatest energy transfer from stage to stage. Matching, so it is claimed, will increase the output for the same reason. Again according to the almost universal claim in radio literature, matching will increase the voltage step-up per stage.

But most of the hullabaloo about matching impedances is nothing but the bleating of the flock that blindly follows the bell wether. Matching is not the condition for getting the greatest step-up per stage. The formula used for proving the case does not apply to the case, no matter what the prestige of the bell wether in this case. The condition for maximum transfer of voltage from stage to stage is to make the tube operate as nearly to 100% efficiency as possible.

The only place where matching of impedance has any significance in a radio receiver is where energy transfer is actually of interest, and that is in the last tube. The impedance of the loudspeaker should match the output impedance of the last tube. However, this matching is not in the interest of quality. The maximum undistorted output is obtained when the impedance of the speaker is twice the impedance of the tube, that is when the efficiency of the transfer is 67%. The higher the load impedance is, the better is the quality of output, but the energy of the output decreases slowly as the impedance of the load is increased.

How to Return Grid To Positive A When Using Gang Condenser



Most sets in use at the present time are wired for the use of the -01A type of tube as detector, that is, the grid return lead goes to the positive end of the filament so as to get a positive grid basis on the tube. The newer type CX-300A detector tube works a little better when the grid return is made to the negative end of the filament. Hence when substituting the newer and more sensitive tube for the old the circuit should be changed so that the grid return is to the negative end of the filament. How this change is most easily done is shown above. R5 is the grid leak. Ordinarily it is connected across the grid condenser C3, but in some cases it is connected across the entire tuning coil and the condenser, that is, it is in parallel with them. The connection across the condenser alone is a shade better than the parallel connection but it cannot always be used. The grid leak could be connected across the condenser because the lower end of the coil is shown to be connected to the negative end of the battery . But if the coil were connected to the positive, as it is in most sets, the connection of the leak shown in the figure must be used.

It is a fortunate coincidence that the new detector tubes require a negative return of the grid leak and that most gang condensers necessitate such a connection of the coils. Hence when gang condensers are used all the coils may be connected to the negative end of the filament, thus making the amplifier tubes the most efficient and at the same time the grid leak may be connected across the grid condenser alone and get the proper grid bias on the detector. Thus the new CX-300A detector tubes fit in with the gang system of tuning in a most satisfactory way.

To return grid to positive when using a gang condenser, connect grid return by the direct method shown above, but to A plus instead of to A minus.

The Rudolph Wurlitzer Company manufacturers of pianos and organs, have entered the radio set manufacturing business, making 5 and 6-tube model receivers, of the tuned radio frequency type.

Proper Tubes Are Stressed for the KH-27

[So many questions such as:—"Is the KH-27 set easy to build?"; "Is it possible to buy a drilled panel?"; "In what issue did the complete list of parts for this set appear?"; "How do you mount the Hammarlund variable condensers, also the radio frequency coils?"; have been received by the Technical Dept. of Radio World, that the following text containing answers to all these popular queries, regarding this excellent receiver which was described by Kenneth Harkness in the Jan. 29, Feb. 5 and 12 issues of Radio World, is herewith given. It will be recalled that this receiver employes six-tubes, two of which are radio frequency amplifiers, neutralized by the modified Rice system; the next, a non regenerative detector and the concluding three, audio frequency amplifiers, hooked up in an ingenious amplifying system, known as the "Twinchoke" double impedance system. To obtain absolute purity of tone on the output, a filter choke and large condenser is employed. There are only two major controls as well as a volume control. The Jan. 29 issue is referred to, at all times.]

It will be readily realized that the KH-27 receiver using this new type of audio amplification, is capable of faithfully reproducing voice and music with sufficient volume to achieve the effect of realism. It is merely necessary to use with the set the proper tubes, the correct loudspeaker and the specified filament and plate voltages.

The KH-27 Receiver is very easy to build and is not expensive. Standard parts, easily obtainable, are used in its construction. The front panel is also a standard size so that any desired type of cabinet can be used to house the set.

