JULY 30
1927

RADIO WORLD

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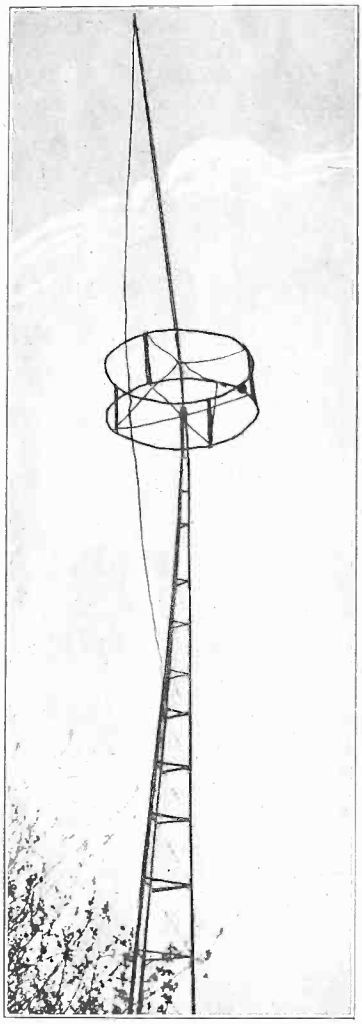
15 CENTS

America's First and Only National Radio Weekly



An aerial constructed in Germany by Hans Wenskus, a former German aviator, out of parts of the fuselage of an old American airplane. (U. & U.)

THE ALL-IN-ONE

A Five-Tube Receiver and An ABC Supply Built into a Regular Cabinet, with a Shield Between the Two.

SHIELDED MELO-HEALD

This Popular Super-Heterodyne, Embodying Eleven Tubes, is Shown with Shields That Add to Stability. A Most Attractive Get-Up.

CURING SPEAKER RATTLES

These Nuisances Are Caused Chiefly by Sectional Vibration and Sometimes Present a Knotty Problem Indeed.

MOTORBOATING DEFINED

Some Persons Still Think It Isn't Oscillation, But J. E. Anderson Explains Why the Two Are the Same Thing Indeed.

SIXTH YEAR

Vol. XI
No. 19

Whole No. 279
July 30, 1927
15c Per Copy. $6.00 Per Year

RADIO WORLD

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

Phones: BRYant 0558 and 0559

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March, 1879]

The All-in-One Set

Receiver and Power Supply in 7 x 21" Cabinet

By Robert Frank Goodwin and Stuart S. Bruno

Consulting Engineers

THE set we are about to describe consists of two stages of radio frequency amplification, detector, two stages of audio and complete power supply for the receiver. Everything is contained in a cabinet 7 by 21 by 12 inches deep.

Glancing at the diagram you will notice that the detector and radio frequency stages are tuned with individual variable condensers. The condensers must be of a reliable make and of very solid construction. Their capacity must be .00035 mfd. The coils are of the binocular type using the Lovejoy winding.

Regeneration is very easily controlled by inserting a 100,000-ohm heavy duty variable resistance in series with the battery lead going to the plates of the RF tubes. This need not be varied on the higher wavelengths, since you will notice that regeneration is only present on the lower waves. The variable resistor will also serve admirably well as a volume control.

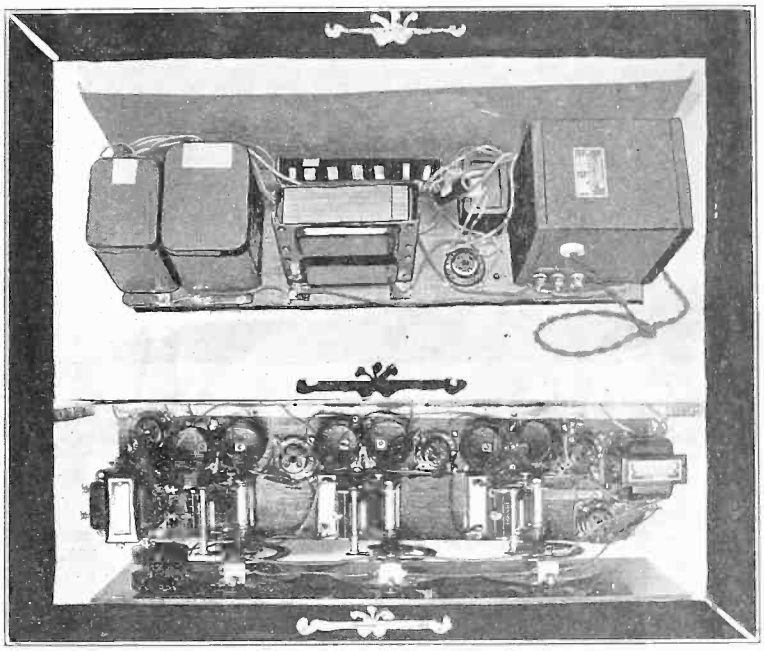
Fixed Resistor Supply Bias

There is a four-ohm fixed resistance in each negative filament lead of the RF tubes. These are made by the De Jur Products Co. and are about one-inch long. Their current carrying capacity is one-quarter ampere. These resistances furnish a negative bias of one volt to the grid of each RF tube. The grid return of each RF tube is brought to the negative end of the A battery, not negative filament. The grid return of the detector is brought to the positive end of the filament. This makes the detector portion non-regenerative and allows for greater stability. The bias of four volts to the grid of the first audio tube is obtained from the drop across the resistance in the negative filament lead of this tube. The tube in this stage is the 301A or 201A, while in the last stage use a 371 or 171 power tube. The filament of the power tube is supplied by the power transformer and the grid bias is taken from the drop across one of the resistances in the supply unit.

While we advise against it, the fan may use a 3201A or 201A in the last stage, but he would have to wire the filament of this tube in series with the filaments of the other tubes in the circuit. And also insert a 24-ohm resistance in the negative filament of this tube. This supplies a bias of six volts to the grid. The negative voltage applied to the grid of a tube depends on the voltage being impressed on the plate of the tube. If 90 volts are applied to the plate of a tube, we find that the grid requires a negative bias of 4½ volts.

Multiply by Four

The correct bias required for any specified plate voltage can be determined from established curves or is stated on the wrapper that contains the tube. Multiplying the required grid bias voltage by four will give you the size resistance to be used in the filament circuit and supplying the necessary grid voltage. That is, if you require 4½-volt bias on the grid of a tube, multiply 4½ by 4 and you will have 18. This means that an 18-ohm resistance will supply 4½ volts of bias providing the correct return is made.



THE ALL-IN-ONE consists of two distinct and separate sections, the power supply (top) and the receiver.

The audio transformers in the circuit must be of good make. The ratio should be low. The primary inductance must be quite high, for the higher the inductance the higher the impedance will be. It is necessary that the impedance of the primary be higher than the plate impedance of the tube. This will insure an even transfer of energy and will facilitate reproduction of the low notes. The distributed capacity of the windings must be low to prevent by-passing of the higher notes and causing distortion.

Half-and-Half

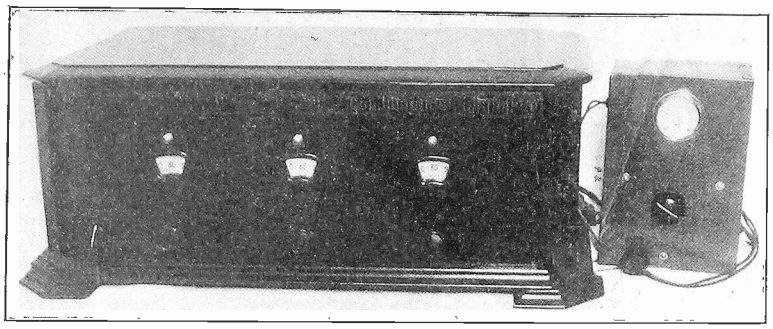
The receiver takes up half the space in the cabinet while the power supply takes up the other half. The power supply consists of first the power transformer. This has a primary winding for 110 volts AC. One secondary winding supplies 380 volts from each side of center. Another winding supplies the power tube filament, still another winding the ionizer (four volts at five amperes.) Then there is the rectifier tube. This is really the heart of the power supply unit. This tube is a full-wave rectifier and delivers a rectified current of 300 mils at about 350 volts.

