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RADIO
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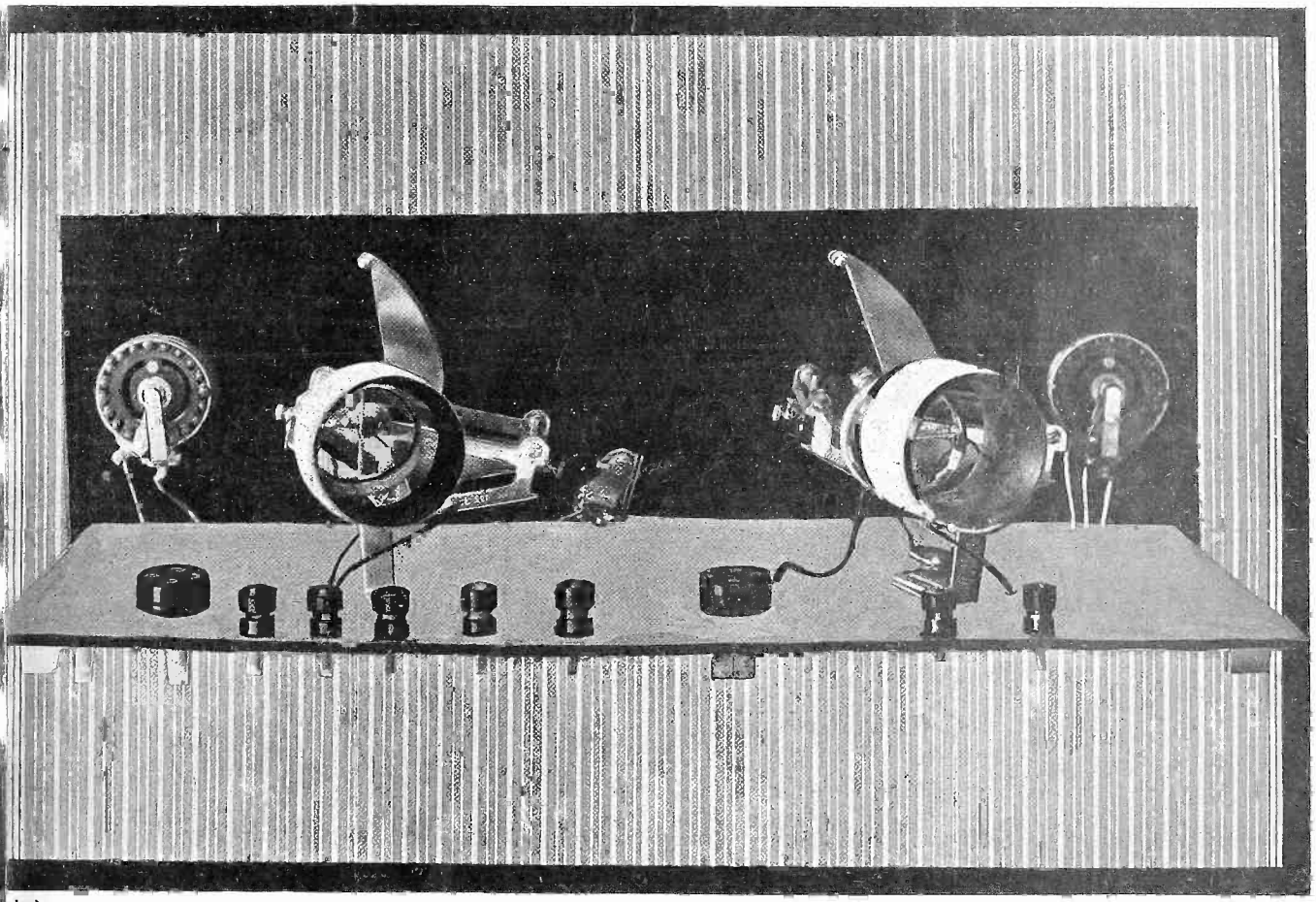
WORLD
America's First and Only National Radio Weekly

A 1-TUBE PORTABLE LOOP RECEIVER

SELECTIVITY SECRETS IN SUPER-HETERODYNES

A SET IN A SHIP MODEL

THE EQUAMATIC MIXER



(Golden)
THE EQUAMATIC MIXER consists of two tubes—a modulator and an oscillator—and provides a highly selective tuning arrangement for use with almost any intermediate coils in a Super-Heterodyne. See article on page 4.

Output Limit of a DC Eliminator is 100 Volts

HOW TO BUILD THREE-FOOT DOUBLE CONE

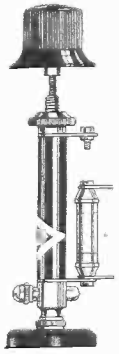
Key to Secret of Getting Coast to Coast. *See Page 7*

SPECIAL PURPOSE TUBE'S RISE TO POWER

Board's Order Helps Reduce Interference By 129 Stations

A Great Deal for a Very Little!

Ordinarily This Seems Too Good to Be True, But Here Is An Instance of Complete Verification



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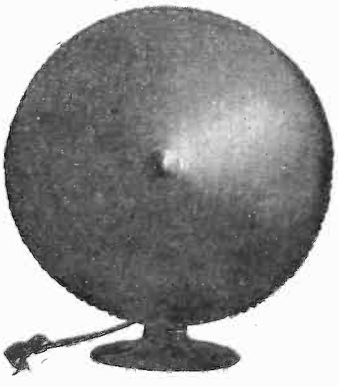

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The Selectivity of a "Super" Depends Largely on Intermediate Channel

By Capt. Peter V. O'Rourke

THE Super-Heterodyne is supposed to be the most selective receiver extant, but not all examples of the circuit measure up to expectations. It all depends on how the circuit has been built and how it is operated. There are more chances of throwing away the selectivity in a Super-Heterodyne than in any other type of circuit, and some designers seem not to have missed a single chance.

The effective selectivity in a Super-Heterodyne is the result of the combinations of the selectivities in the radio and intermediate frequency levels. In neither can the selectivity be slighted if satisfactory results are to be obtained. The greater part of the selectivity is, of course, obtained in the intermediate frequency level, or may be obtained if due regard is given to common-sense principles of design.

As an example for discussion let us take a Super-Heterodyne in which there is one radio frequency tuner and an oscillator control. Stations are then first selected with the RF tuner and brought in with full volume with the oscillator control. When the circuit has been tuned accurately with both of the controls there may be some interference, and if there is, the effective selectivity is not great enough. Where lies the fault? That can be determined only by observing the type of interference and the response of the signal to changes in the two controls.

Test of Selectivity

Is the intensity changed very much when the RF control is varied, that is, can the volume be changed very much by turning the RF condenser a few divisions? If the signal disappears when this condenser has been turned a few divisions either side of the peak, this part of the circuit is selective enough. If the condenser has to be turned fifty, twenty, or even ten divisions either side before any noticeable change in the volume results, then the selectivity may or may not be great enough. The test fails on very strong signals. But if a signal of moderate strength comes in "all over the dial" it is a sure indication that the selectivity in the radio frequency level is not great enough. But this does not necessarily mean that the Super-Heterodyne as a whole is not selective, even is not too selective. In the accompanying sketch the dial on the left represents the RF control, usually called the first detector. This shows that WEAF can be heard from 50 to 100 on the dial, with the maximum at 71. The dial on the right represents the same tuned circuit, but note that WEAF comes in between 64 and 72 with the peak at 68. The dial at left indicates either that the radio frequency tuner was not selective enough. The second dial indicates that the trouble has been remedied.

One might use the oscillator dial (not shown) to indicate the selectivity of the intermediate frequency filter. Suppose that you tune a radio frequency receiver, such as a Neutrodyne, at any frequency within its range, but very accurately. Then suppose that a broadcasting station varied its frequency continuously by varying the condenser which controls its frequency. At some time the signal from that station would be identical with that to which your receiver is tuned. The signal would then come through.

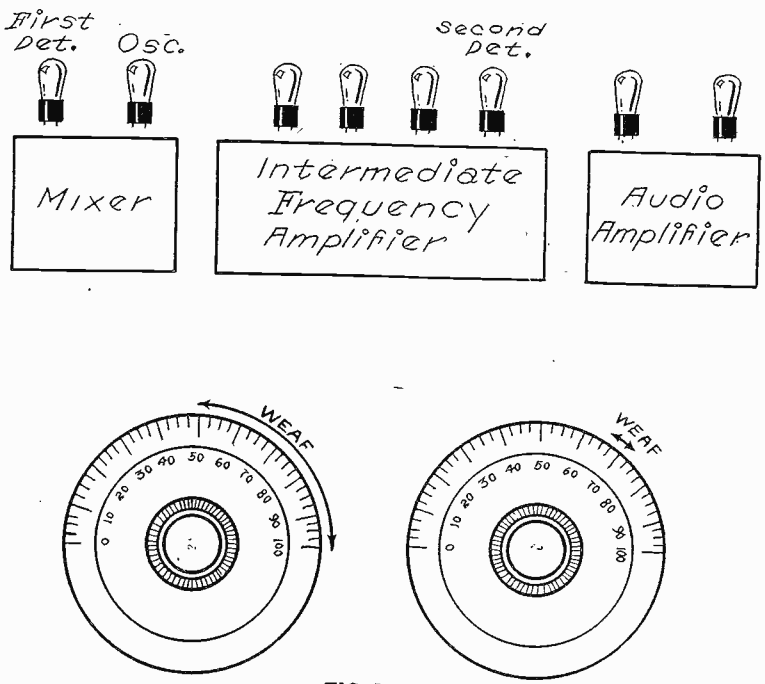


FIG. I

The essential units of a Super-Heterodyne receiver. First the mixer, then the intermediate frequency amplifier, and finally the audio frequency amplifier. In the mixer are included the first detector (modulator) and the oscillator. The two dials at bottom represent the same tuning device, the modulator. At left is the dial spread when the intermediate channel is not selective. At right is the selective result. The bad example was obtained with five volts positive grids on the three intermediate amplifiers, the other example with one volt negative bias.

A Parallel Case

Suppose further that the man at the station turning the oscillator condenser could tell when your receiver receives the signal loudest and that he stopped at that adjustment. Your set would then be tuned to the broadcasting station by adjustment of frequency to the fixed frequency of your set. That is exactly what is done when the oscillator dial in a Super-Heterodyne is turned until the signal comes in loudest. The intermediate frequency filter is tuned to a fixed frequency and the oscillator changes the frequency of the signal until it is the same as that to which the filter is tuned. The frequency of the filter is comparatively low, and when the set is in tune it establishes just the right difference between the signal frequency and the high frequency of the local oscillator to constitute the frequency of the intermediate channel.

The selectivity of the intermediate frequency filter is all that is necessary except under certain conditions, and unfortunately these conditions are of common occurrence. If the intermediate frequency is of such magnitude that it is equal to one-half the difference between the frequencies of two broadcasting stations, both of these will come in with about equal intensity when the set is tuned to either station. The competition of sounds is great. The only way in which to eliminate one of the stations is to tune it out in the radio frequency level. The intermediate frequency filter cannot be made selective enough to differentiate between the two, because the two signals have the same frequency in that level. Hence it is necessary to suppress one of them before it reaches the mixer. That is the reason why a high degree of selectivity is required in the radio frequency level.

Negative Grid Important

The use of negative grid bias on the mixer tube also helps in increasing the selectivity. If the grid condenser and leak method are employed, the selectivity can be upheld by using a smaller grid condenser and a higher value of grid resistance than customary. The grid leak should never be

(*Concluded on page* 8)

The Equamatic Mixer

For Use With Almost Any "Super" Coils

By Herman Bernard

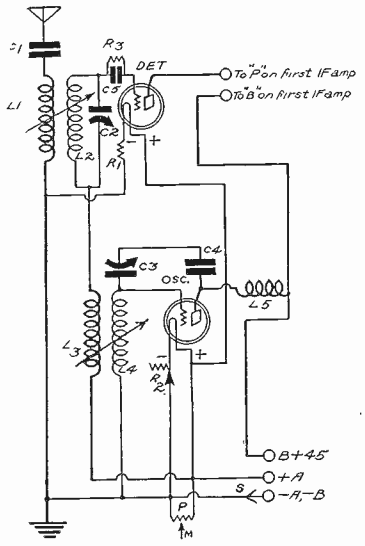


FIG. 1

The Equamatic mixer, for use in tuning almost any Super-Heterodyne, affords exceptionally fine selectivity, due to the automatic variation of the inductive coupling (L1 to L2 and L3 to L4), the series condenser C1 and the capacity of C5, the grid condenser, which is .0001 mfd. The potentiometer P is no part of the mixer, but is shown because it will appear on the mixer panel. The movable arm M goes to the grid return leads of the intermediate couplers preceding the second detector coupler.

THE attainment of expected performance on a Super-Heterodyne depends on an adequate mixer, a good intermediate channel and an audio amplifier relatively free of distortion. The mixer shown in Fig. 1, and illustrated on the front cover of this issue, works well with nearly all of the good intermediate frequency coils popular with the fans today, excepting those that use a high frequency for the intermediate, e. g., Infradyne and One Spot. The mixer, which uses Equamatic tuning coils, therefore is adaptable to such intermediate frequency coils as the Victoreen, High Frequency Laboratories, Melo-Heald, Samson, General Radio, etc.

The Equamatic coils are so constructed that the turning of the variable condensers automatically changes the coupling, and this may be done in a variety of ratios, including the straight line frequency basis of coupling variation. The higher the frequency, that is, the less capacity used in the condenser, the smaller the coupling, so that a uniform effect is obtained throughout the broadcast band, thus avoiding the rising characteristic of tuned RF. The sensitivity is kept on the same level throughout the range, which is not true of fixed coil coupling.

Two Equamatic Points

You will see from Fig. 1 that the aerial input to the modulator or first detector is subjected to this variation, and so is the pickup between the modulator and the oscillator. The coil L5, in combination with the connections of C3 as diagrammed, account for the oscillation, without which no signals would be heard. The necessity for varying the oscillator pickup through L3 is just as great as for variation in the antenna circuit, for thus is the induced energy levelled in the oscillator grid circuit.

The plate coil L5 consists of 14 turns of No. 24 single silk covered wire on a 2¼ inch diameter tubing about ½ inch wide. The turns may be side by side or one turn atop of other turns. As this coil is for the plate circuit the capacity effect and likewise the resistance in the coil itself are of no consequence.