The list of parts needed to build the receiver is given in the Jan. 29 issue.

Drilled and engraved front and subpanels are manufactured for this set, making it unnecessary for the builder to drill these panels. The manufactured subpanel is also supplied with six tube sockets attached, the sockets being riveted to the panel.

The photographs clearly depict the positions occupied by the various parts of the set. (Jan. 29 issue).

When all the parts have been obtained, first attach the subpanel to the front panel by means of the two bakelite mounting brackets. Then turn the set on end so that you can reach both sides of the subpanel and mount the parts on the subpanel as follows:

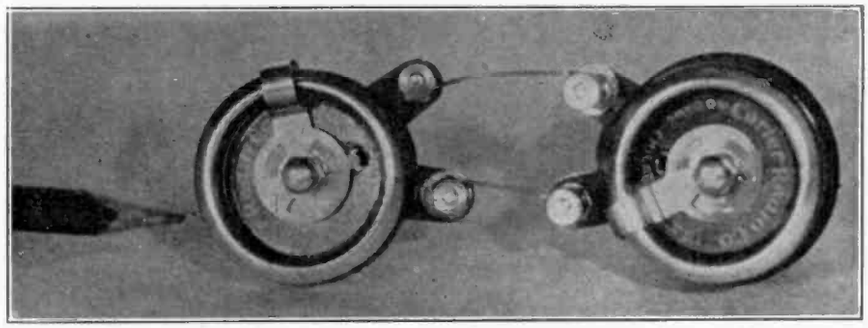
Referring to Fig. 4, mount on the lower side of the subpanel the four Amperites, the grid leak mounting, the .001 mfd fixed condenser, the two 1 mfd by-pass condensers and the output filter choke coil. Note that the type 112 Amperite is mounted at the extreme left, when viewing the set as in Fig. 4, and the grid leak mounting at the extreme right. The .001 fixed condenser is placed beside the Amperite of the detector tube, on the right.

Then, referring to Fig. 2, mount on top of the subpanel the coils T1, T2 and T3, the two X-L Variodensers (used as neutralizing condensers) the eleven binding posts, the 2-ohm fixed resistance and the three KH Twinchoke Audio Couplers. Looking down on the set, as in Fig. 2, mount coil T1 on the left, T2 in the center and T3 on the right. The coils are labelled accordingly. Use brass bolts as the bolts are utilized as conductors. Before screwing down coil T3, bolt one end of the grid condenser underneath the subpanel and then bolt the opposite terminal of the grid condenser and the grid end of coil T3 to the subpanel with one screw, passing through both parts. Make the latter assembly carefully as the mounting volt forms electrical connection between the coil T3 and the grid condenser, no wire being used.

Next, remove the shafts from two of the Hammarlund condensers. Mount one of these condensers on the right side of the front panel, also screwing it down to the subpanel. Then bolt the second condenser to the subpanel, behind the first condenser, and pass the long brass extension shaft through both condensers. Screw the rotors to the shaft, both in the same positions with respect to the stators. The condenser extension shaft should pass easily through the two condensers. If it does not, loosen the bolts holding the condensers to the subpanel and line them up correctly.