The condensers in the filter portion were specially designed. They are manufactured in four metal containers. One contains four buffer condensers and one transformer grounding condenser. Two other containers house (a) the filter block (each 5 mfd., to go across the chokes) and (b) one 5 mfd. and 1 mfd. condenser. From the last named unit four leads are brought out, two of which connect directly across the top unit of the resistance, while the other two connect from A minus to the common lead.

The choke coils are made to carry 300 mils and the direct current resistance is not to exceed 100 ohms. The inductance value is about 6 henrys. Directly across the output of the filter a bank of resistance is used. This is tapped at different values, the drop across each supplying the voltage for the receiver. The receiver is separated from the power unit by a galvanized iron shield.

Cut Out in Back

A large portion of the back of the cabinet is cut out and covered with a piece of copper screening. This is to allow for



THE completed set and power plant in the cabinet. The control box is at right. This should be placed under a table or at the outlet.

proper ventilation of the parts in the supply unit. A twenty-ohm variable resistance is inserted in the primary circuit power transformer. This is largely for control of the filament current of the tubes. The resistance is enclosed in a separate box, called the Control Box, and with this a 0-300 milliampere meter is also enclosed. The meter is in series with the filaments of the tubes. By manipulating the rheostat until the current reading on the meter is 250 mils we may be assured of the fact that the tubes are being operated at a normal point.

In preparing to construct the set let us first start with the cabinet. A portion of the back must be cut out to allow for proper ventilation. The piece is cut in a rectangular shape and measures 20½ inches long by 6¼ inches wide. For the man who has the proper tools this is an easy task. The necessary tools are brace and drill with extension bit, compass saw, files and some sandpaper. With a pencil and rule draw a rectangle on the back of the cabinet 20½ by 6¼ inches. This is to be centered. Then with the extension bit, drill a hole in each corner of the rectangle. Take care that the circumference of the circles are within the rectangle.

Then with the compass saw cut out the center. This will leave a large hole in the back of the cabinet, each end being semi-circular. The fan may leave it so, if he wishes, or he may square the ends with a saw and chisel. Then use a file to smooth down the rough edges, finally with sandpaper. Two coats of stain may be applied to make the job neat. The aperture is now to be covered with a piece of close-knit copper screening. This will keep foreign objects out and allow for full circulation of air.

The screen is tacked on from the inside and is to measure 22 by 7½ inches. To look attractive this must be fastened with care, so as not to sag. The best way to do this is to lay the screen over the opening and tack the bottom, constantly stretching as you go along, then tack one of the sides the same as the bottom.

Stretch the Wire

This will leave two sides to be fastened. The wire should be stretched on the latter two sides and temporarily held by brad nails, half driven. Then tack between the brad nails and you will notice that the screen is securely fastened. Remove brad nails and replace with tacks.

The front panel is a piece of bakelite and measures 7 by 21 by 3-16 inches. This may be purchased in the color to match the cabinet. There are to be four controls on the panel, one variable resistance R4, and three variable condencers, C1. C2, C3. These condensers are controlled by the illuminated control dials. One of these dials is mounted directly in the center of the panel and the other two are mounted 5¾ inches from the center dial.

The window openings in the front panel are easily cut by the use of the special template furnished with the dials. This template has a number of small holes closely in line following the general contour of the window. Drills required are 3-16, ¼ and ⅜ inch twist drills. The template is laid on the face of the panel. Use a piece of paper beneath to prevent the template from scratching the face of the panel. Measure one inch from the edge of the template to the top of the panel. Be positive that the template is in the correct position to insure clearance for the dial scale and frame inside of the cabinet.

Lay the template with the long edges parallel to the ends of the panel. Drill the two end holes first. Then fasten the template securely in place with the screws furnished for the purpose. Follow the outline of the window in the template with a 3-16 inch drill. Then remove the template from the panel and take out the window section. Use a small screwdriver to do this. Enlarge the switch shaft hub hole to ¼ inch. It will not be necessary to trim the edges of the drilled holes in the windows, since the bezels cover this.

Mounting Problems Solved

After the drilling is completed, mount the bezel and indicator. Fasten the indicator in place with the small screws. Do not draw these up too tight or the indicator will be distorted.

Now, in mounting the condensers to the dials it will be necessary to remove the screw holding the frame of the condenser to the tapped brass rod and adjusting the arm. This arm is slotted and is attached to the dial with a machine screw and nut. By adjusting the screw in an upward position, so as to be centered with the hole where the screw has been removed from the condenser, take a ¾-inch 6-32 screw and insert this through the arm of the dial (or support bracket) using three of the washers supplied with the dial, and one nut. This may now be tightened. Leave the screw attached to the dial frame and hold the support bracket slightly loose. This is to be fastened when the condenser has been finally adjusted at an angle in an upward position.

Place the baseboard in the cabinet at its correct position so as to fit snug with the back of the cabinet. Then slide the panel in place and open the rotor blades of the condensers. Adjust the angle of the condensers so as to leave ¼ inch clearance between the baseboard and the rotor blades, and tighten the screw that has been left loose, holding the support arm to condenser frame. With the variable resistance mounted on the lower left-hand side of the panel through a hole 1½ inches from the bottom, we are ready to proceed with the laying out of the parts.

The baseboard should be of hardwood, for it is to support considerable weight. It is to be divided into two portions. With the aid of a pencil and rule draw a line 6½ inches from the back. This back portion will hold the power supply unit.

LIST OF PARTS

L1, L2, L3—Three Benjamin Lekeless RFT.

C1, C2, C3—Three DeJur .00035 mfd. variable condensers.

R1, R2—Two DeJur 4-0hm fixed resistance.

R3—One DeJur 20-ohm fixed resistance.

R4—One 100,000-ohm Centralab heavy duty variable resistance.

R5—One Ward Leonard variable resistance unit, type 507-59.

R6—One Ward Leonard variable resistance unit, type 507-62.

C4, C5—Two Dubilier 1 mfd. fixed bypass condensers, 160 volt type.

C6, C7—Two Dubilier condensers, type PL-543.

C8, C9—Two Dubilier condensers, type PL-544.

C10, C11, C12, C13, C14—One Dubilier condenser unit, type PL-542.

T1, T2—Two Thordarson audio transformers, type R-200.

T3—One Thordarson output transformer, type R-76.

T4—One Thordarson power transformer, type 2291.

L4, L5—Two Thordarson chokes (one unit), type T-2291.

C15—One Dubilier .00025 mfd. grid condenser.

R7—One DeJur 2-megohm grid leak.

One Q.R.S. 400 milliampere rectifier tube.

Six DeJur Buffalo non-microphonic sockets.

Three Mar-Co Illuminated Controls.

One 7x21x14 inch cabinet.

One 7x21 inch Bakelite panel.

One Readrite panel milliameter, 0-300 mils.

One Readrite portable voltmeter, 0-500 volts.

One baseboard, 11¾x21¾ inches.

One control box, 5x9x4 inches.

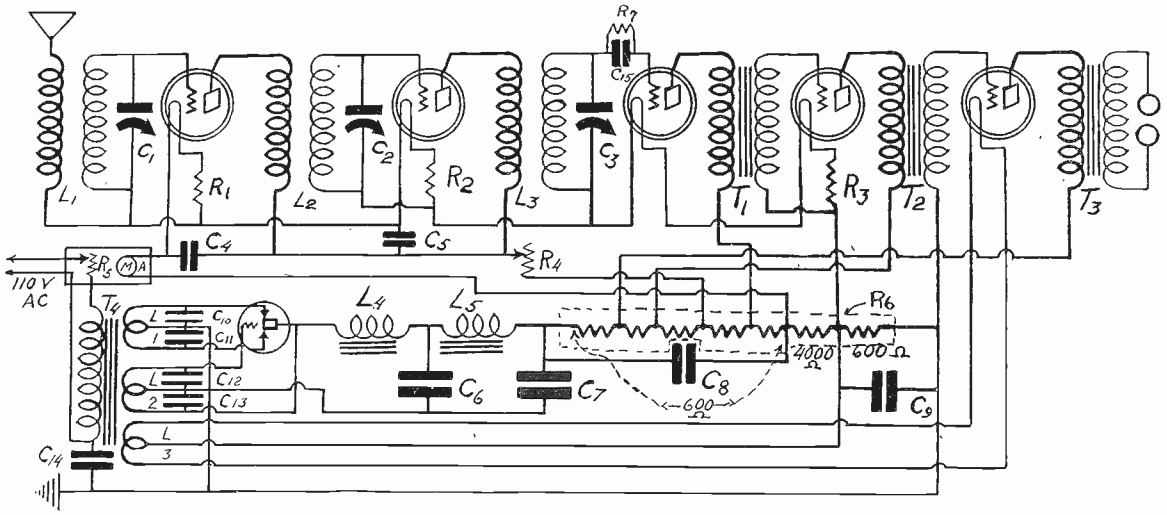
Solder, wire, lugs, etc.