In making this coil it is good practice to prepare it for mounting before the wire is put on. Obtain the form. Take a piece of brass or aluminum ½ inch wide and bend it into a Z shape, so that the top and bottom arms just fit against the inside of the form. Then drill a hole through the center of each arm. Also drill a hole in the center of the crosspiece section of the arm. These holes should be of suitable size to pass the screws you will use for mounting. Normally these would be 6/32.

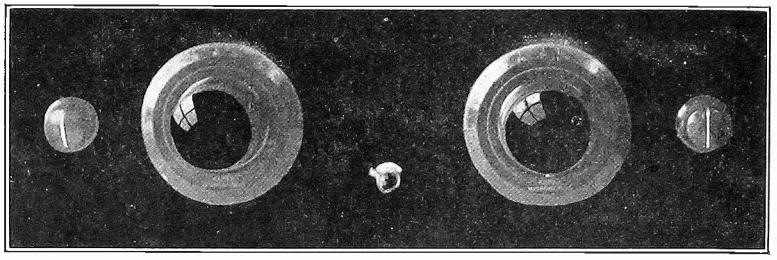


FIG. 2

The front panel view of the Equamatic Mixer.

Mounting the Z Piece

Next drill a hole anywhere on the midline of the coil form, drilling from the outside. Pass a machine screw through this, and through the hole in one arm of the Z piece, with the head outside the form. Affix a nut to this screw on the inside of the form. Snip off the excess of the screw protruding through the inside.

LIST OF PARTS

L1 L2, L3 L4—Two Equamatic coils
L5—One plate coil as described
C1, C5—Two .0001 Aerovox mfd. mica condensers, one of them with clips for grid leaks.
C4—One .006 Aerovox mica condenser
R1—One 1A Amperite, with mounting.
R2—One 30-ohm Yaxley rheostat
PM—One Yaxley 400-ohm potentiometer
R3—One 8-meg. Lynch metallized grid leak
C2, C3—Two Karas .00037 mfd. tuning condensers
S—One Yaxley A battery switch.
Two Karas Micrometric dials
One 7 x 18-inch bakelite front panel
One 8 x 17-inch bakelite subpanel
Three Karas subpanel brackets
Two dial pointers
Seven Eby binding posts (A+, A—, B—, P, B+45, Ant., Gnd.)
Two Benjamin sockets.

Now move the Z piece into position and with a center punch or scriber locate the point for the other hole on the form, and drill this. Fasten with nut and bolt as you did in the other case, snip off the extension. and wind the ten turns on the outside of the form. The wire may be wound on both sides of the screwheads. Now take a 1½ inch long machine screw and tighten a nut against it so that the screw is rigidly in place in the center of the Z piece. Turn a nut loosely all the way down the screw. The subpanel will be drilled at a suitable point on the right-hand side (as you face the panel) so that this screw may be brought through the under side to the top of the subpanel and fastened with another nut, the excess being snipped off. The loose nut bcomes a lock nut.

This coil mounting is one of the last things to do, for you will find a handy place to put the coil, just in front of the output binding posts at right rear, after the mixer is built.

The Equamatic coils themselves are difficult indeed to make at home. Ordinarily an extension shaft would be necessary on the tuning condenser in each case, and a mounting device so that the primary coil could not only be put on this shaft, but varied in its angular setting until just the right gradation of coupling it attained. This setting is done only once and is not to be confused with the automatic variation due to condenser shaft rotation.

Inductance For Tuning

Suitable inductance would be provided for tuning with the Karas condensers if 60 turns were wound for each secondary, on a 3-inch diameter tubing, and about 4 inches long, and for the primary 14 turns on a 2¼ inch diameter tubing 1 inch long.

The front panel is 7 x 18 inches, with the two condensers, two resistors, R2 and PM, and A battery switch mounted as shown. On a central line the rheostat R2 may be mounted 1½ inches from right and the same distance from left. The condenser shafts are put 5¼ inches from left and right, to permit the dials to work without molesting the resistors. For this purpose it may be necessary to tilt the tuning condensers at a slight angle, so that they too will not touch the resistor frames.

Nearly all of the wiring, of which there isn't much at that, is done underneath the subpanel. Where common connections are to be made a hole may be drilled in the subpanel, a machine screw put in place, with nut on the under side of the subpanel, and the connection made through this screw and nut. Thus the lead from

(*Concluded on page* 8)

A One-Tube Portable
That Brings in Locals on a Loop Aerial

By Jasper Jellicoe

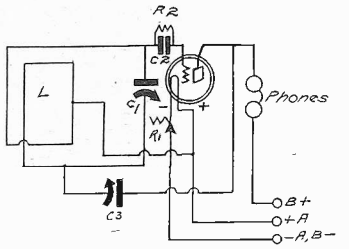


FIG. 1

Circuit diagram of a one-tube regenerative receiver suitable for camping.

SUMMER with its delightful camping trips is coming. The city-bound population with all its artificial amusements will welcome a chance to live in the free and open spaces for a while. Such folk will take delight in camping, hunting, fishing, hiking, swimming, and living the primitive life. But the evenings are long, and the first thing they will miss is the radio, that is, if they are not prepared with a portable radio set. There is no one thing more delightful than soft music on the still evening air in the woodland. And there is no better way of insuring its presence in camp than a good radio set.

The best radio set for the camp is also the best in the home. But not many campers will be able to take their complex receiving equipment with them. Most of them will find a light portable set more suitable to their mode of travel and their camping aims. Some will not even find a small loud speaker set practical, but all can find room in their pack for a one-tube headset receiver

Sensitivity, compactness, lightness of weight are important.

If limited to a single tube one must use regeneration, for it alone adds something worth while to sensitivity without greatly increasing weight.

The loop L in Fig. 1 should be as large as practical. That is, it should have much wire and be wound on a large frame. This insures a large pick-up of signals and high sensitivity. It should be wound with heavy wire to cut down its radio frequency resistance. It should preferably have an inductance which adopts it to a .00035 mfd. tuning condenser. And in the interest of portability it should be collapsible. It should be provided with a tap on the center turn.

The tuning condenser C1 should be of the .00035 mfd. because a large inductance and small capacity usually gives greater sensitivity.

Since sensitivity is of paramount importance the grid leak R2 and the condenser C2 should be so proportioned that greatest detecting efficiency results. Suitable values with this end in view are 5 megohms for the leak and .00015 mfd. for the condenser. The grid return should also be connected to the positive end of the filament battery, as it is done in Fig. 1, for the —99 type tube.

The regeneration is controlled in this set by means of a midget condenser C3, one side of which is connected to the plate of the tube and the other to the loop and the tuning condenser. This midget should have a capacity of about 50 micro-microfarads. No by-pass condenser across the 'phones should be used with this method of regeneration.

The filament current is controlled by a small rheostat R1. Very tiny light-weight rheostats can now be obtained suitable for any type of tube and any of the usual voltage sources. If the tube used is a —99 the resistance of the rheostat should be 50 ohms.

The plate voltage need not be higher than 45 volts, and that can be obtained from a very small battery.

The frame of the loop should be about four feet on the side. About 90 feet of wire should be wound on it. The wire should preferably be a heavy stranded and flexible conductor. The winding should be in a flat spiral and the adjacent turns separated about ¼ inch. The loop in the photograph illustrates the details of construction. The essential things in the loop are the 90 feet of wire and the four-foot frame, not the details of assembly or winding.

FIG. 2

Eugene Garcia and Dorothy Daniels, San Diego (Cal.), High School pupils, testing a one-tube portable receiver which they have built. This set is like the one described by Jasper Jellicoe.

LIST OF PARTS

L-Loop, preferably a collapsible one, that tunes with a .00035 mfd. condenser.
C1—tuning condenser, .00035 mfd. capacity.
C3—midget variable condenser, about 50 mmfd.
R1—50 ohm rheostat.
C2—.00015 mfd. fixed condenser.
R2—5 megohm grid leak.
One X socket.
One —99 tube.
One headset.
Three No. 6 dry cells for filament battery.
One small 45-volt B battery.
One 8 x 10-inch baseboard.
One 7 x 12-inch panel.

Beam Service Opens, Britain to Australia

At the General Post Office in England, greetings were exchanged over the wireless beam service between England and Australia by Colonel Amery, Secretary of the Colonies, and Premier Bruce of Australia.

Thus was inaugurated the wireless beam service which is able to transmit more than 200 words per minute in two directions.

Over this new service a letter takes an eighteenth of a second to pass from the transmitter in London to the receiver in Australia. Because of its speed the beam is expected to revolutionize the transmission of messages. There have been sent as many as 325 words a minute simultaneously in both directions over the Australian beam. According to the time—since wireless waves travel better at night—the new beam will be directed on its 10,000 miles journey either eastward over Europe or westward over America.

A beam to Montreal has been working since October, and beam stations for South Africa and India will be ready for tests in a few weeks. It is expected that the wireless beam will be operated in July between London and New York.

Coded Bourse Prices Jail Four Financiers

In Paris recently four financiers—two Russians, a Hollander and a German—were arrested for having installed a secret radio broadcasting station and assisted the speculation of confederates in their own countries by broadcasting, many times a day, the Bourse quotations, especially exchange rates, from July to December.

It was stated that the broadcast quotations were concealed by the use of additional figures. Though the amount of their profits is unknown, the men were sentenced to pay small fines on a charge of infringing the law of the State monopoly of telegraphic transmission and the law regulating broadcasting.

A Ship Model Receiver

"Santa Maria" Provides Decorative Housing

By Smedley Farnsworth

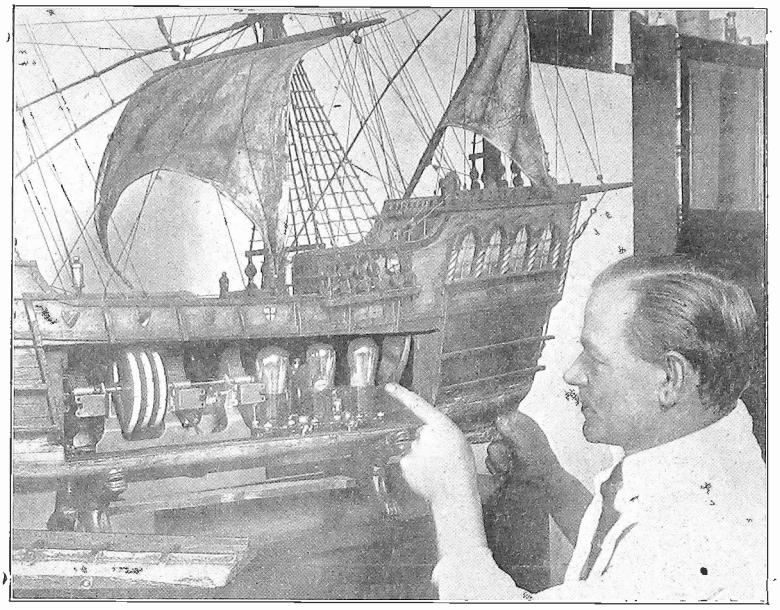


FIG. 1

Stark utility as exemplified in a radio set can be concealed behind the decorative broadside of a ship model, by stowing the receiver away in the hold of the ship. Karl Bauer, of the Bronx, N. Y. City, is shown with the set he built in a "Santa Maria" model. He is pointing to the special detector tube.

THOSE who prefer the artistic to the strictly utilitarian things of life will be interested in how to build a receiver in a decorative ship model. A receiver can be tucked away in the hold of the ship where it can be heard but not seen. When so placed the only objectionable feature of a radio set is eliminated and none of its numerous advantages sacrificed. At this time not even the most critical can deny that the product of a first class radio receiver is artistic; it reproduces faithfully all the artistry of the greatest musicians, whether they express themselves with voice or instrument. A radio set is essentially a machine and it is no more artistic of itself than a steam shovel, so the problem is to make it look artistic by housing.

A good radio set can just as easily be placed in the hold of a decorative ship as in a plain box, and it will work just as well. When so placed not only are the mechanical features of the radio set hidden behind the artistic broadside of an old schooner but the two desirable additions to the modern home are placed in one space, a feature of some importance in small apartments.

Audio Is External

Only the radio frequency stages are placed in the hold. The audio frequency amplifier can be stowed away in the cabinet on which the ship stands or in the box which houses the battery eliminator or the batteries. The radio frequency tubes and the tuning system must be accessible at all times and hence must be placed within easy reach. As will be seen from the photograph, a triple condenser is used for tuning and this is placed midships. Each section is separately tuned. The two radio frequency tubes and the detector are placed, left to right, in the order named. When the side of the ship, in this case serving as a panel, is put in place only a part of the control drums are visible. An opening is cut for this purpose and the panel plate is fastened to the hull. While the coils are not shown in the picture they are also placed in the hold directly behind the tuning condensers.

The circuit used in the ship's receiver follows standard and well tried principles. A fixed control of radio frequency oscillation has been introduced, consisting of the Phasatrol units, invented by John F. Rider and manufactured by Electrad, Inc.

Localized Tuning

There are three separate tuning condensers, each of .00035 mfd. capacity. These are part of the Alden localized tuning control in which the individual controls are bunched so that all can be turned at the same time with a single hand, or they can be turned independently if that is required to effect accurate tuning. These three condensers are labeled C1, C2 and C3 in Fig. 2.

Since space in the hold of the miniature ship is limited, it is necessary to use small tuning coils. This does not in the least detract from the effectiveness of the receiver. In a three-tube RF amplifier of this type small coils are desirable even when the circuit is assembled in a conventional box. Freedom from interstage coupling is the advantage gained by the use of small coils.

The coils can be wound on 2¼-inch bakelite tubing with No. 28 double silk covered wire. This wire is suitable for both secondaries and primaries. L1 should contain 20 turns and L2, 95 turns. If it is desired to make the set more selective fewer turns can be used on the primary L1. Windings L3 and L4 should have from 15 to 20 turns each.

Amplification Kept High

It is not necessary here to reduce the number of turns in order to stop radio frequency oscillation, because of the special device used for this purpose. For loud volume the larger number of turns should be used and for high selectivity the smaller number. The two secondaries L4 and L6 should each have the same number of turns as L2, that is, 95 turns. Due to differences that creep in when making the coils and condensers and when placing them in the set; the three tuned circuits may not tune exactly alike. This can be compensated for by adjusting the turns after the circuit has been connected. It may be necessary to remove a turn or more from one or two of the coils. This only requires a few minutes of work. The set should be tuned in on a station in the middle of the broadcast range and if all the condensers do not read alike when the circuit is accurately in tune, remove turns from the coil which is connected across the condenser that reads the lowest. Make the adjustment until all the coils read as nearly the same as they can be made to read. Do not remove too many turns from any one secondary because it is not easy to put turns on again.