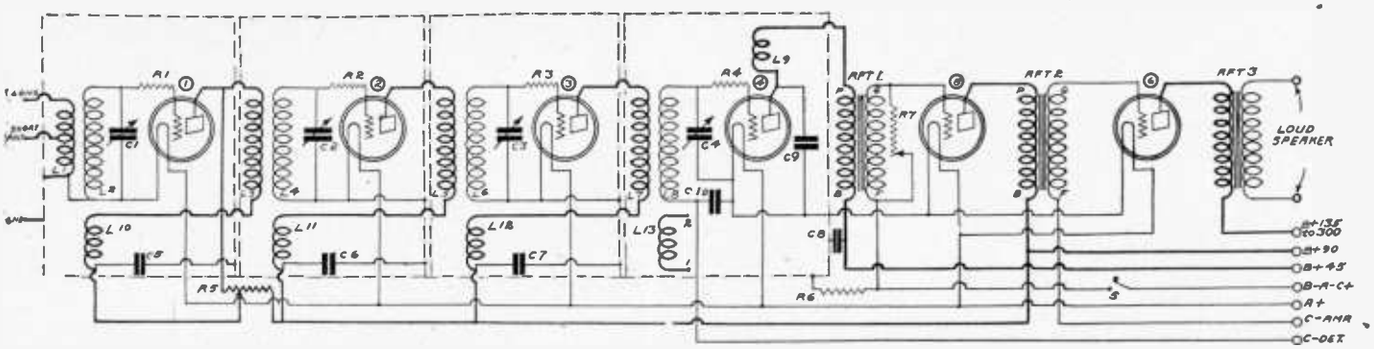
Mount the third variable condenser on the left of the front panel, also the antenna switch and the loudspeaker jack. On the right mount the pilot light bracket and the filament switch; in the centre, the rheostat. Finally, attach the two vernier dials on the condenser shafts. This completes the assembly.

STOPS RHEOSTAT HEATING



IF POWER TUBES or several other tubes are connected to a single rheostat this resistor may heat up. A solution is to connect another similar rheostat in parallel. Only one of the two need be on the front panel. (Hayden)

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



The Silver Shielded Six is shown in schematic diagram form. Note that a transformer is used as the output. The shields are defined by dashed lines.

ANDERSON'S SET

(*Continued from page 5*)

voltage. These are indicated by the symbols R2, R3 and R4.

The first and second audio tubes should be of the same type, either 301-A type or 112 type. The 112 should be used when great volume is required, but for moderate loud speaker volume the smaller tubes will handle the load well enough. The last tube should be a power tube under all conditions. The new type 371 is preferred, but the smaller Mu-6 or 112 may be employed.

The single rheostat Rh used in the set is connected in series with the first two tubes, and it is placed in the negative leg. This is used mainly as a volume control. It is of 30 ohms resistance.

The receiver is arranged for either loop or vertical antenna. There are three binding posts provided for the pick-up, "Loop," "Ant" and "Gnd." In case a vertical antenna is used the last two posts are used. In case the loop is used. the little switch S1 is thrown over to point (1) and one terminal of the loop is connected to the post marked "Loop" and the other the post marked "Gnd." The switch S1. is not put on the panel but is placed inside the set in such a manner that the leads are the shortest possible. It is made of a heavy flexible wire one end of which is permanently connected to the condenser or to the grid. The other end is provided with a terminal lug which may be inserted in either one of two small binding posts.

The tuning coil L1 is wound on 2" hard rubber tubing and contains 71 turns of No.

LIST OF PARTS.

For J. E. Anderson's Set

C1, C3—Two General Radio .0005 mfd. condensers.

C2, R1—One XL variodenser with clips, .00035 mfd. max., and one 1,000,000 ohm grid leak.

C0—One fixed .01 mfd. condenser.

C4—One fixed .0005 mfd. condenser.

L1—One tuning coil as described.

L2, L3, L4—One three circuit tuner, or Bruno 99.

T1, T2, T3—Three audio frequency transformers (Meloformers).

Rh—One 30-ohm Carter rheostat.

P—One 500,000 ohm Carter potentiometer.

R2, R3, R4—Three suitable Amperites (1A, 1A, 112).

S1. S2—Two Carter Imp filament switches.

Eleven Eby binding posts.

Two four inch dials and one small knob.

Five X sockets.

Two brass angles.

Panel, 7"x18". Baseboard, 8"x17.5".

Cabinet to match.

(*Concluded from page 30*)

24 DSC wire. The tap for the antenna is taken at the 15th turn from the ground side. Coils L2, L3 and L4 are wound on a small Bruno three circuit form (type 99). The primary contains 10 turns of No. 24 DSC wire and the secondary 53 turns of the same kind of wire. The tickler L4 contains 40 turns of No. 32 DSC wire. The two condensers C1 and C3 which are connected across L1 and L3, are General Radio modified straight line frequency of .0005 mfd. maximum capacity.