The Dead Line

It must be borne in mind that none of this apparatus is to extend beyond this line. The power transformer is mounted at the left-hand corner of this space. In approximately the center the choke unit is mounted. Then the socket for the rectifier tube is mounted between the transformer and choke, towards the rear. The buffer condenser block PL-542, should be mounted alongside of the transformer, in front of the tube. Then the resistance 507-62 is mounted directly in front of the double choke. Do not bring these units too close together. The three condenser blocks PL-543, PL-543, and PL-544, are mounted at the right-hand side of the baseboard. The PL-544 being on the extreme left-hand side. Since all the condensers are mounted in four containers, it will simplify the job and also makes it quite economical. Leave a half-inch space in front of the dividing line so as to accommodate the iron shield.

Now lay out the parts for the receiver in the front portion of the baseboard.

For the shield, cut a copper strip 23¼ inches long and 7¾ inches wide. Bend one-half inch of the bottom and two sides into a box form, the half-inch edge serving to fasten the shield to the sides of the cabinet, with wood screws from the inside. Drill eight holes with a ⅜-inch drill, one-half inch from the bottom of the shield. The first hole is drilled one-half inch from the left and marked B-45;



THE five-tube set and the ABC eliminator, shown in a single diagram. The filaments in the receiver—except in the power tube—are series connected. The Q. R. S. 400-mil tube is the rectifier.

then three inches from the right another hole is drilled and marked A minus. Ten inches from the right a hole is drilled and marked B 90 plus or B 110. Drill a hole seven inches from the left and mark this A plus. Five inches from the left a hole is drilled and marked C-40. Another hole is drilled two and a half inches from the left and is marked B-180. The last hole is drilled one inch from the left; this is for the power tube filaments.

Before fastening the shield, wire the power supply portion of the receiver. Then fasten the shield to the bottom of the baseboard, leaving the sides loose until the receiver has been completed, after which they will be securely fastened so as to prevent vibrations and other trouble.

Bringing Out the Leads

The different leads coming from the supply unit to the receiver are brought through those holes drilled at the bottom of the shield. The wires connecting to the resistance bank and those located near it should be No. 18 asbestos covered. The lamps in the illuminated control dials should be wired in parallel and a fifty-ohm resistance shunted across them. These are then to be wired in series with the filaments of the receiving tubes, negative end. The illumination of the dials is an added feature and may be disregarded if the fan so wishes.

After the set is placed in the cabinet the antenna and ground leads may be brought from underneath and soldered to two Fahnestock clips placed in the back of the cabinet. The two leads from the transformer are brought from underneath the cabinet and go directly to the control box. Also the two leads going to the milliameter.

Before turning on the house current, check the wiring carefully, then turn the rheostat in the control box all the way to the right. Insert the rectifier tube in its socket. Also insert all other tubes. Turn on the house current and then turn the rheostat in the control box until the milliammeter reads about 250 mils. This may now be left permanently.

Check Up Voltages

Before proceeding check all B and C voltages with an 0-500 high resistance voltmeter. This is done by connecting the negative lead of the meter to the negative terminal of the resistance bank. With the red cable connect to all B voltages and check until the proper voltages are found. The lead coming from the power tube plate should be 180 volts. If not, we advise planting an additional 200-ohm resistance in series with the top resistance bank and placing the leads formerly going to the end of the top bank to the end of the additional resistance. Do not make any voltage measurements unless the filaments of the tubes are turned on

To insulate the cover of the cabinet from heat radiated by the tube and chokes it would be advisable to secure a piece of galvanized iron directly over these, and raised from the surface of the cover with washers. This will allow air to circulate.

The cabinet should be of well seasoned hardwood.

BRITON IS CONFIDENT

2XAF and 2XAD, the short wave transmitters of the General Electric Company, are broadcasting standards for short wave receiving equipment in England. An English manufacturer guarantees that his short wave sets will receive 2XAF or 2XAD or money will be refunded. 2XAF operates on 32.77 meters and 2XAD transmits on 22 and 26 meters.

WGL HAS NEW STAFF PIANIST

WGL announced the appointment of Edward McArthur, concert pianist and composer, as studio accompanist on the staff of the Hotel Majestic station, New York City. Mr. McArthur has appeared in leading cities in the United States and Europe.

DX With a Vengeance In New Zealand Now

New Zealand in winter is apparently the DXer's paradise.

W. A. Waters, engineer and manager of the Manawatu-Oroua Electric Power Board, of Palmerston North, New Zealand, in a recent letter to a General Electric radio engineer reports as follows:

"Yesterday (June 3) I rebroadcast Holland in the morning, listened to WGY of Schenectady for two hours in the afternoon and finished up with JOAK, Tokio, Japan, on the loud speaker for an hour."

Mr. Waters is an ardent radio fan and is active in the Palmerston North Radio Club which operates station 2ZF, a 25 watt transmitter.

FAMOUS QUESTIONS

How many tubes?
Get any DX?
How much plate voltage?
Any distortion?
Power tube in last stage?

Power Transmission Claimed by Tesla, 71

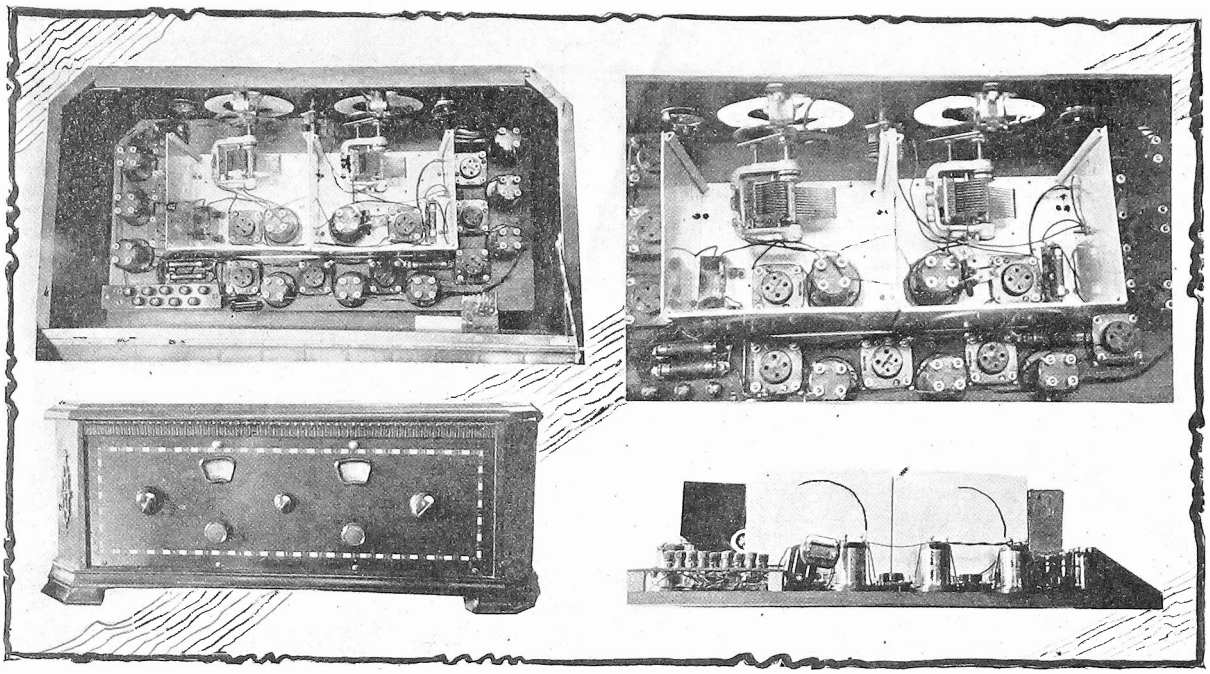
Gasoline engines and fuel tanks will have no place in the airplanes of the future, according to Dr. Nikola Tesla, pioneer in electricity and radio. The planes instead will be driven by light electric motors receiving their power from generating stations on the ground by means of radio waves. Thus driven, the planes will be capable of making nonstop trips around the world. This pronouncement the noted inventor made on the occasion of his seventy-first birthday.