The three tuning coils should be placed as far apart as the room in the ship permits, provided they are not removed too far from the condensers with which they go. The coils should also be placed at right angles to each other. This can be done in either of two ways. In the first place they can be placed at right angles geometrically, when they will also be at right angles electrically. One is placed with the axis vertical and the two others with their axes horizontal.

Phase Problems

These two can be placed so that their axes form a right angle in their plane. The second method of placing the coils electrically at right angles it to incline them at an angle as is done in Neutrodynes. The angle depends somewhat on the distance apart and on the ratio of length to diameter, but the angle is approximately 53 degrees with the line which passes through all their centers.

The dotted rectangles in Fig. 2 contain the Phasatrols. As the drawing indicates, they consist of a high-resistance rheostat with a condenser. The total resistance is placed in the plate circuit and this helps to prevent oscillation. It is well known that if the resistance in the plate circuit is high enough the tube cannot oscillate. This fact has been partly taken advantage of in the design of the Phasatrols. However, the resistance has not been made so high as to do the job alone, as this would preclude possibility of getting maximum sensitivity out of the set. Hence a variable feature is introduced whereby the set can be adjusted near the

(*Concluded on next page*)

LIST OF PARTS

C1, C2, C3—One Alden three-section localized tuning control.
L1, L2, L3, L4 and L5, L6—Radio frequency transformers as described.
PT1 and PT2—Two Phasatrols.
R1, R2 and R3—Three No. 4 Lynch Equalizors.
R4—One 2-megohm Lynch metallized grid leak.
C4—One .00025 mfd. Electrad grid condenser.
C5—One .001 mfd. Electrad mica condenser.
S—One filament switch.
Three X type sockets.
Two binding posts.
One decorative ship model.

A Coast-to-Coast Set

The Adams-Griffin Proves Exceptional

By Dana Adams-Griffin

EVERY radio fan in checking the results he obtains against those of other members of the radio fraternity with nearly identical equipment has found a difference which may be attributed to location. The importance of location and the antenna used, cannot be too strongly emphasized. Some interesting information on the wide variance which may occur when identical equipment is used in different locations has been collected.

To check up on the DX ability and the selectivity of a receiver I designed (the Adams-Griffin), the final model, with the same set of tubes, was tried out in several New York "dead spots." That New York City is a radio freak is a recognized fact. Many a set with a good reputation has fallen down when put among the steel canyons, subway lines and the general noise barrage of the Metropolis. For this reason I felt confident that if excellent results were obtained in various parts of the city, the receiver could be offered to the set builder with confidence in its ability to cope with any situation.

Locations Tested

I live on Fifty-second street, 200 feet from the Third Avenue elevated and next door to an Edison powerhouse. With 175 feet of antenna all New York stations come in with good volume. Stations in Newark, N. J., only twelve miles away, are practically inaudible. The huge Park Avenue apartments form an effective radio barrier to the west. KDKA is the only station west of the Hudson River that is worth while. This station is easily tuned in on my set without interference from WGBS and WMSG. A glance at a wavelength table of stations will show that this is remarkable separated ability. WGY, WBAL, WPG and practically every station to the north and south may be brought in through the locals.

A change was noted when the set was tested at a well-known radio store in the East Eighties, where distance reception is supposed to be nil. WOR and all other Jersey stations came in very loud in this location in distinct contrast to the other test. WLW, WSB, WJR, WBAL and other DX stations came in with good volume on a forty-foot inside aerial. With WOR pounding away on 405 meters, WAT was perfectly separated on 400 meters. KDKA was excellent with WGBS only half a mile across the East River.

Results on the ground floor of the Alamac Hotel, at Seventy-second Street and Broadway, furnished a surprise. The antenna used was a vertical affair, stretching 125 feet up the side of the building; six inches from the brick and steel wall. All local stations were very loud with the exception of WGBS and WAHG, which are located on Long Island. WFI, on 395 meters, was easy to get, with WODA on the air in the day time. WIP also came through despite WEAF and WNYC. WJAZ, WLS, WLA, WBAL, WGY and many others were brought in during the early evening in this seemingly adverse location. The best bit of selectivity here was WCAU clear and distinct with WPCH on the air just two blocks distant.

Tries Another Place

Another store, this one on "Radio Row" on Greenwich Street, also showed the shielding effects of tall buildings. The stations uptown and to the East were hardly recognizable on the 50-foot antenna. With the elevated outside the door, a subway line and the Hudson tubes underneath, the man-made static was very bad in this location. Nevertheless, WGY, KDKA and WBAL were right on top at 6 P. M., and by 7:30 WLW, WSAI, WSB and several Chicago stations came in well above the noise level.

In conjunction with these trials under admittedly poor conditions, several trips were made to Summit, N. J., twenty miles from the city. This location may be classed as average. All the local stations came in well here with a forty-foot antenna. Stations within a 200-mile radius were consistent daylight performers. At 5 P. M. distance up to the 1,000-mile mark gave excellent loud speaker volume. No trouble was experienced later in the evening in bringing in any distant station separated 10 kilocycles or more from a local. Exception to this must be made only in the case of WJZ, six miles away, with an output of 50 kilowatts. WNAC on 445, WJZ, 455, and WRC, 469, were distinct on this receiver. As a one-tube regenerative set cannot separate WJZ and WEAF here, the selectivity of the Adams-Griffin becomes apparent.

The stations tuned in ranged from Miami to Toronto, New Orleans to Minneapolis, Dallas to Denver, culminating in confirmed reception of KFI, Los Angeles.

* * *

[This receiver is all that the author states. It was tested in Radio World's laboratories and proved ace high. Its construction will be described by Dana Adams-Griffin, beginning with next week's issue, dated May 7.]

How to Hook up Circuit for Ship Model

(Continued from preceding page)

oscillation point yet kept within the stable condition. By moving the slider on the resistance any desired voltage may be put across the primary coil following the Phasatrol, hence any degree of volume wihin the limits of oscillation. The device is called a Phasatrol because the oscillations are more controlled by adjusting the phase of the feedback energy than by varying the amplification. The device does not need to be adjusted more than once. The two Phasatrols in the receiver are designated PT1 and PT2.

Discussion of Constants

The two radio frequency amplifier tubes are operated with a negative bias on the grid in order that maximum amplification and selectivity may be obtained. The bias used is the voltage drop in the Lynch Equalizors R1 and R2. The grid return of the detector tube is connected to the same point, that is, below R3, so that this tube also gets a small negative bias. This adapts the circuit to the new, gaseous type of detector. However, the set can easily be adapted to the use of the CX-301A or UX-201A as detector. It is only necessary to connect the grid resistance R4 directly between the grid and the positive end of the filament. This method would be required in this case for general purpose tubes because the tuning condensers used have a common connection to the frame. The grid leak should be of 2 megohms resistance and the grid condenser C4 should have the usual capacity of .00025 mfd.

The .001 mfd. bypass condenser C5 is connected in the plate circuit in the ship to prevent radio frequency currents from entering the audio amplifiers, which may be at some distance. Similarly the filament switch S is placed in the ship in order that it may be easily accessible. The audio tubes take their filament current from the leads as shown, so that it will be unnecessary to use more than one filament switch.

A plate voltage of 90 volts is used on the radio frequency tubes. This high voltage makes these tubes step up the amplification much more than it a lower voltage were used, and such a high plate voltage source can be used by virtue of the Phasatrols. The detector gets the usual 45 volts on the plate.

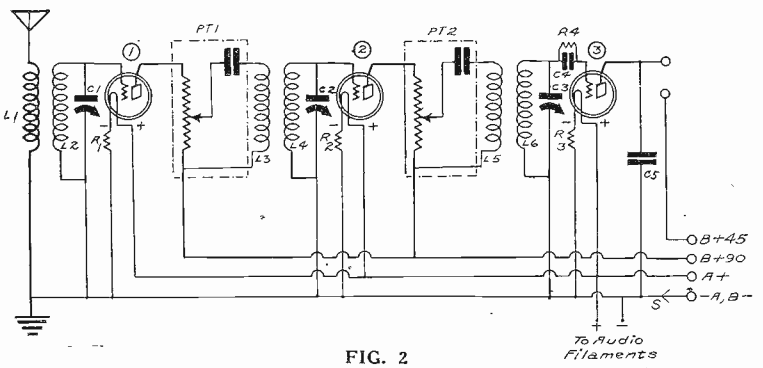


FIG. 2

The circuit diagram of a receiver suitable for building into the ship model. The radio frequency and detector alone are built into the ship. The audio frequency part and the power supply can be stowed away in other convenient places.

The Output Limit of a DC Eliminator Is Under 100 Volts

By Sidney Entfield

WHEN the voltage of the lighting supply lines is direct this may be used for supplying the plate potential of a radio receiver. However, the voltage across the supply terminals is usually around 110 volts. This is not sufficient to supply the potential for the plates in modern loudspeaker receivers. Many of these call for 180 volts or more.

A voltage of 110 volts would not be so bad even for loudspeaker sets if that could be obtained from a 110 volt supply line. It cannot, because it is necessary to employ a filter system for taking out the ripple in the supply current, or the hum as it is called in radio. To filter this out adequately, it is necessary to use choke coils of high inductance, and these coils must necessarily have a considerable resistance.

When the set draws a heavy plate current the voltage drop in the choke coil resistance is quite large, and this drop is subtracted from the supply voltage. Thus in many cases the voltage that is left for the tubes in the set may go as low as 90 when the supply is 110. Ninety volts is not enough for sets intended to operate a speaker with good volume and quality, with a power tube in the last stage.

The Limitation

When B batteries are used to plate voltage, the potential can be increased to any desired value by merely connecting many batteries in series. Thus if 90 volts are used the voltage can be doubled by connecting two 45-volts blocks in series with the battery already used.

Why cannot the same thing be done when a direct current supply line is used in connection with a B battery eliminator? This is a question that every novice asks as soon as he learns he can get 90 volts from the line. Why can he not hook up two DC eliminators in series to get 180 volts from the line when he can get 90 volts with the use of one eliminator?

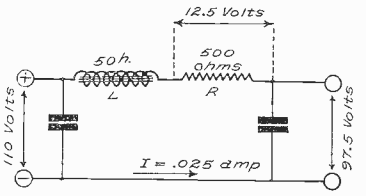


FIG. 1

Diagram of a typical DC eliminator, showing the voltage drop in the choke coil resistance and also the effective voltage across the output.

Two men climbing up one flight of steps do not get as far up as one man climbing up two flights.

100 Volts All You Can Get

When two batteries are connected in series two electromotive forces are added in series. If two resistances are connected in series with one battery, the voltage of the battery is not doubled. It remains the same. The electromotive force in a DC eliminator is the voltage of the generator at the power house. This is not affected by putting resistances in series with it. It certainly does not double by putting two equal resistances in series with it. The only way to double the voltage is to put two equal generators in series.

The maximum voltage that can be obtained from a 110-volt source is 110 volts, and that can only be obtained when no current is taken. As soon as current is taken the voltage drops, and the drop is proportional to the current taken. For example, if the resistance in the filter is 100 ohms and a current of .1 ampere is taken, the voltage drop in the resistance is 10 volts. There remain 100 volts with which to work the set. If the current taken is .5 ampere the voltage drop in the resistance is 50 volts, and the remaining voltage is only 60 volts. Suppose that the total plate current taken by a five-tube set is 25 milliamperes. The voltage drop in the resistance is 2.5 volts, and the remaining voltage is 107.5 volts.

It is not practical to make a choke of sufficient inductance with as low resistance as 100 ohms. The actual resistance in a filter is more nearly 500 ohms. With that resistance and a current drain of 25 milliamperes the voltage drop is 12.5 volts, and the effective voltage is only 97.5 volts. In many cases the effective voltage is much less.

The Circuit Analyzed

In Fig. 1 is shown the circuit diagram of a typical DC eliminator connected to a 110-volt line. The inductance L has a value of 50 henrys. This causes no DC drop in voltage, but does cause a very great drop in the AC or ripple voltage. The resistance of the wires in the coil is represented by R, which has a value of 500 ohms. This causes a negligible drop in the ripple voltage, but it does cause a high drop in the DC voltage. When the current which flows in the circuit is .025 ampere, the drop in the filter is 12.5 volts. This leaves a voltage of 97.5 volts across the output terminals.

Effect of Positive Grid on IF Channel

(*Concluded from page 3*)

connected across the tuning condenser, that is, directly from grid to filament.

When the signal comes in all over the oscillator dial the filter is not filtering. The intermediate frequency coupling devices are aperiodic to a greater or lesser degree. There may be many reasons for this condition. The wire in the intermediate transformers may be too fine, although this is not likely to be the main cause. The different transformers may not be well matched as among themselves. This is often a serious cause for lack of selectivity in the intermediate channel. Faulty placement of the transformers with respect to shields and with respect to one another is also a prolific cause for broadness of tuning. In some cases the coils are so placed and the connections so phased that the output of one stage kills off the gain of a preceding stage. Low volume and poor selectivity result.

Why Positive Grid Is Bad

The booby prize goes to the designer of a Super-Heterodyne who first employed positive bias to prevent oscillation in the intermediate frequency amplifier. He ruins the quality of the receiver, runs down his B batteries four times as fast as he should, stops the oscillations sometimes, but looses most of the selectivity and the sensitivity of the receiver. And why does he lose the selectivity? Because when the grids of the amplifier tubes are positive the input resistances of the tubes are low, and the result is equivalent to short-circuiting all the secondaries of the transformers. No short-circuited tuner has any selectivity. And why does he lose sensitivity or volume? For the reasons that the secondaries are short-circuited and that a tube does not amplify well when the grids are positive.

The dial at left in Fig. 1 shows the poor selectivity resulting from a positive grid bias in the intermediate channel, while the other representation of the same dial shows the result of a slight negative bias. No other change was made in the circuit.

Selectivity Is High in Equamatic Mixer

(*Concluded from page 4*)

the low potential end of L2 is carried to the primary L3 (oscillator pickup) for ultimate joining to A plus. This is done by drilling a hole directly under the rotor lug of C2, passing a lead from that lug through the hole to the under side of the subpanel, and connecting to the nut of a screw, as explained. The connection to the pickup coil is made by sliding one lug of the pickup on L3 under the nut on top of the subpanel.

The eight terminals of L1L2 and L3L4 are connected in this way.

The binding posts are mounted on the rear of the subpanel, left to right (when you are facing the front panel) as follows: Ant., Gnd., A plus, A minus, B minus, B plus 45, P and B. The output posts are P and B, but any designations may be used, such as Speaker plus and Speaker minus, although these posts are never connected to the speaker.