The grid condenser is an XL variodenser having a maximum capacity of .00035 mfd., and equipped with clips for the one megohm resistance R1. By-pass condenser C0, used for keeping the RF current out of the plate battery, has a capacity of .01 mfd., and the by-pass C4 across the primary of the first audio frequency trtnsformer has a capacity of .0005 microfarad.

Although these audio frequency transformers are used in the set, this fact does not militate against quality. The particular transformers used have very low transformation ratios, are completely shielded magnetically as well as electro-statically, and have adequate core area and primary impedance.

A volume control potentiometer P is placed across the secondary of the first audio transformer. That is the logical place for it because when in that position the signal voltage level in the entire audio amplifier for a given output is the least possible. Hence the distortion due to overloading either the tubes or the transformers is also the least. If the potentiometer were placed in the secondary of the last tube, as is often done, it is possible that the two tubes and two transformers preceding may be overloaded, and this cannot be removed by manipulating the potentiometer.

Avoiding Distortion

It is easy to keep this type of distortion out of the signal but it is not possible to remove it once it has crept in. All volume controls, particularly the audio frequency potentiometer, should be placed as far forward as possible. Note that the sliding arm of the potentiometer is connected to the grid battery instead of to the grid. This, of course, is done to shorten as much as possible the lead from the transformer to the grid. The potentiometer should be so placed with respect to the grid of the first audio tube and that the lead from the potentiometer to the transformer or grid is short. This is not always easy to do, however, since the potentiometer is usually on the panel and the transformer back in the set.

Since the first two audio tubes are of like characteristics, both plate and grid voltages should be the same. Hence the plate return leads are both connected to the 90 volt line and the two grid return leads are connected to the grid battery binding post marked "C-1." The last tube, being a power tube, should have higher grid and plate voltages. The plate binding post for this tube is designated by 135, but this should be increased to 180 volts is a 371 type tupe is used. The binding post designated "C-2" serves the grid of this tube. The negative post of the plate battery is connected to the positive of the filament battery in order that the additional six volts may be effective on the plates.

The panel layout of the set is shown in photograph Fig. 4. The tickler is at the top center, the filament battery switch near the bottom directly below it, the potentiometer is to the left of the switch, and the rheostat to the right. Of course, the two large dials are for the tuning condensers.

The Inside Layout

The interior layout is shown in Fig. 2. The grid condenser may be seen under the three circuit tuner next to the grid binding post of the detector tube. The input binding posts may be seen at the extreme right on a strip of hard rubber. The switch S1 may also be seen on this strip at its left end. There are two small metal binding posts with screw between them. This screw is permanently connected to the tuning condenser and grid, and the flexible lead may be switched to either of the two binding posts. Incidentally the flexible lead is much longer than it needs to be.

The two grid binding posts, "C-1" and "C-2," are the same as the corresponding terminal posts on the transformers. C plus is not especially provided for as minus A may be used for this purpose.

A side view of the set is shown in Fig. 3. The panel is held to the baseboard by means of brass angles, one of which may be seen in this picture. This method of holding the panel to the baseboard was necessitated by the mechanical weakness of the board, which is of whitewood 3/8" thick, 8" wide and 17.5" long. It had been boiled in paraffine to improve its insulation qualities. This treatment did not strengthen the board.

BST 5

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

$40.00

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

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

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

B. S. T. Has the "Punch"

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

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

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

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

IMMEDIATE DELIVERY

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

DIRECT FROM FACTORY TO YOU SAVES HALF AND IS GUARANTEED

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

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

RADIO WORLD Guarantees the Responsibility of This Advertiser

B. S. T. CONE SPEAKER

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

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

Immediate Delivery

$7.50

Shipped Direct from Factory

Satisfaction Guaranteed or Money Back

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