Besides outlining his views on the future of aviation he predicted that power for manufacturing and lighting purposes would be transmitted by radio from central generating stations. He also predicted that electric current controlled by radio waves would in the future be used for releasing the moisture in the atmosphere and thus change deserts into fertile fields. Battleships, he said, will some day be equipped with apparatus which will enable them to destroy enemy craft many miles away by radio directed force more powerful than the death ray.

"I have demonstrated already that I can transmit power half way around the earth without losing one-half of one percent of it," he said. "I hope some day to put up a power plant to give the world my best invention, the one which will survive all others."

Some of his ancestors lived to be 120 years old, and one lived to be 129. The noted inventor hopes to go the record-holder one better.

All who know him wish the same.



THE construction of the Shielded Melo-Heald is simplified by the arrangement of parts, as shown in the two upper views. At left is the general layout, at right a larger view of the shielded portion. The front panel view is very attractive. At lower right is the rear view of the set out of the cabinet.

A Shielded Melo-Heald

Set Tunes in Cuba Through N. Y. Locals

By Clifford Denton

THE Super-Heterodyne is conceded by the leading engineers to be the most sensitive and selective receiver known today.

Perhaps many persons have wondered just what the word Super-Heterodyne means. It is taken from the Greek, 'heter'' meaning other and "dyne" meaning force. A "Super" has another force, namely its oscillator, the energy of which is applied to the incoming signal and the resultant difference of the two forces is amplified in the succeeding tubes.

As the saying goes, "There are more than one way to skin a cat," and that holds good for "Supers." Scores of ways have been utilized to accomplish the same objective.

Every engineer has his own pet methods and no two technicians coincide exactly. But it can be said that certain methods to obtain an end have become standards of practice. I have tried to incorporate in this receiver the efforts and the accepted standards of those men who have been responsible for the tremendous and well-deserved popularity the "Super" now enjoys.

The day of the long and cumbersome radio receiver is drawing to a close. Compactness and simplicity rule.

The pictures show the receiver in a Corbett Model C cabinet. The finish is walnut. The inlaid walnut Lignole panel, with the nickle and black finish of the illuminated dials and the supplementary knobs, form a very attractive combination.

Two tuning controls and two supplementary controls are so located that the hand has to be moved only about four inches to have the receiver under complete control.

The left-hand illuminated dial tunes the loop circuit and the right-hand dial tunes the oscillator. The dial settings can be accurately logged.

The left-hand knob controls the sensitivity of the receiver and can be left in one position when listening to locals. This position of the potentiometer will remain the same for all the dial settings, thus cutting down the number of tuning operations necessary for local reception.

The center knob controls the split-loop regeneration control and can be adjusted for the best operating position and left alone except on extreme distant stations.

The right-hand knob is the audio volume control and by its aid the music can be raised gradually from a whisper to a roar.

The receiver can be shut off by turning the left-hand knob counterclockwise. The filament switch is mounted upon the potentiometer.

It may be well to express thought as to the advisability of controlling the sensitivity of a radio receiver. It offers the operator a method of volume control due to the fact that it has a definite relationship to the amount of energy applied to the detector. Detector overloading is a common source of distortion now that we have good radio frequency amplifiers. By reducing the sensitivity on local signals we do not run the risk of overloading our detector so readily. Secondly by controlling the sensitivity it is possible to adjust the receiver at any desired sensitivity level. This will be a big factor in mitigation of background noises. Even with the most sensitive receivers on some nights the noise level is so high that it is practically impossible to listen to distant stations, so we decrease the sensitivity and enjoy the local or nearer and louder programs without a surplus of background noise. The advantage is that the signal is clear. We do not, when listening to a local station, have to hear the same background noises which would be present when listening to stations miles away.

As can be seen from the circuit diagram and the pictures, eleven tubes are employed. This seems like a lot of tubes, but as proper biasing and low plate voltages are used, there is little greater drain than there is in the average nine-tube Super.

Perhaps a rapid explanation of the circuit with its possibilities would help you realize

LIST OF PARTS

One 160 oscillating Melocoupler
One No. 120 mixing Melocoupler
Six 135 long-wave Melocouplers
Three Multistage Meloformers (audio transformers)
Eleven Benjamin sockets
One Sangamo .00025 mfd. fixed condenser
One Sangamo .00025 mfd. fixed condensers with clips
One Sangamo 1 mfd. condenser
One Lynch metallized 5 meg. leak
Four Lynch Equalizors (one No. 4 3; one No. 4/5, two No. 2)
Eleven binding posts
One Carter 400-ohm potentiometer with filament switch attached
One Carter 0-to-500,000-ohm Hi-Pot
Two Carter tip jacks with plugs
Two Hammarlund .0005 mfd. Midline variable condensers
Two Hammarlund .0005 mfd. Midline vari-
One Hammarlund .00032 mfd. condenser (for regeneration)
One 7x21-inch two-tone Walnut inlaid Lignole front panel
One Corbett type C cabinet with baseboard
Two Mar-co Illuminated Controls
Acme Celatsite for wiring connections

the advantages of this popular receiver, known as the Melo-Heald. The input circuit is tuned by the left-hand variable condenser. A split-loop is employed so that the detector circuit may be sharpened and the sensitivity increased by the aid of the small variable condenser which acts as a regeneration control. The familiar condenser-leak method of detection is employed.

The oscillator circuit employes the Melo-Couplers (120 and 160), forming an oscillator, with several distinct advantages. Undesirable harmonics are reduced by the removal of the pickup coil from inductive relationship to the plate coil of the oscillator. Thus by the employment of a link mixing system the undesirable condition of both grid and plate oscillations acting on the pickup coil was stopped. This resulted in a system which is selective, stable and does nothing to distort the quality of the received signal. The input and the first detector circuit are shielded from each other and the rest of the receiver by the aluminum shields. These shields act more as a static than an electromagnetic shield.

Can Use Negative Volt

The intermediate frequency amplifier is distinctively different, not only that five stages are employed but the circuit is so stable that as much as the full one-volt negative bias can be applied by the aid of the potentiometer without the amplifier becoming uncontrollable. These transformers were designed by Merwyn Heald of Chicago and are known as Melocouplers (135). They are accurately peaked at 125 ke. or 2,400 meters, and are very accurate. They are peaked by an inductance change and not by any form of capacity adjustment. It may be noted here that due to the fact that the value of the shunting resistance caused by the grid to filament impedence is raised to a high amount by the negative bias that the resonance curve of each stage is sharpened to the point where 10 kc. separation between local and distant stations may be accomplished. The potentiometer which controls the intermediate amplifier is located on the left.

The second detector employe s a C biasing battery or plate rectification, which is advisable due to the fact that the intermediate amplifier feeds an immense amount of power into the detector.

Three AF Stages

The audio amplifier employes three stages of transformer coupled amplification. They can be used in any order. Being small in size they can be made into a compact amplifier. They have a solid cylindrical iron core and a shell with a longitudal slit that eliminates eddy currents. It has a perfectly stabilized impedence without leakage flux or stray coupling.

The volume is controlled by the 0-500,000 ohm potentiometer located on the right-hand side of the panel.

Mount the illuminated dials, the midget condenser, potentiometer with filament switch and the audio volume control on the Lignole panel.

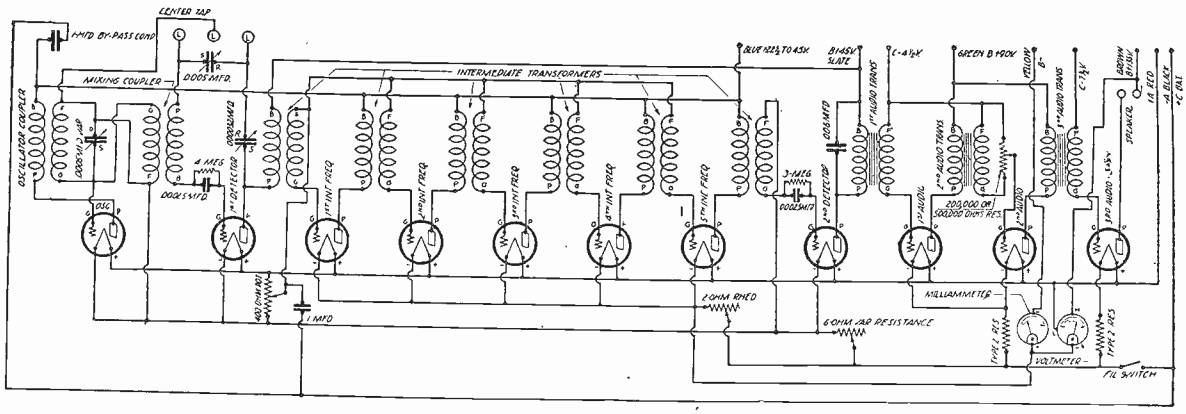
The tuning condensers are mounted on the brackets furnished with the dials. Then we are ready to spot the positions of the shields which enclose the first detector and the oscillator. After the shields are spotted the Melo Couplers and their respective sockets are equally spaced around the shields as shown in the photographs.