The potentiometer is made a part of the mixer construction because it is necessary to have this device on the front panel, easily accessible. It serves as a combination volume and sensitivity control. The movable arm M goes to the common grid return of the first three intermediate coils. The other grid return (fourth intermediate coil that couples to second detector) goes to A plus usually, unless a special detector like the CX-300-A or UX-200-A, is used, when the connection is to filament minus.

A Double Three-Foot Cone That Affords Faithful Reproduction

By W. H. Sinclair

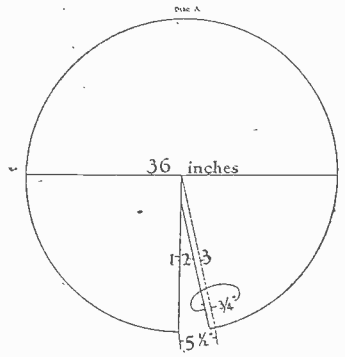


FIG. 1

[*Last week this first part of the following article appeared. If you have not read it, get out your copy of* RADIO WORLD *and do so.*]

IT has now been definitely settled that a properly constructed three-foot cone speaker built of quality parts, affords the maximum in reproduction. But it is not the size alone which does this; it is a combination of things—design and parts used.

Also it is generally accepted by our leading acoustic engineers that a double three-foot cone speaker is the only type so far developed which reproduces with the same completeness, fullness and roundness of tone as the original.

You are going to construct a three-foot cone speaker some day. The sooner you do so the more quickly will you be enjoying reception at its best.

Let's start building the double three-foot cone now.

LIST OF PARTS

One Penn Cone Speaker Unit
One pair Penn Back Rings
One set Penn Unit Mountings
One 5-ounce can Special Ambroid Cement
Two sheets Fonotex, 38 inches by 38 inches.

But five parts are needed; the unit, cone material, back rings, unit mountings and cement.

For the cones we will use Fonotex.

First make yourself a compass capable of marking out a 36-inch circle. Get a thin slat of wood, brass or aluminum about ¾-inch wide and 20 inches long. In the center of the strip and about ½-inch from one end drill a hole large enough to hold a small nail. Eight inches from this hole drill another large enough to hold the point of a pencil. Nine and one-half inches further down drill a similar hole and one-half inch further drill a third.

This makes the farthest hole 18 inches from the first hole drilled; the next is 17½ inches from the first hole.

A Line to Draw

Lay your 38 x 38-inch sheet of Fonotex on the floor, smooth side down. Find the center. With a nail secure the compass and put a pencil in the *farthest* hole. Draw a 36 inch circle. With a pair of sharp shears cut it out. Now lay it on the floor again and with a ruler as a guide and a sharp knife cut line 1 as in Fig. 1.

Next measure a point 5½ inches away in a straight line from where the slit cuts the periphery of the cone. Mark this point and DRAW, but do not cut, a line to this point from the center. (Line 3.) Then measure another point ¾ of an inch nearer the slit and CUT as in line 2. (Fig. 1.) Remove the cut segment and you have a flap ¾ of an inch wide for cementing. Spread the Special Ambroid Cement on the flap and bring line 1 over to line 3, so that the flap is on the inside of the cone; smooth carefully. Put weights on the cemented parts and let dry.

This forms the FRONT cone with exactly the correct angle for tone quality.

Now take the LARGER brass disc which comes with the PENN Cone Speaker Unit, cover it with AMBROID Cement and cement it to the INSIDE of the apex of the cone, making sure that it is in the exact center. In a smilar manner cover the SMALLER brass piece with cement and cement on the OUTSIDE of the apex of the cone.

Next comes the back cone.

Draw this circle exactly 35 inches in diameter.

Then, from the exact center draw another circle—circle "O"—exactly 16 inches in diameter—8 inches in radius. DO NOT CUT THIS OUT BEFORE THE CONE HAS BEEN CEMENTED and is perfectly dry.

Then cut out the segments as you did for the front cone and cement in the same way.

After the cement is perfectly dry cut out the circle "O" with a sharp pair of shears.

Finishing the Back

You must now finish the back cone by mounting the part completed between the two back rings and cementing them together.

You will notice that one of your back rings is covered on one side with Fonotex. This is the outside back ring and should be laid on the floor or table with COVERED SIDE DOWN.

Take the little cone which you have cut out of the large back cone. Place it on the back ring so that the center is exactly over the center hole of the back ring and the seam in line with a line on the back ring drawn from the center hole to the lower hole in the back ring. With a pencil trace a circle around this cone. This will serve to show where the large cone should go to be exactly centered.

You are going to cement it now and you must work rapidly, for Ambroid cement has the virtue of drying quickly. Provide

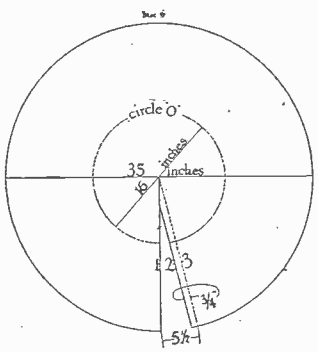


FIG. 2

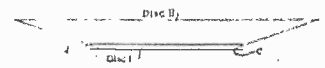


FIG. 3

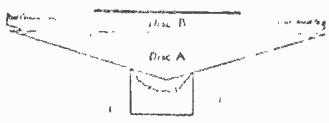


FIG. 4

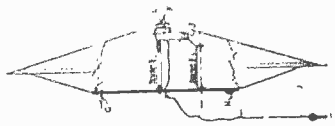


FIG. 5

yourself with about a half dozen of those small tacks used to fasten shade cloth to the spring roller.

Spread a thin layer of Ambroid cement on the outer rim of the back ring. Place the cone along the line marked and hold it in position with the small tacks. Still working rapidly spread a thin layer of Ambroid Cement ALL OVER one side of the other back ring. Then place the other back ring over the one on the floor making sure that all holes meet perfectly. Place weights on the back ring and give the cement time to set and harden.

Joining Front and Back

Your next step is to join the front and back cones.

Take any old cardboard box, such as an old hat box, and cut out a perfect circle about a foot in diameter in one of the sides.

Into this hole place the front cone—Disc "A" with the apex down, making sure that it is level. Then set the back cone—Disc "B" into Disc "A"—so that the two seams come together. You may notice that the two cones do not touch at all points. You should remedy this by propping up certain parts of Disc "A" with bits of wood and laying light weights at the proper places on disc "B". When all parts touch you will have a nice little trough all around into which to pour cement. Do not pour too much into the trough the first time. Give the cement a chance to set and then go over it carefully and pour some cement on the places where it is needed. Do not fasten or join the edges of the cones with clips or other devices. The cement will draw the cones together as it sets.

Let set undisturbed until thoroughly dry, for you now have but to insert the PENN Cone Speaker Unit and adjust it to thoroughly enjoy your radio.

Now you are ready to take the final step in preparing your speaker for amplifying reception.

Unit Mountings

First see that the LARGER of the two brass discs, which comes with the unit, is cemented tightly into the side of the cone's apex and that the SMALLER, is cemented to the outside of the cone's apex.

The insert your Unit Mountings through three of the holes in the back rings. Place a washer next to the bolt head; insert the bolt through one of the

(*Continued on next page*)

AIR FAVORITES PUT ON RECORD

(Harold Stein)

RECORDING one's favorite announcer, orchestra, singer, talker on DX station is becoming a fad. Mrs. G. W. Johnstone and Velma C. Forrest are shown recording Graham McNamee's voice on an office dictation machine.

GRAHAM McNAMEE

Many fans have taken to a fad in radio, that of recording the sonorous voices of their favorite announcers, speakers, singers or DX stations. Some use the phonograph, others such instruments as are used in offices for recording dictation, etc., as shown in the photograph.

One announcer whose voice is probably the most recorded is Graham McNamee, of WEAF.

When the office dictation device is used for recording it is common to put the receiver of the device against the reed of a cone speaker. When the recording is finished one can listen to it on the earphones that are auxiliary to the recording device. The recording is not difficult.

Lost in a Snowstorm, Man Found by Radio

Montreal.

A newcomer to the Saskatchewan section, Robert Thompson, who was on a visit to some of his friends, took a walk and struck a northern snowstorm, with the result that he was lost. After a twenty-four hour search he was still missing. Constable Band of the Saskatchewan provincial police when notified, requested CFQC at Saskatoon to broadcast a general description of him.

An elevator man miles away picked up the message, and recalling that he had seen a person resembling Thompson, sent word to the police station. Searchers were immediately sent out. After a short search, he was found wandering about in an exhausted condition. He had gone forty and one half miles in a day and one half.

How to Build A 3-Foot Double Cone Speaker

(*Continued from preceding page*)

holes. Slip another washer over the bolt, then one of the aluminum brackets; then screw TWO nuts down about 1 inch from the end of the bolt. Do this in all three of the holes for the Unit Mountings. The center hole in the back rings is for the cord.

Use Pliers for This

Now you are ready to insert the PENN Cone Speaker Unit. The brass discs and the nose piece have, of course, been removed. First tie a single knot in the cord about 10 inches from the unit. Insert the unit through one of the holes in the back ring. Work carefully so as not to puncture either of the cones. With the tip of the unit toward the front cone, slip each of the legs over the proper bolt. Then put a nut on the end of each bolt. Do not run the nut down; put it on just so that the thread catches and holds.

Next get the tip of the Penn Unit right up into the apex of the cone and screw the nose piece tightly into the threaded brass sleeve. You may need a little help for this. Screw the nose piece in TIGHTLY. Use a pair of pliers to get it as tight as you can.

Now screw down the last nuts—the ones nearest the back rings. Hold the nuts with your fingers and use a screwdriver in the slot in the bolt. When you have the unit mountings rigid, tighten the nuts on both sides of each leg of the Unit. This is to prevent chattering. DO NOT PULL THE UNIT BACK OUT OF POSITION; DO NOT FORCE IT INTO THE APEX OF THE CONE. The position you need is the one that the Unit itself assumes when you have tightened the Nose Piece and the speaker is held apex downward.

Next take the LARGER of the two screws, and screw this lightly into the tip of the Nose Piece. This screw is to adjust the Unit. The smaller screw, G, goes into the side of the Nose Piece and acts as a set screw.

Now make sure that you have reception with your receiver. Plug in your Penn three-foot Cone Speaker; turn the large screw slowly to the right until you get volume and then turn it left or right until the speaker is operating at maximum of efficiency.

Be Careful With Screw

WARNING: Do not turn the adjusting screw too far in, as it might force the armature.

For this speaker we have worked throughout with Penn Cone Speaker parts. The writer has found them completely satisfactory. The unit is noteworthy. This part, as has been written, is the heart of the three-foot cone speaker and upon the unit depends what your three-foot cone will deliver, especially in tone quality.

The Penn C. S. Unit is so engineered that it operates with a set using only 90 volts of B battery. Yet it takes all the voltages now used in radio and it reproduces all the volume that the tubes will pass and does not blast or lock.

The magnet is 16 oz. in weight, made of thoroughly seasoned steel, cyanide hardened instead of heat treated and is then chromium plated to prevent rust and preserve magnetism.

This unit reproduces, without distortion, all the frequencies passed to it by the receiver. And it is so engineered that it will take all the volume that the tubes will pass without blasting.

Stand High Voltage

Not only does the Penn Cone Speaker Unit do all of this but it is so designed that the coils cannot be burned out even if no output transformer or choke is used with the high voltages.

Another very desirable feature of this unit is its adjustability to the output of the set with which it is used. The adjustment is from the outside of the tip of the cone and can be made instantly without removing the speaker from the wall. It is an acknowledged fact that no two sets have exactly the same output. As a speaker works at its highest efficiency only when it is matched to the output of the set, the adjustability of the unit becomes almost an essential feature.

To complete your speaker get a small screw eye and two rubber screw bumpers. Screw these into the back rings—the screw eye directly opposite the seam and the two rubber bumpers about six inches apart on the opposite side of the back ring.

Advocates Wall Use

Of course this speaker can be used as a pedestal speaker but the writer recommends that it be placed on the wall. Its size and its fragility—especially the latter—almost demand that it be placed high on the wall out of harm's way. The speaker may also be suspended from the ceiling with the back in line with the ceiling. If this is done, paste some silk over the openings in the back rings to keep dust out.

Many constructors have shown marked ingenuity in decorating the cone, thereby making it both an article of beauty and utility in the home.

Many hundreds of readers of RADIO WORLD already have built this speaker to their complete satisfaction. It should appeal to others of our readers at this time as a speaker. Built as described it will help improve the quality of summer reception.

The cost? Oh yes; an amount that represents about one-fifth the cost of a factory-built three-foot cone of equal quality.

Special Purpose Tube New Crown for Sockets

Dr. Goldsmith Says Such Valves Now Are Taking Their Rightful Place, Improving Both Sensitivity and Tone

By Dr. Alfred N. Goldsmith

Chief Broadcasting Engineer, Radio Corporation of America

Life proceeds from the simple to the complex; but comfort, after all, depends upon the complex. Thus the automobile is certainly more complex than the ox-cart, yet we can all agree that the former is the more comfortable means of locomotion. Anyway, this is an age of specialization. Devices, to be really efficient, must be designed to do their intended jobs particularly well.

Guided by the foregoing philosophy, it becomes evident that the day of the general utility vacuum tube has drawn to a close. It may have been pleasant and convenient to put any tube into any socket. Absolute standardization is a wonderful thing. However, such pleasant and convenient practice was purchased at the sacrifice of results. It is a cold fact that the receiving set of the past as viewed from our present-day standards was limited as to sensitivity; it was quite limited as to volume, and therefore realism; it has been most limited as to maintenance of tone quality with the increase in volume. The standard, all-purpose tube might be satisfactory on weak signals, but it became overloaded with consequent distortion in the rendition of powerful signals.

Radio reception has therefore been faced with handicaps just as long as one type of tube has been available for use in every socket. The problem has been one of increasing the sensitivity, the volume and the tonal quality.

Special Detector Tube

Of course, sensitivity might be increased by multiplying the number of standard, all-purpose tubes. And so the problem of a suitable super-detector tube, whereby to obtain greater sensitivity yet without increase in battery drain or complication of adjustment, was put before the research laboratories. In due course there evolved the UX-200-A detector. This detector tube is not only super-sensitive, providing any receiver with what amounts to the approximate equivalent of another stage of radio-frequency amplification, but, at the same time, it requires no more attention or adjustment than the standard UX-201-A type which it is destined to replace in the detector socket.