The wiring of the receiver is not hard, due to the fact that the position of the components lends simplification to the wiring and the repetition in the five intermediate stages. Start with the filament circuits, then wire the B circuits. It would be a good idea to check up the work to this point. If the test shows that the filament and B circuits are O. K. start at the first detector and wire all the grid circuits. The remaining plate circuits are then wired in and the receiver is ready for testing.

A No. 2 Equalizor feeds the two tubes at left, the No. 4/5 the next four, the 4/3 the next three, and the other No. 2 the last tube (112 or 71).

In a recent test in New York City the following stations were tuned in, the DX right through locals:

Meters	Station	Location	Dial Setting
272.6	WPCH	N. Y. C.	19.30
258.5	WWRL	N. Y. C.	15-25
341.	WMCA	N. Y. C.	37-54
350.6	WNJ	Newark	42-57
374.8	WRNY	N. Y. C.	48-65
405.2	WOR	Newark	55-72
422.3	WGL	N. Y. C.	60-77
431.	WHAP	N. Y. C.	61-78
455.	WJZ	N Y. C.	66-84
492.	WEAF	N. Y. C.	73-90
252.	WGCP	N. Y. C.	12-22
315.6	WGBS	N. Y. C.	30-44
295.1	WARS	N. Y. C.	22½-37
315.6	WABC	N Y. C.	30-46
309.	KDKA	Pitts.	27-44
384.4	WLWL	N. Y. C.	50-68
390.9	WODA	N. Y. C.	51-70
526.	WNYC	N. Y. C.	80-97
270.1	WGHP	Detroit	16-28
275.1	WHAD	Milwaukee	16½-28½
246.	WBAL	Balt.	13-18½
361.2	WHN	N. Y. C.	43-62
389.4	WTAM	Cleveland	50-69
325.9	WSAI	Cincinnait	32-50
239.9	WAID	Col., Ohio	23½-38
	WPG	Atl. City	25-40
422.3	WLW	Cincinnati	58-77
428.3	WSB	Atlanta	59-78
379.5	WHAZ	Troy	47½-66½
374.8	KTHS	Hot Springs	46½-65½
240.	6KW	Tuin. Cuba	44-62½



THE MELO-HEALD circuit, as it usually appears, is shown above. The author, however, used fixed filament resistors throughout, and the C battery method of detection in the second detector.

Defender of Worms Barred for Politics

Station WABC and the Izaak Walton League have both denied that they censored or suppressed a speech by Fred B. Shaw, former international fly-caster, because he had taken the Coolidge side of the angleworm controversy. A. H. Grebe, head of the broadcasting station, said that WABC had not been guilty of censoring Mr. Shaw's pro-worm speech. J. Miles Flynn, Chairman of the Committee on Education of the Izaak Walton league, said:

Opposed Politics

"I asked Mr. Shaw to make a speech during the Izaak Walton hour on WABC on Wednesday night on the ethics of using angleworms, and I sent him clippings from editorials in most of the New York papers, some for using worms, some against.

"When I received Mr. Shaw's speech I found that he had argued for the use of worms. That was all right. He was entitled to his opinion as an expert angler, and that was what I had asked for. But he went on to devote two pages to praising the Coolidge economy program and other political achievements of the President.

"I wrote him a letter saying that his remarks on the angleworm question were all right and could be delivered in full, but that it would be necessary to drop the general eulogy of President Coolidge from his speech, for the reason that the constitution of the Izaak Walton league forbids political activities. He declined, and that is all there is to it. WABC had nothing to do with it."

How Question Arose

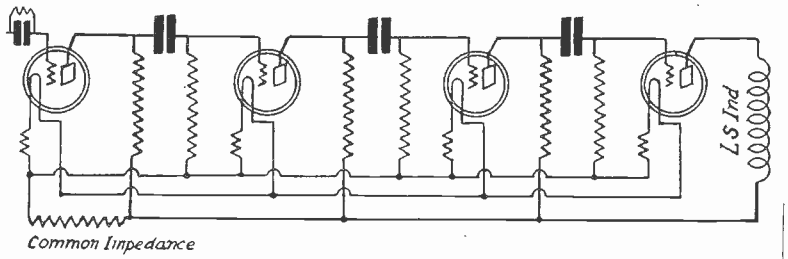
The worm question gained public attention because President Coolidge uses worms to catch brook trout. Artificialfies are the thing, others contend, some giving technical, others merciful reasons. The debate is still raging.

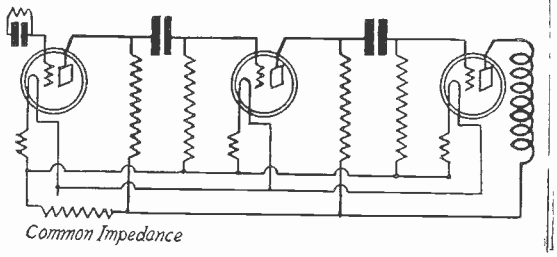
Why Even Experts Go Wrong

Trying To Diagnose Motorboating Cause

By J. E. Anderson

Contributing Editor; Consulting Engineer; Associate, Institute of Radio Engineers





AT top is an even resistance coupled amplifier because it has four plate circuits on the same source of voltage. Regeneration through the common impedance will cause oscillation at high frequencies.

THE subject of motorboating in radio receivers is generally not well understood, although it can be reduced to mathematical formulas as definite, if not as simple, as the formulas which express Ohm's law.

The term motorboating was first applied to the noise emitted by loudspeakers when connected to certain radio sets of good quality. Similarity in sound and frequency to the put-put of a motorboat was responsible for the name. When the frequency of the noise was still lower it was generally called fluttering. When the frequency of the noise emitted was over 100 cycles per second it was usually called howling or squealing, depending on the pitch of the disturbance. The causes assigned as responsible for the noises were legion and sometimes they were fantastic.

That the disturbances of all pitches in the audio amplifier were due to the same cause was not suspected, and the true cause was never included in the lists.

It is a fact that nearly all disturbances from a low frequency flutter in the signal to a super-audible squeal are due to the same cause, namely, regeneration through the impedance in common with the several plate circuits when served by the same source of plate voltage. Whether the amplifier will oscillate by virtue of this regeneration depends on how close the plate circuits are coupled, on the degree of amplification, on the type of circuit, and on the value and type of impedance in common with the circuits. Suppose that the amplifier contains no reactances other than the inductances of the loudspeaker and some reactance in the plate voltage supply. This would have to be a resistance coupled amplifier with stopping condensers of infinite capacity.

It is possible to generalize about a circuit of this type.

Suppose that the number of plate circuits on the common source of voltage is odd. That circuit will very likely oscillate at a low frequency, motorboat or flutter. Suppose that the number of tubes in the common source of plate voltage is even. That circuit will most likely oscillate at a high frequency. That is, it might squeal. It will not oscillate at a low frequency.

If the common impedance is reduced in the odd circuit by connecting a condenser across the source of plate voltage, the low frequency oscillation will stop or the pitch will be lowered. It will always stop if the condenser is large enough, and it stops the oscillation by reducing the frequency to zero.

If the common impedance is reduced in the even circuit by connecting a condenser across the common source of plate voltage the high frequency oscillation will stop. One microfarad should be enough to stop it in most cases unless the "high" frequency oscillation is quite low. If a very large condenser is connected across the voltage source in this even circuit, the amplification on the low notes will be improved, that is, increased.

Now if the circuit contains stopping condensers the rule is modified somewhat. An even circuit which should be stable on low frequencies might start to flutter at a very low frequency when the resistance and the inductance in the common voltage lead are high. And this might take place even if there is a condenser across the impedance large enough to stop all high frequency oscillation. Some might point to this fact in refutation of the theory of the common impedance as the cause of the oscillation. In fact, many have already done so. But the fact that the fluttering does occur is in reality evidence of the correctness of the theory. The stopping condensers change so much the phase of the energy fed back, that an even circuit takes on the characteristics of an odd circuit. Substitution of actual values in the formulas at a low frequency will show that oscillation should be expected. Well, it very often occurs. High amplification and a high inductance in the common impedance are requisites. Resistance in the common impedance aids and abets the fluttering tendency.

It is the inductance of the speaker which is largely responsible for high frequency oscillation in an even circuit, that is, when it is taken in conjunction with an inductive common impedance. The speaker inductance is in series with the line. So are the stopping condensers. Since a series inductance will change the phase of the feedback so that an even and stable circuit will oscillate at high frequency, it is logical to assume that a series condenser, or condensers, will have the opposite effect, that is, will change the even and stable circuit so that it will oscillate at low frequency. Both formulas and experience prove that the assumption is correct.

When the coupling impedances contain inductance the case is more complex, although the formulas are identical. It is difficult to lay down any general rules as to the behavior of the circuits under various conditions. But the same formulas hold and the behavior will be similar.

Even when the coupling is by means of audio transformer the behavior is somewhat the same, particularly for one connection of the transformers. It is safe to say that in 99 cases of squealing or fluttering in audio transformer coupled circuits the common impedance is to blame.

Eliminator Patent Awarded to Dunmore

The issuance recently of a patent to F. W. Dunmore, of Washington, D. C., broadly covering the operation of vacuum tube circuits by means of B eliminators, and the beginning of interference proceedings between the Westinghouse Electric and Manufacturing Company, Dunmore and P. D. Lowell, started another patent upheaval.

The Board of Examiners in Chief of the Patent Office recently decided adversely in the appeal of the Latour Corporation of New York, in which this corporation brought interference proceedings against Dunmore and Lowell with reference to patent No. 1,455,141 relating to operation of radio receivers without batteries. The Latour Corporation claimed priority rights to this invention.

Three other leading radio manufacturing companies are involved in the legal controversy, including the Westinghouse Electric and Manufacturing Company, Wired Radio, Inc., and Murad Laboratories, all of which have brought interference proceedings which claim that Dunmore and Lowell do not hold basic rights to B eliminators and alternating current receivers. The claims by Westinghouse are based on a ten-year-old idea of Prof. Michael Pupin of Columbia University, which patent was assigned to the company at the same time that Armstrong assigned his regenerative patent to the same concern. The various companies which have brought interference proceedings will be heard in turn.

Final disposition may take years.

A Super on Wheels

How to Build a Receiver Into An Auto

By John F. Rider

Member, Institute of Radio Engineers

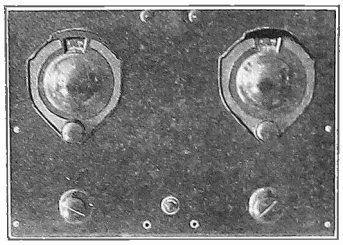


FIG. 4

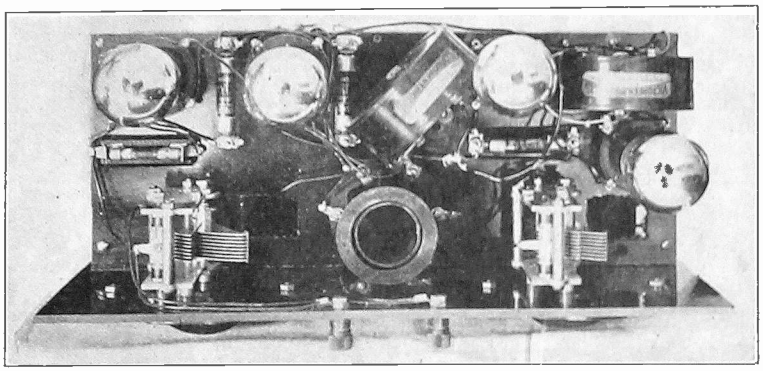


FIG. 5

Top view of the upper shelf. Note how the Victoreen coils are placed at an angle.

[Part I last week; Part II, the conclusion, follows:]

CONSIDERING that the receiver will be operated with a loop, and that the minimum controls are necessary, radio frequency amplification preceding the mixer tube has been omitted. Only two tuning controls are used—one for the loop and the other for the oscillator. Two other controls are provided—one for sensitivity and the other for the volume. The sensitivity control is a potentiometer in the grid circuit, varying the bias. The volume control is a variable resistance shunting the secondary of the first audio frequency transformer.

The remaining item on the panel is the battery switch. The front panel view of the receiver is given in Fig. 4. The dial to the left of the battery switch is the loop tuning control and the other dial is the oscillator tuning control. The design of the oscillator is the regular tickler feed back such as used in the ordinary tickler feedback detector circuit. This precludes burnout of the osillator tube filament if the isolating condenser used in some oscillator circuits breaks down.

Can Be Used in Home

Grid condenser-leak detection is used for the mixer tube and the second detector. This assures greatest sensitivity and consequently greatest receiver output. Transformer coupling is used in the audio amplifier, since it affords maximum output with the fewest number of tubes. An output unit is not used, due to the limited space. The wiring diagram of the receiver is shown in Fig. 3A.

Special tuning of the intermediate stages or the use of a special filter unit is unnecessary, with these Victoreen units, due to the accurate response adjustments of the units at the time of manufacture. All three units are identical, two being used as intermediate amplifying transformers and the remaining one as the filter unit.

The 285D General Radio transformer possesses response characteristic very suitable for use in a receiver of this type, when a high degree of output quality is desired.

While this receiver is described for use in a car, it can be utilized to every advantage in the home as the regular receiver. The only change necessary to adapt this receiver to the home is the use of a nicer cabinet or housing. Everything else remains intact, though the total amplification is much greater than is available with some other higher ratio units. These transformers, furthermore, are suitable with some of the new gas content detector tubes. These tubes possess a high value of output impedance, and if a transfer of low notes is desired between the tube and the transformer it is necessary that the transformer possess a high value of inductance in the primary winding.

The Amsco tuning condensers are of the straight frequency type and are very compact and durable. The sturdiness was illustrated by the action of the condenser during its use since the construction of the receiver. Over mountains, through marshes and bogs, jounced innumerable times, the plates nevertheless maintained their adjustment.

The Silver Marshall coil is removable from the socket and carries three windings.

Good Volume Control

The volume control, an Electrad Tonatrol, in the audio circuit, is one which gave great satisfaction during the period of use of the receiver. This item is so designed that when in operation the lever moving over the resistance element and varying the resistance in the circuit never touches the resistor itself, consequently deterioration of the element does not take place. The potenitometer is wound with heavy wire and showed no wear after a year of use.

Realizing that the receiver would be used under various atmospheric conditions, particularly when the receiver was located in the mountains and at the seashore, it was decided that elimination of moisture from the grid and bypass condensers was essential. For this reason condensers moulded in Bakelite were selected (Aerovox type 1450), moisture absorption after the item has been completed being impossible. Furthermore, the insulation resistance of these units is exceptionally high.

Tube Versatility

The use of the Amperites makes possible the choice of almost any types of tubes. In order to change from 199s to 201s or to substitute a 171 in place of a 201a, it is only necessary to change the type of Amperite used. It is understood of course that the correct values of B and C potential are being applied.

These automatic filament control units apply the correct filament voltage to the tube filament, assuring longevity of the filament. By utilizing these units, it is possible to dispense with additional controls upon the panel. Incidentally some persons guessed that automatic filament control of the intermediate stages using Victoreen transformers is unsatisfactory. This is not so. Full satisfaction was obtained with the automatic filament control of the intermediate amplifier tubes.

Having concluded the list of parts we will enter upon the construction. To facilitate matters we will divide the subject into separate parts. First we will lay out the necessary holes and then mount the parts.

The two self brackets are reversed. The upper panel mounts on top of the bracket, but the lower panel mounts below the bracket. Specific layout of the mounting screws for fastening the shelves to the brackets is unnecessary. The screws function as the supports for the lower shelf when resting in the cabinet. Their length should be sufficient to be on line with the base of the front panel. A view of the brackets can be seen in Fig. 2.