Then there was the problem of obtaining increased volume without loss of tone quality. No longer were radio enthusiasts satisfied with mere noise. This problem eventually led to the evolution of the new power amplifier tubes which are now available for the receiver operating either on dry cells or storage battery. An extra large power amplifier tube is especially intended for socket power devices.

The Power Tube

Power tube—a rather crude name for a really elegant device. The name is too much apt to suggest brute power, yet that is not the prime purpose of the power tube. This device is intended to maintain good quality rendition even though the volume is greatly increased. The power tube, with its ample reserve of current-carrying capacity, is enabled to produce fortissimo passages in full volume with effortless ease. It should not be forgotten, however, that the power tube, lay opinion to the contrary notwithstanding, does not supply its own powerful wallop. It is a handler of power, not a producer of power. The power comes from the increased B-battery voltage and current which the tube is capable of handling.

To the music lover who seeks full and realistic volume without distortion the power tube is the artistic agent of radio. The power tube, in any receiver, virtually tears away the veil which blurs ordinary radio reception, and reveals a deep, full, realistic rendition of the broadcast music or speech.

Even further has the specialization in tubes gone towards the goal of sensitivity and volume. With the advent of the era of battery eliminators or socket power devices, special rectifying tubes have been developed.

Attains Majority

And so the tube art has come of age. Instead of utter simplicity and interchangeability of all tubes, we now have a diversity of tubes, each fulfilling a function with maximum of efficiency. Only through such a move could maximum radio efficiency be gained.

What has taken place at the receiving end has had its counterpart at the transmitting end, where the demand has been for more and still more power output, without distortion through overloading of tubes. The big brothers of the home receiver tubes are of 50, 250, 1,000 and 20,000 watt capacity, the first three being of glass construction as in standard receiving practice, while the last is partly of copper with a water jacket and constant circulation, to take care of the great amounts of heat generated when the tube is in operation, carrying its huge load. The output of this giant Radiotron is roughly a million times that of the usual receiver tube. And it may be said that the knowledge and experience gained in the small tubes of the home receiver has been applied to the larger transmitting tubes, just as the knowledge and experience at the transmitting end has been made available in the development of power tubes and rectifier tubes for the home end.

So, from the simple beginning in the form of the two-electrode Fleming valve, which marked the first application of the vacuum tube principle to radio reception, there has grown up the tube family which is today enabling the "theatre of the air" to realize its full destiny.

WWNC Is Situated 2,496 Feet Above Sea

J. DALE STENTZ
Director and announcer of WWNC, Asheville, N. C.

WWNC, Asheville, N. C., which had its premiere in February, boasts of being the highest broadcasting outfit east of the Rocky Mountains, having an elevation of 2,496 feet above sea level. WWNC employs 1,000-watt power and broadcast on 254.1 meters.

The station is owned and operated by the Asheville Chamber of Commerce. Programs during the first few months of Spring will be confined to three or four nights each week. Among the interesting events on the programs will be the broadcasting of the famous Grove Park Inn organ which has never before been on the air.

The personnel includes J. Dale Stentz, director and announcer; W. A. Shropshire, formerly technician of WSB, Atlanta, technician; F. A. Barber, chairman of the Radio Board; Carl Bamford; E. A. Jackson, Jr.; and F. Roger Miller, manager of the Asheville Chamber of Commerce.

Goose As Insulator In Station's "Stunt"

Los Angeles.

A goose, yes, a real live goose, is the latest thing in the way of a novelty in carrying radio equipment. This goose hailed from Hollywood and the antenna is stretched from the neck of the goose to a small cart which carries the receiving set. This equipment went merrily down Hollywood Boulevard tuned in to KNX. Wally Beery happened to be talking over the air at the time.

KOA Bars De Valera; Speech Held Propaganda

Denver

Carrying out the station's policy of censoring all talks before put on the air, KOA, the General Electric station, recently denied Eamon De Valera, the Irish Republican leader, the privilege of bringing his Irish freedom views to the public via radio. Too much propaganda against the present government was contained in the address, the officials stated.

Freeman H. Talbot, director of the station, said:

"Mr. De Valera did not send his complete speech as we asked, but gave only a number of abbreviated headings. These were sufficient, however, to cause the decision. In view of our large number of Canadian listeners we could not allow the talk to be given.

"We notified Mr. De Valera of our decision and asked him to modify some of his statements. He decided not to change it and the matter naturally was closed."

Mr. De Valera was greatly disappointed.

MYSTERY SOLVED

HERBERT HOOVER, Secretary of Commerce, all dressed up for an ornate occasion, was the most interesting person at a recent movie industry banquet. Persons were wondering why President Coolidge's spokesman said that even if Secretary of State Kellogg resigned, Hoover would not get his place. Later it turned out that the spokesman intended to compliment the radio co-administrator as being just about indispensable in his present place.

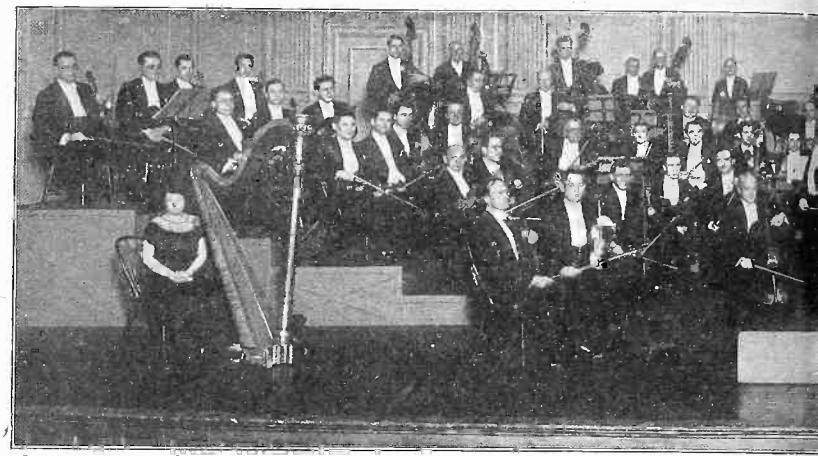
Not One Amid 20,000 Asks Jazz Music

A search through 20,000 letters written in response to a radio program which is broadcast weekly reveals that jazz music, which has been hailed by many as a real interpretation of American life, has not yet made a place for itself with those who love classical, old-time and folk music, the kind of which the programs were entirely made up. No jazz was included, and did not seem to have been missed by the thousands who wrote in to praise the numbers and ask for encores. Occasionally one writer would voice the protest that there is too much jazz nowadays, anyhow, and scarcely a writer requested that jazz be included in the programs.

Another thing revealed in these letters was the number of people who will suddenly be moved to write in their opinion of a program after listening to the radio for years, without writing. One man, in praising a program, said that he had been an ardent radio fan for four years, and never until that night had a program made him want to write about it. Others would state it was the first time they were writing after having owned a radio for a long time.

These thousands of letters have been written in less than two years in response to "Edison Hour" which is now broadcast by WRNY, New York City.

Broadcasting An 80-Piece



THE BALTIMORE SYMPHONY ORCHESTRA, which broadcast recently from overcome so that the ensemble effect would be faithfully preserved. When an 80-piec not respond to all the tone values with equalit

Broadcasting the music of a large orchestra is a difficult acoustical problem. Often the full musical value is not achieved. Poor results are sometimes ascribed to echo in the auditorium. But if this were the cause orchestras and even choruses would sound no better to a listener present in the auditorium. Sometimes it does not sound well for this reason, but even when there is no objectionable echo the radio reception may be all but satisfactory. The sound that comes from the loud speaker seems to have no organization, but each member of the orchestra or chorus may seem to be his own leader and act independently of all the rest.

The trouble cannot arise fr because they are very much through which the sound tra origin. But the medley may the electrical devices through before it gets to the speaker proportions for different fre note may be advanced a whole one of lower frequency. But to a small fraction of a seco much worse than that. Test

Printed Pages to Fly Over Ocean on Beam

If experiments now being conducted turn out successfully, as they give every promise of doing, before the year is over trans-Atlantic communication will undergo changes undreamed of a couple of years ago. It is the successful development of beam wireless between England and Australia which leads to this statement, for in a combination of the beam wireless and the principle of photographic transmission lies the secret of a new method of facsimile transmission.

The basis of the new method is the same as that used in sending photographs. But instead of long waves the new system will employ short waves with a corresponding increase in speed. It is calculated that from one and a half to two minutes will be needed to transmit a page of 250 to 300 words.

The facsimile transmission patents are the property of the Marconi Company. The Radio Corporation of America will have the rights in the United States. In the course of time it is expected the system will be inaugurated in all countries but at first the system will be limited to transmission between London and New York.

An official of the Radio Corporation was in England recently working on new plans and it is understood that elaborate stations are to be built on Long Island in connection with the installation of the new method of trans-Atlantic communication.

SICILIAN NATIVES SKEPTICAL

On the island of Sicily the natives don't believe in radio. They have seen demonstrations but they still think the operator is playing a trick on them. This was discovered by radio manufacturers who tried to sell sets there.

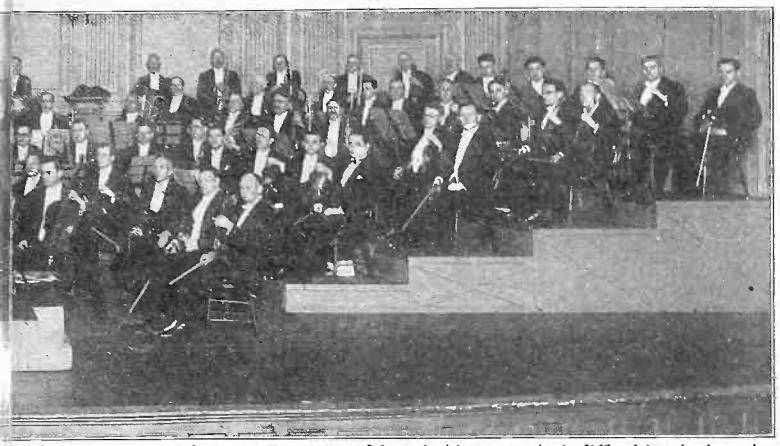
What'll they think of television?

THE MINSTREL team of WSM, the N pany's station, at Nashville, Tenn., comp the station, Joe Coombs and Tom Mooney Joe and Jack and appear every other Frida

TALKERS MUST WAT

Persons appearing before the microphc frequently non-professionals, must pay st mouth and the microphone, to avoid blastin

Orchestra a Big Problem



BAL, gave great delight to listeners, although big acoustical difficulties had to be hestra like this one broadcasts the sounds are so complex that the microphones do d ingenuity is required to make up for this.

ny inertia of the electrons, er than the air particles o a hearer in the hall of roduced by the fact that h the sound has to pass ges the phase in different es. Thus a high-pitched length in comparison with change can only amount The distortion may sound e shown that this phase change does not usually make any noticeable difference. Perhaps it does not on relatively simple sound assemblies but it may have a great effect on such complex sounds as that originating in an 80-piece orchestra.

Another place where the distortion may originate is in the diaphragms of the microphone and in the reproducer. These are not able to follow all sound with equal facility and it may be that they simply quit when they are called to execute so many contortions and vibrations at the same time.

So it is really a difficult matter to broadcast such music, yet highly creditable results ensue.

ial Life and Accident Insurance Com- of Jack Keefe, associate director of t to right). They are known as Tom, ht at 10 P. M., Eastern Standard Time.

THE MICROPHONE

particularly talkers, because they are attention to the distance between the

Baird Claims Television From London to N. Y.

John L. Baird, Scottish inventor, recently claimed in London that he has established television between London and New York. It is his intention to give with the special receiving set built for the purpose, a wireless telephone-television demonstration between London and New York.

Mr. Baird declared that for several weeks he carried on experiments between his station at Couladon and a station twenty-five miles outside New York City. A new station is being built in America by means of which Mr. Baird says it will be possible to demonstrate the practicability of his invention. Should these tests be successful, Television, Ltd., the company of which he is technical director, will place a television receiving set on the market for $150, said Baird.

1,500 Volunteer Blood To Save Life of Boy

A radio appeal for blood-giving volunteers to save the life of Sherman Winton, 7 years old, of Philadelphia, brought 1,500 immediate responses. Within a few minutes after the physician broadcast the appeal 100 men, women and children were at the doors of the hospital, ready to give their blood. Additional persons telephoned or wrote their willingness to appear at the hospital at any time.

Several of the volunteers were chosen, and the doctors said more would be selected if necessary. The boy was injured when he tripped over a toy express wagon.

BABEL IN EUROPE

The tower of Babel has lost prestige since Europe opened up with broadcasting in a dozen different languages.

CAN'T SWAT 'MIKE'

(Acme)

CALM at bat, Babe Ruth was nervous at the microphone as he said "hello" to listeners on the occasion of the microphone's fiftieth anniversary.

50th Birthday Is "Celebrated" By Microphone

Recently the microphone had its fiftieth anniversary. Going along for more than forty years without ever achieving public recognition, the microphone suddenly came to be looked upon as one of the really great inventions contributing to human happiness.

Though scientists recognized the invention as being the essential factor in telephonic transmission, the public at large knew nothing about the microphone and cared less.

On April 14, 1877, Emile Berliner, a young German immigrant, unable to speak good English, filed his application for a patent on the microphone.

The First Microphone

His first instrument, constructed from a small toy drum, a steel dress button, and a needle, had actually "talked." The microphone as it is used today is merely a refinement of the loose contact principle discovered by Berliner.

Although Berliner is also the inventor of the disc talking machine, it is the microphone that is his chief pride. And Berliner, now 75 years old, believes that the microphone, at 50, is just in its adolescence.

"Music," he declares, "is one of the finest of mental and spiritual foods. If the mind is pleasurably exercised by the harmonious vibrations of the songs, dances, rhythms, stirring marches and inspiring overtures, freer circulation, better health, greater activity and more smiles will be the result in our daily lives.

Lauds Kent

"That this is being brought about through the broadcasting of musical masterpieces by great artists there can be no doubt. Men like Atwater Kent, for instance, who have made it their aim to project good music into our homes, must be classed as benefactors. They are not merely giving pleasure to the millions who listen in; they are giving inspiration, morale and a better attitude toward life generally."

A THOUGHT FOR THE WEEK

MORE or less well attested history tells us that if Napoleon had not been suffering from a toothache he might have won at Waterloo. Don't insist your set is all wrong without careful study of the difficulty. Perhaps you have a mental toothache.