The layout of the parts on the shelves is shown in the pictures. Holes are cut in the top shelf to permit free play of the variable condensers mounted on the panel. Without these holes it will be impossible to turn the condenser dials beyond 40, starting from the maximum setting of 100, and reading down. The parts designations include:

(S1) mixer tube; (S2) the oscillator tube; (S3) the first intermediate amplifier; (S4) the second intermediate amplifier; (S5) the detector; (S6) the first audio amplifier, and (S7) the second audio amplifier. (A) designation means Amperites, (C) grid condensers and (G1) the grid leaks. (VT1), (VT2) and (VT3) are the Victoreen transformers, (C1) is the transformer primary bypass condenser, (C2) the potentiometer bypass condenser and (C3) is the battery bypass condenser. (AF1) and (AF2) are the audio frequency transformers. The other equipment—the tuning condensers, potentiometer, volume control, battery switch, binding posts and tip jacks—is mounted on the panel. (VT3) is fastened to the lower shelf by placing its mounting bracket underneath the shelf mounting bracket. This will be sufficient support. By frequently consulting the various photographic views of the receiver it will be a very simple procedure to locate and mount the various parts.

It is only necessary to follow the wiring diagram. The actual wiring is simple.

(*Concluded on next page*)

(*Concluded from preceding page*)

Tricky circuit combinations have been avoided. All leads should be short. Segregation of the various circuits by means of the different colors can be used to very good advantage. The grid, plate and filament circuits should be wired with different colors, or the mixer, oscillator, intermediate and audio amplifiers should be wired in different colors. This will greatly facilitate tracing, in the event of faulty operation and the necessity for trouble shooting.

The dimension of the panels, the height of the tube sockets mentioned and the height of the standard run of tubes are such that this combination as a unit will fit perfectly into a case with inside dimensions of 14x10 inches, so much so that the top of the tubes will just touch the bottom side of the upper shelf and the tubes on the upper shelf will just touch the inside of the cabinet. This will keep the tubes from vibrating or rattling, even if the car is traveling at a high rate of speed. This is not a haphazard statement, but a proven fact.

The last constructional detail relative to the assembly of the receiver proper prior to its fastening to the car, is the placing of the two support between the shelves. These are the two rods, one in each corner as shown in Fig. 2. A hole is drilled in each rear corner of the upper and lower shelves. Then the rod is cut to exact size. Tap the rods at both ends, so that when placed between the two shelves, they can be screwed into place, forming a rigid and very satisfactory support.

The next step is the placing of the receiver in the car. The position of the receiver in my car is shown in Fig. 3. This is an inside view. The set is suspended between four brackets fastened adjacent to the side rear window to the rear of the driver's seat. Screw-eyes are fastened into the cabinet and heavy springs are attached thereto. These springs are then attached to the four brackets fastened to the woodwork inside the car. This four spring suspension works in an excellent manner. The only precaution necessary is to use brackets of sufficient length to allow enough clearance between the rear of the set cabinet and the window. It is understood that the mounting brackets will be of sufficient strength to hold the set. The springs should be heavy and pulled out into place. If they are loose the set will vibrate. If they are taut, the set will ride wonderfully over the biggest bumps. The method of mounting is shown in Fig. 1.

The aerial on the car is a loop and made up of six strands of bell wire. These six strands are mounted on the roof of the car on four bakelite supports, a support in each corner. The bakelite supports are 6 inches high and the turns are ¾ inch. apart. The supports are fastened to the roof with brass angle brackets. The leads are carried into the car through the rear side window. The B and C batteries are carried outside on the running board nearest the set. They are contained within a tool case of sufficient size.

The connecting wire from the case to the set is rubber-covered seven-strand connecting cable and is passed underneath the running board and into the car through a hole drilled in the floorboard of the car, directly beneath the receiver. The A battery supply is the battery regularly used in the car. Connections thereto is made through the ammeter on the dashboard. The negative receiver lead goes to the ground, i.e., chassis, and the positive receiver lead to one terminal of the ammeter. The lead from the receiver to the ground and antenna can be carried along the floorboard or across the top. The speaker is fastened to the top or attached to a flexible cable so that it may be shifted when the car is parked for any length of time.

Aerials for Summer Use That Give Great Delight

By Hugo Gernsback
EDITOR "RADIO NEWS"

There is no good reason why you should not use your radio in the summertime as much as in the winter. There is just as much fun and education to be derived from your radio in the summer as in the winter season. It is an erroneous idea that static ruins all programs in the summertime. This has never been borne out by observation.

Once in a while, during a thunderstorm, or immediately preceding it, there is, of course, a great deal of static, but even here it is possible to minimize the static with a little ingenuity.

To start with, if you have an outdoor aerial, which seems to be true in a majority of the cases, it would be best to disconnect this entirely during the summertime and use an indoor aerial, which is nothing but a wire run around the moulding in one of your rooms. By using this aerial and a ground wire you will find that you can listen in to most of your favorite stations, but at the same time the static will be reduced quite a good deal.

An Outdoor Aerial Indoors

You can also string an outdoor aerial in your attic, should you have one, by running the wires back and forth in a sort of grid fashion. If you have a long hall, you can run a few wires the entire length of the hall, along the moulding, or if you wish to do even better, you can make a regular 4-wire aerial and suspend it with small insulator knobs. The wire can be quite thin, say No. 26 copper wire. Once in place, it will be hardly noticed and will not mar the appearance of your hall in the least.

Another excellent aerial, which the editor of this publication has used, consists of covering the entire inside of a closet door with tinfoil, using with it the ordinary ground. There is an advantage to this sort of an aerial, because it is directive, similar to a loop, and by opening the door and pointing it in different directions, different stations will be brought in with varying results.

Another good temporary summer aerial is had by connecting the aerial post to the bell system of the house, particularly the dumbwaiter bell. Any one wire will do nicely. The only difficulty with this is that every time the bell is rung you will hear a noise in your radio set, but inasmuch as bells are not rung so frequently this device may be said to be fairly satisfactory.

May Dispense with Aerial

If you have a set that is not shielded, and you are troubled a good deal by static, it is even possible to use a set connected to the ground without a regular aerial. Disconnecting the aerial entirely allows reception of a good many locals, if the set is on the 5-tube variety, without using any aerial at all. If you should find that the results are not so good, it will be advisable to connect a large piece of tinfoil, or any other suitable piece of metal that is handy, to the aerial post of the set.

Thus, for instance, the writer has had excellent results by attaching the aerial binding post to a metal bedspring, which picked up enough energy. At another time he used a metal window screen, which did handsomely, in lieu of an aerial, and recently he has experienced with the metal frame of his piano, with excellent results.

Then there is on the market a so-called condenser antenna, which is a sort of plug that sells for about a dollar. This is connected to the light socket and to the aerial post of your set. In this case the lines of the electric system act as the aerial. Further, a similar device is also sold on the market which is simply placed underneath your telephone set and works very nicely in picking up enough energy through the telephone lines.

Another Good Suggestion

No actual metallic connection is made with the telephone wires, but still the device works by what is technically called "capacitative coupling." This device works very satisfactorily and does away with quite a good deal of static.

Still another device which you may try is to use the same ground, but connect the aerial to the radiator system. This may not work in all instances, but in certain localities it works very well, and brings in at least all of the locals, while cutting down static a good deal.

Of course, with all of these arrangements, it should be understood that, while the static is cut down, the strength of the signals is cut down as well, but still it is a great deal better to have a weak signal that is clear than a loud signal that can not be heard at all because of static.

Why more people do not take their sets with them on trips has always been a mystery to us. Most any home set can be taken along in your car, and wherever you go. The automobile battery can be used to light the tubes, and all you need to carry along is a small set of B batteries, which should not be too much trouble.

The Nail in the Tree

It is possible, if you stop in wooded country, to have good radio reception by driving a large nail into a live tree about three or four feet above the ground. Attach your aerial binding post to this and the ground binding post to a metal rod driven into the moist ground. In this case the tree becomes the aerial and good reception can be had.

Of course a better system is to throw an insulated wire over the limb of a tree and use a metal rod driven into moist earth as the usual ground. Good results may be had that way.

All of these systems are useful in the summer, and there is no reason in the world why your radio should not be used in hot weather.