SIXTH YEAR

RADIO WORLD

Pats. Reg. U. S. Pat. Off.

The First and Only National Radio Weekly

Member, Radio Publishers Association

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

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Daily Weather Data By 18 Broadcasters

Chicago.

Eighteen stations will broadcast daily weather warnings, and other information necessary to the shipping, navigation and aviation interests in the Great Lakes Region and surrounding states, during the entire Summer, in cooperation with the Government, who will issue the reports. The stations are:

WEBC, Superior-Duluth; WHBY, Green Bay, Wis.; WHAD and WSOE, Milwaukee, Wis.; WGN, KYW, WEBH, WAAF, WHT, and WLS, Chicago; WKBX, Ludington, Mich.; WCX, WGHP, and WWJ, Detroit; WEAR, Cleveland; KDKA, Pittsburgh; WHAM, and WHEC, Rochester.

Many telegraph stations along the Great Lakes will also transmit these reports.

Esquimos in the Sub-Arctic Hear American Programs

Montreal, Canada.

Word has come by courier, overland from the western shores of Hudson Bay that the radio speech of Bishop Arsene Turquetil in Eskimo, French and English from KDKA, was heard throughout the sub-Arctic regions. A letter carried out from Chesterfield Inlet, addressed to Monseigneur Turquetil, was turned over by the latter to George A. Wendt, of the Canadian Westinghouse Company, who organized the special broadcasts to the Far North.

The courier reported that everywhere along the line of his travel the programs were received in their entirety. Four were broadcast by each of the Westinghouse stations—KDKA, Pittsburgh; KYW, Chicago; WBZ, Springfield, Mass., KFKX, Hastings, Neb. Extreme gratitude was expressed by all the inhabitants along the route, the messenger declared.

Started Three Years Ago

The special broadcasts were organized three years ago by Mr. Wendt, and transmitted through the Westinghouse radio stations. By means of them, official and personal messages have been sent to isolated residents in the Arctic regions, from the lower Bay of Hudson Bay to the tip of Ellesmereland, and from Iceland to the Yukon.

Bishop Turquetil, while in the United States in February, went to Pittsburgh especially to take part in the last program of the season from KDKA, on February 26. He addressed his Eskimo parishioners in Eskimo; his priests in French, and the great majority of the listeners in English. He is prefect apostolic of Hudson Bay in charge of the Oblate Missionaries.

"Grandfather" Talks

The Eskimo speech was the first prearranged talk ever made in Eskimo over the radio. For weeks prior to the talk, word was sent out for the Eskimos of Hudson Bay to assemble at convenient radio sets, in order to hear their "grandfather" speak to them in their native tongue. More than 600 of the Eskimos in the bishop's diocese have been christianized.

Danish Farmers Keen For More Crop Talks

As in the United States, radio is proving of distinct economic value to the farmers of Denmark, according to a mail report from E. A. Johnson, vice consul at Copenhagen, received in the Department of Commerce. The full text of the report follows:

During the past few years the Danish agricultural industry has been aided especially in its harvest work, by the radio service of the Meterological Bureau. That this service has been of value to the farmer is now brought out by the fact that important Danish farm organizations have decided to work for its extension. To this end a committee has been appointed which will cooperate with the Government Radio Control Bureau. This bureau has met the request of the farm organization with sympathy, and at the present time plans are under way for the broadcasting of special programs for the Danish farmer; at least two lectures dealing with agricultural problems will be broadcast each month, and from time to time agricultural experts will deal with seasonal agricultural matters in the same manner.

Few Sets in Athens

In Athens, Greece, the radio is almost unknown. This is due to the fact that Gen. Pangalos, dictator, lived in fear of revolution during the time he held office, and one of the measures he took to insure safety was what amounted to the prohibition of radio. He feared the news bulletins that might be sent from European stations. The only radios that were brought into Greece were those belonging to some few privileged foreigners.

DIAL RADIO FOR 'PLANES

Captain Paul A. Edwards, commanding the Signal Corps aircraft radio laboratory at McCook Field, Dayton, Ohio, has invented a device which combines the radio, a dial similar to that on the automatic telephone, and a small call board, to facilitate communication from the ground to airplanes by supplementing telegraphy with a visual signal system.

Blind Woman Extols Her Radio in Verse

The appreciation of the blind and the aged for the boom of radio is feelingly expressed in the following verse addressed to WGY of Schenectady by Miss Harriet Stone, a blind woman, aged eighty-eight, a resident of Amsterdam, N. Y.

WHO leads me from my corner small,
Shut-in and blind, and lacking all
Of strength and power to journey far
By aeroplane or motor car,
Yet carries me three thousand miles
To land of sunshine and of smiles
To hear the speech of little child
Whose accents all my heart beguiled?
My radio. My radio.

Who lures me at the midnight hour
To listen to great tests of power,
Sending our greetings oversea
To foreign ears in amity?
Who puts the keys into my hand
Of pews renowned through all the land
To hear from pulpits high enrolled
The gladdest story ever told?
My radio. My radio.

Who seats me at the banquet rare
Sans dinner dress, sans railroad fare,
To hear great words from magnates great
In after-dinner speech of state,
And hear my President's own voice
Bidding the people to rejoice
O'er shrunken taxes, prosperous times,
And World Court Treaty Congress signs?
My radio. My radio.

Players, announcers, singers fine,
Contribute to this niche of mine,
Giving to me their very best
From coast to coast, and East to West,
With far-flung echoes of the life
Across the seas, in peace or strife,
And all this through my radio,
My best beloved radio.

NORTH AMERICAN APPOINTED

The North American Radio Corporation, 1845 Broadway, New York City, has been appointed exclusive distributors of Zenith receivers and products in the counties of New York, Queens, King, Nassau and Suffolk.

Music Week To Be Opened By Broadcast

Radio is given official recognition in the world of music with the announcement by the National Music Committee that the nation-wide celebration of Music Week, beginning May 1, will be inaugurated with a radio program.

The Atwater Kent Hour, regularly broadcast from Station WEAF and eighteen connected stations at 9:15 P. M., Eastern time, has been officially selected to open the week's program, and a gala concert has been arranged for the formal opening.

World famous artists of the opera and concert stage have been obtained for this special program, the artists including Frances Alda, soprano of the Metropolitan Opera; Reinald Werrenrath, concert baritone; Mary Lewis, soprano of the Metropolitan Opera; Charles Hackett, tenor of the Chicago Civic Opera; Jeanne Gordon, contralto of the Metropolitan Opera; Paul Kochanski, violinist, and others.

The growing importance of radio in musical circles is further evidenced in a census just completed by A. Atwater Kent. Answers to a series of questions, addressed to thousands of radio listeners, showed the chief requirement of radio in the home to be the furnishing of music. While the majority of radio owners replying said they had purchased radios for amusement, one owner in five specified the reason as a desire to hear "fine music." As to the kind of program they liked best, nine out of every ten expressed a preference for music.

It is estimated that the program inaugurating national Music Week, broadcast from the usual Atwater Kent hook-up of stations, can be received by more than 60% of the receiving sets in the country. The number of receiving sets reached by the WEAF network is estimated at 3,337,000, in an area of 525,900 square miles, containing a population of 68,052,000.

* * *

KOA GIVES RIGHT O' WAY

Denver.

Music Week, Denver's eighth annual spring festival of song, will have the right of way over the air channels of KOA, the General Electric Company's station of this city, beginning May 1. Highly diversified programs of both the jazz and classical nature, will be sent out.

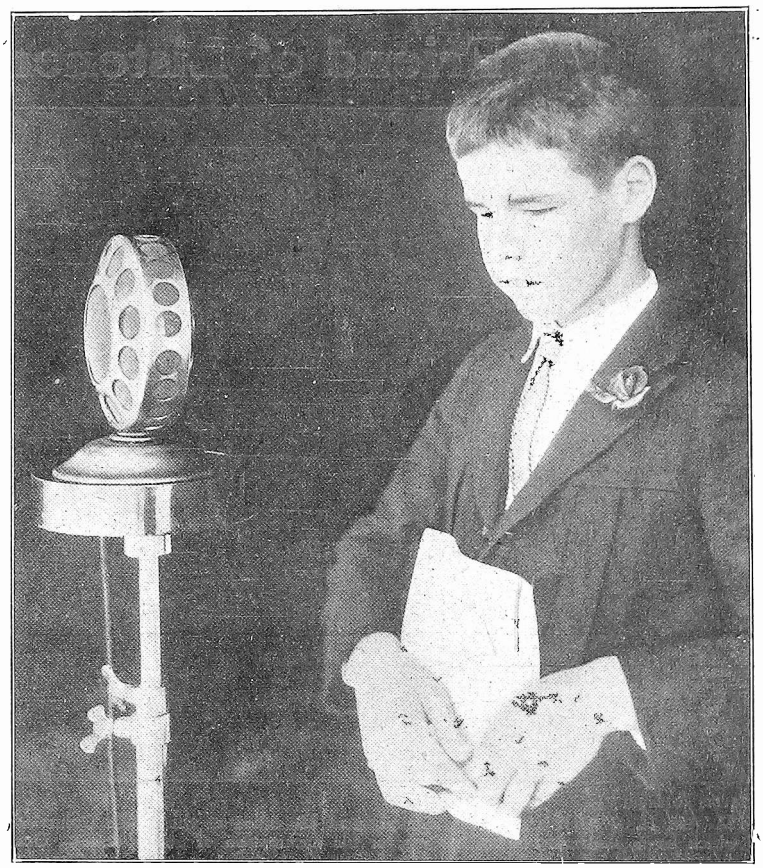
COOLIDGE ASKS ADVICE

Washington.

President Coolidge recently sent a letter to Secretary Hoover, requesting advice on the duties imposed on the President under the recent radio act, as to the assignment of frequencies to government-operated stations, such as those of the Army and Navy.

The letter has been given to Stephen Davis, who is solicitor of the Department of Commerce and also chairman of the Interdepartment Radio Advisory Committee, who with the aid of the Committee, will advise the President shortly.

BLIND BOY ANNOUNCER



(International Newsreel)

RONNIE MATTHEWS, 12-year-old blind announcer of CNRV, the powerful Vancouver station of the Canadian National Railways, uses specially printed Braille type sheets to read announcements. Not only does he announce, but fills in gaps by entertaining at the piano.

"Radio Power Control Near"—Alexanderson

Speaking before members of the Sigma Xi Society at their annual dinner at the Hotel Astor, Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company and of the Radio Corporation of America, declared that the knowledge and entertainment obtained from the radio at present are only a fraction of the value which new discoveries in radio will bring. He predicted control of power by radio, succeeding the massive machines now required to do this work, was just a short step ahead.

"The electric power industry cannot remain much longer untouched by the discoveries of radio," he said. "It is just waiting until this new knowledge has been widened and matured, so that it can be put into use on a wider scale, and this is the real significance of the entrance of the electrical industry into radio—and the latest branch of it, television."

WBAL ON BLUE CHAIN

Speaking before members of the Advertising Club of Baltimore at a luncheon, Frank A. Arnold, the National Broadcasting Company's director of development, announced that WBAL, owned and operated by the Consolidated Gas and Electric Company of Baltimore, Md., which operates on a wavelength of 246 meters, joined the N. B. C.'s Blue Network. WJZ of New York, WBZ-WBZA of Springfield-Boston, KDKA of Pittsburgh and KYW of Chicago constitute the Blue Network.

Chain Programs Aid Artists to Success

Network broadcating of radio programs is enabling young musicians to short-cut their way to success, according to Miss Grace Towne, of the National Broadcasting Company, which owns and operates radio station WEAF of New York, Manages WJZ, New York, WRC, Washington and KFKX, Hastings, Neb., and in addition furnishes program features on regular schedule to three separate networks of broadcasting stations located in all parts of the United States.

Miss Towne, who is director of the field division of the broadcasting company's artist's bureau, expressed this opinion in an address before the National Federation of Music Clubs' Convention in Chicago.

Wired Wireless Aims To Serve the Big City

After having successfully operated wired radio lines in Staten Island, N. Y. City, for the past year, for which service $1 and $2 a year is charged, the Wired Radio Co., a subsidiary of the North American Corp., 60 Broadway, N. Y. City, which has access to the light and power lines in many communities, will attempt to bring wired radio into New York this fall.

Three types of programs are sent over the lines at the same time, they being classified as vocal, instrumental and talks. Either earphone or loud speaker reception may be had.

Bullard Takes Reins As Friend of Listeners

(Harris & Ewing)

WILLIAM H. G. BULLARD, photographed at his office at the Radio Commission, of which he is chairman, immediately after his assumption of active duties. One of his first pieces of information was obtained from the installation he operated—and that was the present condition of the airway.

Back From Orient, Chairman of Radio Commission Assumes Duties and Puts Public Interest Before Welfare of 732 Broadcasters

Washington.

William H. G. Bullard, chairman of the Federal Radio Commission, in an oral statement on his arrival from the Orient, said he was more concerned with the radio listener, particularly the "far-away" listener and the "shut-in," than with the 732 broadcasting stations seeking licenses to operate under the Radio Act of 1927. Mr. Bullard said he would always oppose imposition of any kind of listening tax on the American radio public.

"My guiding policy," he said, "will be the interest of the listener. I care less about the man who makes the music than the man who hears it. Radio is a tremendous thing, and I cannot say just now how we can solve this problem of a large number of stations, a few wave channels to divide among them and a highly-irked public waiting for the present interference conditions to clear up.

Public Interest First

"I can say that the Commission in my absence seems to have taken some very wise steps toward approaching the problem. I am not thoroughly acquainted with the whole situation as yet, but within a few days I feel confident we will begin functioning as a unit. Certainly the listening public may rest assured that all of our decisions will be predicated upon its interests."

Mr. Bullard, former Chief of Naval Communications, who was retired from the Navy in 1921, came to Washington directly from San Francisco, where he arrived from Shanghai. In China and in the Philippines he has been engaged in civilian activities pertaining to radio, one of his recent connections having been with the construction of KZRM, a program broadcasting station operated by the Radio Corporation of the Philippines at Manila and built with the former equipment of WGY, Schenectady, N. Y.

Took Oath at Shanghai

While visiting his son, a naval officer stationed at Shanghai, Mr. Bullard received word from Washington in March that he had been appointed and confirmed for the six-year term and as chairman of the Federal Radio Commission. He said that he had at once taken the oath of office before Consul General Gauss, at Shanghai, and immediately proceeded back to the United States.

One Station in China

Mr. Bullard said that China today has one broadcasting station, operated by an American in the international settlement at Shanghai. Several more stations are contemplated, one at Mukden and another at Harbin, as well as a project at Peking, but at present the importation of radio equipment is proscribed in China, he said.

"China is the only country of any prominence," Mr. Bullard said, "which has practically no radio broadcasting facilities. Radio sets are classed as munitions of war and therefore contraband in China, just as guns might be contraband. The reason is that the war lords think there is something suspicious about radio, that it is used by their enemies."

Pickard Gets High Praises From Bellows

Commissioner Henry A. Bellows paid the following tribute to Sam Pickard, newly appointed secretary of the Radio Commission:

The Commission is fortunate in having the services at this formative period of Sam Pickard, Chief of the Radio Service of the Department of Agriculture, who is now its Secretary.

Mr. Pickard is one of the outstanding figures in the radio world, because of his pioneer work, especially among the farmers of the middle West. It was he, while extension editor at Kansas State Agricultural College, who conceived the idea of making the radio of real educational service to the people living in rural districts.

Gets College Station

Through his efforts the college station, KSAC, was installed in 1923, and a comprehensive educational program, designed primarily to help farmers solve their many problems, inaugurated. Prior to that time farmers had to a large extent looked upon the radio as a plaything devoted chiefly to pastimes and light amusements.

Soon after Mr. Pickard started his wise venture farmers generally in that section of the country began to manifest keen interest in the valuable information concerning crops, etc., he so freely dispensed and groups would gather at homes where sets were located to "listen in." Most of the farmers soon concluded that it was to their distinct advantage to own their own radio equipment.

Better All the Time

All the time Mr. Pickard was improving his programs, adding more useful information and as a climax he arranged for a university extension course for farmers. Thousands completed the course, and expressed their appreciation of the benefits they had received.

Mr. Pickard also provided instructive and helpful programs for the housewives which were broadcast during the morning hours.

Thus this aggresive young man solved the problems of many stations in outlying districts which had been complaining of the lack of an audience, when he demonstrated people will "listen in" if they are supplied with worth while educational programs which appeal to their tastes and inclinations.

A Trail Blazer

Mr. Pickard blazed the trail, which many colleges have followed in supplying the radio audience with useful and helpful information dramatized in a vivid, interesting style. He also proved himself an expert in the art of adapting all types of education subject to radio presentation.

William M. Jardine, Secretary of Agriculture, formerly President of the Kansas State Agricultural College, was so impressed with the results obtained by Mr. Pickard that he brought him to Washington and placed him at the head of the Radio Service of the Department of Agriculture, where he has continued to render valuable service to the farmers through daily broadcasts from approximately 100 stations.

World War Veteran

Mr. Pickard is a veteran of the World War, in which he did more than his "bit." He served as a pilot in the Air Service with the rank of Lieutenant and was wounded in aerial combat at the front.

N. Y. and Chicago Stations To Be Separated By 50 kc

Locals Must Be That Far Apart, While No Two Stations in the Separate Cities May Be Nearer Than 20 kc, to Stop Interference

The elimination of station interference in New York and Chicago, by making local stations in those cities use frequencies that are 50 kilocycles apart, and requiring that New York and Chicago stations be no nearer than 20 cycles to one another, was decided on by the Federal Radio Commission.

In other air-congested localities similar remedies will be applied.

This is part of the general plan to restore the air to the condition of two years ago when it was easily possible to separate local stations, tune in distance through locals and encounter no whistles, so prevalent today due to heterodyning of one station's wave with that of another station.

Good Separation

In New York, for instance, all stations would therefore be separated in frequency just as much as WJZ is now separated from WEAF. Almost all sets can tune in one of these two stations and get no background of reception from the other.

Considerable shifting of wavelengths will be necessary to carry out the Commission's plan, and this will be accomplished by imposing the requirements in the issue of licenses. At present stations are operating on temporary permits, all licenses under the 1912 law having been revoked by the new radio statute.

Also many stations, now operating on an "exclusive" wave, will have to share time on the air.

Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America, said that the ruling would mean a return to conditions as they had been several years ago. He added:

"The ruling of the Attorney General in July, 1926, that the Secretary of Commerce had no discretionary power in assigning wavelengths came like a bolt out of the blue and shattered the previous orderly arrangement.

"The resulting disorder could be classified under four headings: Stations that were closer than fifty kilocycles to their nearest neighbor, stations that were closer than twenty kilocycles to distant stations, stations operating in the Canadian wave band and stations operating on odd frequencies.

Follows Conference Ideas

"The previous regulations had been in accordance with the recommendations of the second, third and fourth national radio conferences called by Secretary Hoover.

"Apparently, the commission is placing great weight on those recommendations and believes that they were arrived at in a democratic way by intelligent cooperation. The commission first took up the question of infringement of Canadian stations and eliminated that. Next, hybrid wavelengths were barred by refusal to issue licenses. Now, apparently, the commission is undertaking to remedy the evils under the first and second classes."

129 Shiftless Stations Do Some Tall Shifting

Broadcasters Who Used Frequencies Not Within the Decimal System Get Authorized Waves—Power Cut, Too—Interference Lessened

Washington.

The Radio Commission ordered 129 stations, operating on frequencies outside the authorized scale, to shift to approved frequencies. Commissioner Bellows said:

"When the new law went into effect there were 129 broadcasting stations operating on frequencies outside of the regularly authorized scale. Originally, licenses were issued by the Department of Commerce to use frequencies on a decimal basis, thereby maintaining the necessary separation of 10 kilocycles between frequencies.

"After July 1, 1926, however, a considerable number of stations selected intermediate frequencies, realizing that the Department of Commerce had no power to prevent such action. Each station thus operating has created interference on three different wave lengths—on the one on which it is actually operated, and on the nearest regular wavelengths above and below.

Interference Eliminated

"As no temporary permits are being issued for these intermediate frequencies, and as the Federal Supervisors are being instructed to watch carefully for any violation of the terms of these permits all of the 129 stations which have been creating interference on two wavelengths besides their own will be operating on frequencies where they will create interference only with other stations on the same wavelength.

"In many cases it has not been found practicable, on account of interference, to move the stations to the nearest authorized frequency, and accordingly many of them have been assigned to frequencies in less congested parts of the broadcasting band.

Power Reduced, Too

"Furthermore, the temporary permits state the maximum permissible power, and in a number of cases, particularly where stations are located in congested residential districts, this maximum power is being materially cut down in the interests of the listening public.

"Thus, although the temporary permits do not represent any complete attempt to solve the broadcasting problem, which will begin with the issuing of short time licenses as soon as possible after April 24, the Commission believes that these temporary permits will in themselves bring about a certain amount of immediate and very desirable relief to the radio listeners of the entire country."

Bloom Says Cities Can Suppress Slander

In a letter to Mayor Walker of New York City, Representative Sol Bloom, of New York, urged the passage of an ordinance by the city whereby the Mayor or the Police Department would be vested with the power to regulate broadcasting by all stations within the city's jurisdiction.

Mr. Bloom's letter was written after he had received numerous protests and complaints concerning alleged "vicious, slanderous, and trouble-breeding broadcasting by Station WHAP, New York City, together with many queries as to whether a method could not be found to prevent these mischevious public utterances."

According to Bloom, the recently enacted Federal Radio Law contains no remedy for such a situation.

"Prevention of the radio broadcasting of false and defamatory statements concerning any individual, firm, company, race, nationality, political party or any group, body or association of individuals is thus left entirely to local authority," he declared. "It seems to me that it is not only within the province, but that it is the duty of municipal government of the City of New York, not indeed to undertake any abridgment of the right of free speech, but to prevent the abuse of this right by any radio station broadcasting under its jurisdiction. That objectionable broadcasts from elsewhere may be accessible to New York City listeners is entirely beside the point."

The commission in an announcement held the contention of Representative Bloom.

"A Federal license simply means that the radio station has the permission of the Federal government to broadcast," Commissioner Bellows said on behalf of the commission.

"If, however, a city in the exercise of its police power for good cause kicks out a Federally licensed radio station it might have our sympathy, but there is nothing we could do for it.

"No Federal law can interfere with local police power. But regulatory radio legislation by states or municipalities must not come into direct conflict with the Federal law, for in that case the Federal law would prevail."

Listeners Cast Ballots For Fewer Stations

Washington.

An almost unanimous vote of 25,000 listeners who communicated their views to the Federal Radio Commission called for a reduction in the number of broadcasting stations. A majority of the listeners asked that the broadcasting band be widened. Less than half of them asked for a division of time. Practically all of them asked that the present frequency separation between stations be maintained or else increased. A small percentage asked that the power of stations be decreased.

Many of the suggestions offered in the letters were similar to those brought out during the hearings of the Commission. Others proposed schemes for reducing interference which are considered impractical. On the whole, the letters indicated a tremendous dissatisfaction with existing conditions and an expectation that it would not take the Commission long to straighten things out.

Most of the letters indicated that their authors were fond of "fishing" for distant stations. This fact is being considered by the commission.

FOUR USE SHORT WAVES

Four radio stations now are broadcasting on wavelengths below 150 meters in addition to their regular channels. These are WLW, WGY, KDKA and WRNY.

Radio University

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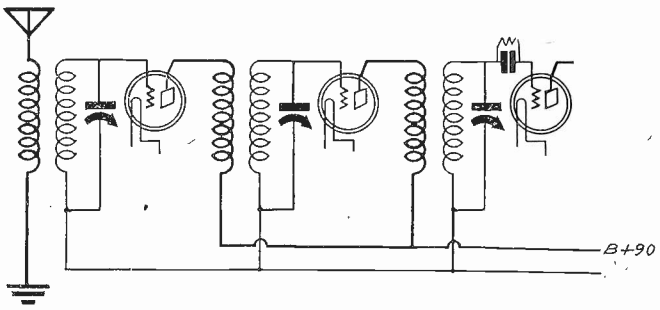

FIG. 531

The circuit diagram of the radio frequency and detector portion of a set, wired for the —01A tubes as RF amplifiers and an —00A tube as a detector, as sent in by William Burley.

IN THE April 16 issue on page 5 there appeared an interesting description of a one-tube regenerative receiver by Wally Frost. I am going to build this set, but before doing so, there are a few questions that I would like to ask. Can a .00035 mfd. variable condenser be used for C2? What capacity condenser is C3? What type variable grid leak is best for this set? What is the best value for the fixed leak? So as to have the tube regenerate properly, what capacity should C4 have? Is regeneration necessary? What tubes will give best results? Please state the proper rhoestats to use, if either the storage battery or the —99 type tube is employed. What plate voltage should be applied for best results? What type batteries can be used, if the —99 type tubes are employed?—Gerald Malcolm, Chicago, Ill.

* * *

A .00035 mfd. capacity may be employed provided that the tuning coil is adjusted for this size, by adding 10 turns to the secondary (total 53 turns). The same size form and wire is used.

The grid condenser C3 is .00025 mfd. or smaller and should be of the mica dielectric type. The value of the grid leak depends somewhat on the tube that is used, and a variable leak, like the Bretwood De Luxe model, can be used to good advantage in case different tubes are to be tried. If a fixed value is used it should be about 2 megohms.

The condenser C4 should be from .0005 to .001 mfd. Its use is necessary if the tube is to regenerate properly. Regeneration is necessary if satisfactory selectivity and adequate volume are to be expected.

The choice of tube depends largely on whether the builder is willing to invest in a storage battery or if he is limited to dry cell operation. With storage battery operation he has the choice between the —00A and the —01A. Both are excellent tubes for use as regenerative detectors. The —01A is also a good amplifier but the —00 is more sensitive as a detector.

For dry cell operation the builder has the choice between the —12 and the —99. The latter is recommended because of its lower filament power requirements.

If the storage battery type of tube is used the rheostat R2 should be of 10 or 20 ohms. If the —99 is used the rheostat should be 50 or 60 ohms.

For headset operation it is not necessary to use more than 45 volts on the plate. This applies to all the different tubes above. But a higher voltage may be used if desired, though it should not exceed 90 volts. Since only one tube is involved it is not necessary to use very large battery units. Those ordinarily called small will suffice.

If the —99 type tube is used two 4½-volt dry cells may be used to heat the filament. The connection is to join the two minus posts to each other and the two plus posts to each other. The wire leads to the set go from the common plus and minus of these batteries.

* * *

I HAVE three tuned radio frequency transformers containing twelve-turn primaries and forty-seven-turn secondaries. Each primary and secondary is wound on a three-inch diameter hard rubber tubing. There is a small space, say ¼-inch, between the two windings the wire used seems to be of the No. 24 double cotton covered type. I would like to use these coils in a receiver containing two stages of tuned radio frequency amplification, a non-regenerative detector, and a special audio amplifier which I have in unit form. Now I have the enclosed circuit diagram of the radio frequency and detector circuits.

(1)—Will you please tell me, if the grid returns are for the —01A tubes in the RF circuit and for the —00A tubes in the detector circuit? That is, does the unmarked lead go to the minus A post?

(2)—What is the capacity of the variable condensers shunted across the secondaries of the coils I have?

(3)—Is the output taken from the plate post of the detector post, as well as the B voltage applied to this tube?

(4)—I intend using a ten-ohm rheostat for filament control of the two radio tubes, and a twenty-ohm rheostat for filament control of the detector tube. Is this all right?

(5)—Are the rotary plates of the variable condensers connected to the terminal of the coils that adjoin the end of the primary windings?

(6)—Are ninety volts too much for the plates of the radio frequency tubes?—William Burley, Cincinnati, O.

(1)—Yes.

(2)—These condensers should have a capacity of .0005 mfd.

(3, 4 and 5)—Yes.

(6)—In most cases, yes. Try 67½ volts. Use 1½-volt bias.

* * *

ABOUT TWO months ago I built a five-tube receiver that consisted of two stages of tuned radio frequency amplification, a crystal detector (using an untuned radio frequency transformer for detector coupling) and three stages of resistance coupled audio frequency amplification. The results are good. The tuning is a bit broad. Could I cure this by adding regeneration to the second stage of radio frequency amplification? The secondary winding of the coil used in this circuit contains fifty turns wound on a two-and-seven-eighths-inch diameter tubing using No. 22 double cotton covered wire.

(2)—If I can add regeneration I would like to use a one-and-three-quarter-inch diameter tubing and No. 26 single silk covered wire. Using these, how many turns are necessary for a tickler?

(3)—I now have a common B lead for the plates of the RF tubes. Should I connect the plate of these RF tubes to separate B posts if I use this regenerative feature?

(4)—Should I insert a separate rheostat also? How many ohms?—Thomas Josephs, Atlantic City, N. J.

(1)—Yes.

(2)—Thirty-seven.

(3 and 4)—Yes to both. Use a twenty-ohm rheostat.

* * *

I HAVE a three-tube receiver, built along the same lines as the Crosley Trirdyn, described in the August 21 issue of RADIO WORLD, Radio University columns, with which I would get very good results. A stage of transformer audio frequency coupling is now used.

(1)—I would like to substitute this stage with a three-stage resistance amplifier unit. Could this be done? (2) Are the connections on the input the same as for the transformer?—E. Frank, N. Y. City, N. Y.

(1 and 2)—Yes.

* * *

ABOUT SIX months ago, I built a three-tube receiver employing a regenerative detector and two stages of transformer coupled audio. The Hartley system is used in the detector. I would like to add a stage of tuned radio frequency amplification. Could this be done? The primary of the coil consists of fifteen turns. The secondary consists of sixty-two turns. Both are wound on a two and one half inch diameter tubing, each winding being separated one quarter of an inch. No. 22 double cotton wire is used. The secondary winding is tapped at the thirty-first turn. This terminal is brought to the plus A post. A .0005 mfd. variable condenser is shunted across the entire secondary winding.

(2)—Is it necessary to control the filament with a rheostat, or could an automatic ballast resistor be used?—Karl Ruchert, Oakland, Calif.

(1)—Yes. Wind a fifteen turn primary and sixty-two secondary on a two and one half inch diameter tubing, separating them one quarter inch, using No. 22 double cotton covered wire. The winding should not be tapped. This winding should be shunted by a .0005 mfd. variable condenser.

(2)—You can use an automatic ballast resistor.

* * *

I READ with interest the article by Asa Schenk in the March 19 issue of Radio World, which told how to use a tube base as a means of connecting any type audio amplifier to the first portion of your receiver, which you don't wish to change. I would like to construct the circuit diagrammed, which appears to consist of a step of tuned radio frequency amplification and a regenerative detector. Please give the necessary coil, condenser and tube data, etc.—Wallace Urving, Houston, Tex.

The heavy lines in the antenna circuit represent the primary winding, which consists of ten turns. The lighter lines in grid circuit of the first tube, (RF amplifier), represent the secondary winding, which consists of forty-five turns. Both are wound on a three inch diameter tubing, using No. 22 double cotton covered wire. The primary winding in the plate circuit of this tube, represented by the heavy lines, consists of ten turns. The secondary of this coil, represented by the lighter lines, consists of forty-five turns. No. 22 double cotton covered wire is also used. Allow a one-quarter inch space between the primary and secondary windings on both coils. The tickler, which is

represented by heavy lines in the plate circuit of the second tube (detector), consists of thirty-six turns, wound on a one and three quarter inch diameter tubing, using No. 26 single silk covered wire. Across the secondary windings of the radio frequency coil and the tuner, .0005 mfd. variable condensers are shunted. A twenty ohm rheostat is used to control the filament of the RF tube, while the filament of the detector tube is controlled by an automatic filament control, passing one quarter ampere. In series with the grid post of the detector socket, a .00025 mfd. fixed condenser and 2 megohm grid leak is placed. Should you wish to use a long antenna, the antenna is connected to the post, connected to the .0001 mfd. fixed condenser. The tap is made at the tenth turn of the secondary winding. For a standard length antenna, connect to the primary. Optional B plus, means that you can either place a separate B voltage on the detector plate and on the RF plate or a common one. Use —01A tubes.

* * *

A CHUM of mine recently gave me a four-tube receiver. The set works very well on the locals, but fifty miles is the greatest distance that I can cover. One tuned stage of radio frequency amplification, a non-regenerative detector and two stages of transformer coupled audio frequency amplifications are used. Could I add another stage of tuned radio frequency amplification so as to increase its DX range?

(2)—The primaries of the coils consist of ten turns. The secondaries consist of eighty-two turns. Each coil is wound on a two-and-one-half-inch diameter tubing with No. 22 double cotton covered wire. An eighth-inch separates the primary and secondary windings on each tubing. If it is advisable to add the extra stage, how should the coil to be used here, be constructed?

(3)—Should the filament of the tube be controlled by a rheostat? The other RF and detector tubes are so controlled, fifteen ohm types being used.

(4)—Should a separate B voltage be applied to the plate of this new RF tube, or should the voltage be common with that of the other RF tube?—Alexander Burwon, Jersey City, N. J.

(1)—Yes, this will increase the range greatly.

(2)—Use a two-and-one-half-inch diameter tubing. Wind ten turns to constitute the primary and eighty-two turns to constitute the secondary. Space them one-eighth inch.

(3)—Yes. Use a fifteen ohm type.

(4)—No. You can apply a common B voltage to the plates of both RF tubes.

* * *

WE HAVE a five-tube tuned radio frequency receiver. The set works fine until we come to the lower wavelengths where it oscillates beyond control. The signals are very loud. The primaries contain sixteen turns and are wound right over the secondaries. Could I cure this over-oscillating trouble if I reduced the primaries and spaced them also? How much reduction and space is suggested?—Kenneth LeMart, Baton Rouge, La.

Take six turns off the primaries, and space the primaries at least one-quarter inch from the secondaries.

* * *

I HAVE a 4-tube Browning-Drake receiver transformer coupled, using one 199 and three 301As, National condenser and coils. I wish to improve on the audio side. I am interested in the Browning-Drake set described by Herman Bernard in the August 14, 1926, issue, using one stage of transformer and two of resistance.

(1) Do you think the improvement will be worth the spending of a few dollars?

(2) Can I use a Sangamo condenser .01 mfd. condenser for blocking?

HARRY ERICKSON.

(1) Yes. (2) Yes.

* * *

I am a reader of RADIO WORLD and take the opportunity of asking you a question or two. I have a National 5-tube Browning-Drake set, using resistance coupled amplification. I also use a B eliminator, with detector, 90 and 135 volt posts. I am also using one UX199, three UX201As, and one UX112 in the last stage. I do not get very good results, for when I increase volume I get motorboating. I use no C battery and control power tube with 6-ohm rheostat. My aerial and ground are O. K. Please tell me what I can do to avoid this interference.

WM. ROBERTSON.

You must use a C battery with a 112. Use 6 volts bias for the 135-volt plate. Up to nine may be used. Using 90 volts on the first two audio stages, use 3 volts of C battery. Use a 1.0 meg. resistor in the detector plate circuit.

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Good Back Numbers of RADIO WORLD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Feb. 19—The 6-Tube Victoreen, by Herman Bernard, (Part 1.) The Big Six Receiver, by Wentworth Wood. "B" Eliminator Problem, by Wm. P. Lear. The Phasatrol Circuit, by Capt. P. V. O'Rourke. The 6-Tube Victoreen, by Herman Bernard (Part 2) conclusion.

Feb. 26—The 5-tube Diamond in a Phonograph, by Hood Astrahan. How To Read Curves, by John F. Rider. Proper Tubes for 5-Valve Receiver, by J. E. Anderson.

Mar. 5—Introduction of 4-tube Universal, by Herman Bernard. Discussion on DX, by Capt. P. V. O'Rourke. Sensible Volume Control, by Chas. Gribben.

Mar. 12—Ten Tell-Tale Points, by J. E. Anderson. How To Figure Resistors, by Frank Logan. The 4-tube Universal, by Herman Bernard, (Part 1.)

Mar. 19—Psycho-Analyzing Circuits, by Thomas L. McKay. The Universal, by Herman Bernard (Part 2). How to Use a Wave Trap, by James H. Carroll.

Mar. 26—The Universal, by Herman Bernard, (Part 3). Flow of Current in a Vacuum Tube, by Radcliffe Parker. Broadcasting Hypnotism.

April 2—Facts Every Experimenter Should Know, by J. E. Anderson. A Ship Model Speaker, by Herbert E. Hayden. The 3-tube Compact, by Jasper Henry. The Nine-in-Line Receiver, by Lewis Rand (Part 1.)

April 9—A 5-tube Shielded Set, by Herbert E. Hayden. The Power Compact, by Lewis Winner. The Nine-in-Line Receiver, by Lewis Rand, (Part 2.)

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Fans can now procure these condensers at any good dealer's and a circular giving full details on these and other Hammarlund products may be had from the Hammarlund Manufacturing Co., Inc., 424 West 33rd Street, New York City.—J. H. C.

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Sternfield-Godley Agency Expands

Sternfield-Godley, Inc., Advertising agents, are moving from the Tribune Building 154 Nassau Street, New York City, to larger and more modern offices in the new Park-Murray Building at 9 to 15 Park Place. They will be settled here after May 1 on the 11th floor and their quarters will be the last word in modern advertising efficiency.

Sternfield-Godley was one of the first agencies to pioneer in radio, in which field they have made a great success, being noted as one of the foremost result producers for their clients. They are also noted for their success in the retail radio field, handling some of the largest radio retail accounts in New York City. With a new and enlarged art department they will be able to give their clients the finest kind of art, cut work, photography and every other aid to productive advertising.

Two Companies Unite

The Heymsfield Laboratory, with shop formerly located at 683 Wales Ave., Bronx, N. Y. City, and executive offices at 165 East 105th St., N. Y. City, has joined forces with the Eisner Electric Company, which will be located at 1979 Jerome Ave., Bronx, N. Y. City.

For the past two years the Heymsfield Laboratory has been manufacturing console model receivers.

THE 5-TUBE DIAMOND

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

100 Million Is Mu of New Knowles Tube

Most Sensitive Valve May Be Used for Relay Control In Radio and Other Electrical Circuits and for Alarms

By James H. Carroll

Associate, Institute of Radio Engineers

A new electrical wonder is a device invented by an American, D. D. Knowles, twenty-eight years old, a research engineer on the staff of the Westinghouse Electric and Manufacturing Company. In appearance similar to a radio tube, this device is said to be so sensitive that the shadow of a butterfly or the footstep of a grasshopper on connected wires would stop the Twentieth Century Express going at full speed. When properly connected up with the proper apparatus, an ocean liner may be manoeuvred by a shadow falling across the tube, or the entire electrical system of a great city may be turned on when a hand is held close to it.

This new tube is said to amplify the current sent through it 100,000,000 times and the power required to start it is only about one-billionth of a watt, or approximately one-fortieth the energy expended by the house-fly crawling along a plane surface. The uses to which this new tube may be put are incalculable and it may be that it will find some wonderful and practical use in radio or in the newly developing television.

Most Sensitive

According to experts who witnessed a recent demonstration given to scientists and newspapermen, this tube is the most sensitive device of its kind ever invented. The demonstration showed the first practical use of the tube as a sort of super-burglar-alarm. No actual contact with the object safeguarded was necessary to set off an alarm, the approach of a person or the projection of a hand in proximity being sufficient to operate the tube and set off the alarm.

At a glance, the Knowles tubes greatly resembles the radio tube as we know it, having an anode, a cathode and a grid. However, it has no filament and the connections of the anode and the cathode are the reverse of the radio tube, the grid is merely a piece of heavy wire and the tube is filled with a rare gas similar to neon or argon.

According to Mr. Knowles, the tube is a relay, that is, it is operated by a small current and controls a much larger one. The ordinary relays in current usage in electrical engineering have an amplifying power of about 10,000, which means that they can control a current 10,000 times greater than the current controlling them, and he claims that the Knowles tube has an amplifying power of 100,000,000 and that it is probably by far the most sensitive device of its kind ever produced.

Simple to Construct

It is claimed that the operating speed is but 1-120th of a second on an ordinary 60-cycle alternating current and it can be operated continuously for several years before depreciation sets in. Being very simple in construction, it therefore can be manufactured in quantities at a small cost. The device is the result of two years of experimentation and research on the part of Mr. Knowles.

Its chief application so far would seem to be in electrical engineering where the tendency lies in the direction of automatic, semi-automatic and supervisory control for electrical circuits and for this purpose relays of every description are needed.

INTERESTING FACTS

It is often said that in resistance coupling the effective plate voltage on the tubes is very low. That is a fact. There is a considerable voltage drop in the plate coupling resistor and this voltage is not effective in driving electrons around the circuit. But what of it? The function of the tube and the associated coupling device is to amplify alternating voltages. The function is not to maintain a high effective potential on the plate. If the amplifier amplifies better, that is with a greater step-up and less distortion, with a high coupling resistance and a very low effective plate voltage, is not that to be preferred to a poor step-up and much distortion, which is the inevitable result when a high effective plate voltage is obtained by using a low coupling resistor? Of course it is. Let us not worry so much about low effective plate voltage. It does not mean a thing, except that a high step-up can be obtained with a low rate of consumption of plate current.

We hear much about harmonics in radio work, such as the second harmonic and higher harmonics. It is nearly always in connection with distortion. What is a harmonic? In mathematics the term is used for many kinds of functions, but in radio we are interested only in simple harmonics. The movement of a piston which is actuated by a crank is simple harmonic motion. Sound waves and pure radio waves are simple harmonic. It simply means that the force and the resultant motion or effect rise and fall at a certain rate, first in one direction and then in the other. This rising and falling occurs at a certain number of times per second. That number is the frequency of the simple harmonic motion.

Suppose that the frequency of the motion is 10 per second. There may be other simple harmonic motions present at the same time as the one that has a frequency of 10 per second. Suppose there are some which have frequencies which are exact multiples of the 10-cycle motion. These may have frequencies of 20, 30, 40, and so on. The first in the series, or the 10-cycle motion, is called the fundamental. It is also the first harmonic. The 20, 30 and 40-cycle frequencies are the second, third and fourth harmonics, respectively, of the fundamental.

The frequency separation between two consecutive harmonics is always equal to the fundamental frequency. It makes no difference which two harmonics are chosen. For example, if the fundamental is 100 cycles, the fortieth and forty-first harmonics are 4,000 and 4,100. The difference is 100 cycles.

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It is generally held that the pitch of a sound which contains many harmonics including the first is determined by the fundamental. Recent work has shown that the fundamental can be eliminated, leaving only the harmonics of higher order, and yet the pitch is the same. That is, it is still the pitch of the fundamental. It, therefore, appears that the pitch is determined by the difference between the harmonics, rather than by the first or fundamental. When the fundamental is missing, the ear recreates it, or detects it. This process of detection is similar to grid bias detection in a tube.

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If one frequency is twice as great as another, the interval between them is one octave, or one is an octave higher than the other. Thus the second harmonic is an octave higher than the fundamental. The fourth harmonic is one octave higher than the second, and therefore the fourth harmonic is two octaves higher than the fundamental.