(Broadcast from WRNY)

Radio Health Is Good Through New England

Having returned from the first part of his tour in the New England sector, Radio Commissioner O. H. Caldwell stated that he was very much satisfied with conditions there. He also reported that the peanut whistle which been bothering listeners to WJZ had been due to an improperly grounded crystal control unit at WEEI, Boston. This was immediately corrected.

"While in New England I talked with many radio listeners, manufacturers, dealers and radio editors. They all reported conditions greatly improved," he continued.

"Mr. Batcheller, Radio Supervisor in New York, is checking up the waves of the New York broadcasters and they show marked improvement."

Ships Spoil Some Programs

Washington

Code messages sent by ships interfere seriously with the reception of programs from broadcasting stations operating in the 600 and 700 kilocycle range, Louis W. Southgate, of Worcester, Mass., complained to the Federal Radio Commission. (WJZ is 660 kc. and WEAF is 660 kc.) Answering his letter Commissioner Caldwell wrote that as adjustment of sea wavelengths involves some forty nations, he would take up the matter at the International Radio Conference in the Fall. The commissioner wrote:

"It will be very desirable to shift this ship SOS and calling band to a new location further removed, but such shifting will require the cooperation of some forty nations and actual re-equipment of 30,000 ships.

Interference Very Objectionable

"The matter will be brought up at the coming International Radio Conference, but at best it will require some years before the transfer can be made.

"The Commission has repeatedly pointed out to American broadcasters that the interference caused by ship transmitters on these high waves is very objectionable along the coasts, and that for this reason the best broadcasting channels are those near the center of the broadcasting band.

"The kind of interference you refer to is experienced all up and down the whole Atlantic Coast, especially at Boston, Cape Cod, Long Island, New York City and Atlantic City, and has been the means of spoiling many wonderful programs put out by some of the leading stations operating in the 600 and 700-kilocycle range.

Safety Paramount

"Transmission to ships and safety of life at sea is a paramount use for radio, but it is unfortunate that the rapid development of broadcasting has not made it possible to further separate these services so that both broadcasting and ship communication might proceed without mutual interference."

Set Tuned From Distance By New Control Device

The Algonquin Electric Company, Inc., 245 Fifth Avenue, New York City, have purchased the trade name and manufacturing rights of Thermiodyne, the original master control receiving set. Leo Potter is president of the Algonquin Company.

A device that enables one to tune a single dial receiver from a distance is being marketed by the company under the name "Thermiodyne Remote Control." Mr. Potter said:

"The set owner can attach 'Remote Control' to his old set—provided, of course, it is a single control instrument. While originated by the same engineers who introduced Thermiodyne in 1924 for use with the New Thermiodyne, now about to be brought out, 'Remote Control' is available to any single control set by simply removing the dial attaching 'Remote Control' and making one simple hook-up to the rheostat terminal.

"In the case of our mechanical type control of the set from across the room in which it is placed makes even our mechanical 'Remote Control' not only a lazy man's radio control, as it has been called, but a boon to shutins and invalids who cannot get up from bed or chair to turn a finder or manipulate reception.

"Remote Control of the electrical type is even more revolutionary, for with the electrical type, the set owner can install his set anywhere he likes—downstairs in the basement or out in the garage—place his loudspeaker wherever he likes and tune from wherever he finds it convenient."

Hospitals will find them useful.

Independent Chain Fostered By Columbia

Employing WOR as the key station, thirteen stations scattered throughout the country will be connected up in a chain system, to be known as the Columbia Broadcasting System, and will begin simultaneous transmission of programs Sunday Sept. 4. The chain will be directly controlled by the Columbia Phonograph Company, according to H. C. Cox, the president of the system. Headquarters are in the Paramount building in New York City. Major J. Andrew White, prominent sports announcer, will be in charge of technical affairs, while Arthur Judson, with the assistance of program constructors, will select the entertainers.

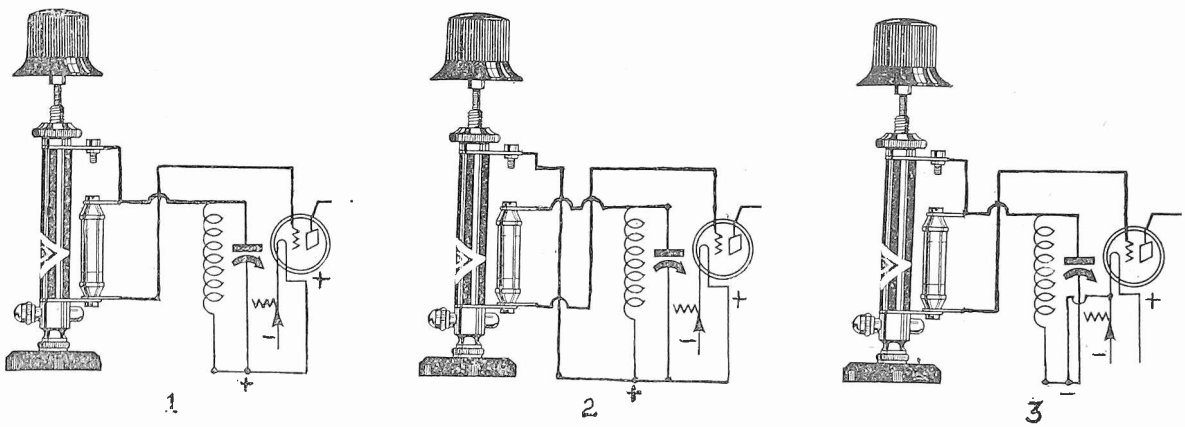
Linked up with WOR will be WEAN, Providence, R. I.; WNAC, Boston; WFBL, Syracuse, N. Y.; WHAM, Lockport N. Y.; WCAU, Philadelphia; WJAS, Pittsburgh Pa.; WADC, Akron, O.; WKRC, Cincinnati, O.; WGHP, Detroit, Mich.; WMAQ, Chicago; KMOX, St. Louis, Mo. and WHO, Des Moines, Ia. Other stations are also expected to hook in also.

Aylesworth Proposes Cross-Ocean Programs

In an address, delivered before a meeting of the International Advertising Association, a plan for the inauguration of across-the-ocean-broadcasting, by which London and New York would regularly exchange feature programs, was suggested by Merlin H. Aylesworth, president of the N.B.C. It will be proposed by the N.B.C this Fall at a conference in New York with Sir John Reith, director-general of the British Broadcasting Corporation.

THE NEW AC TUBES

Everybody should have on hand for ready reference full data on the new AC tubes. The filaments of these tubes are heated by alternating current from a step-down transformer and anybody having AC can put these tubes into a set by making some wiring changes. Those who have AC and who are about to build a set also should possess this full information. Send 15c for the June 4 issue that contains the data on the AC tubes and also on two new rectifier tubes for B eliminators. Radio World.



In Fig. 1, the standard method of connecting a variable grid leak and condenser is diagrammed. The leak is shunted across the condenser, which may have a value of .0001 or .00025, the leak and condenser being connected in series with the grid post of the detector tube socket and the high potential point of the secondary winding. In Fig. 2, the method, when using a gang variable condenser, with a common rotor and an —01A tube, is illustrated. The condenser is connected between the coil and the G post of the socket. The leak is, however, connected between the G post of the socket and the plus A post. This is due to the amplifier tubes requiring a negative return, while the detector tube requires a positive return. Of course, connecting the actual grid return of the coil to the plus, would cause a short, since it is connected to the rotor of the condenser, which is common to the other minus returns. The last diagram, Fig. 3, shows where to connect the grid return, when the special detector tube, e.g., —00A is used. The leak and condenser are connected in the same way as in Fig. 1. The grid return is however brought to the minus F post of the socket, thus giving the tube a zero grid bias. The Bretwood variable grid leak and bullet condenser are shown.

A Tube Microammeter Using a Milliammeter

By Hudson Sande

It is often desirable to measure small currents accurately, currents so small that they cannot be measured with a milliammeter. Such currents can only be measured with a microammeter of a galvanometer. But either of these instruments is expensive and the average fan cannot afford to keep or procure one. But this fact need not deter him from measuring small currents, because he can improvise an accurate microammeter with apparatus he already has. A milliammeter of fair sensitivity and an ordinary vacuum tube are the main ingredients of this meter.

The first thing to do in setting up a microammeter of this type is to obtain a plate current, grid voltage curve of the tube which is to be used. This curve is essential. The tube should later be used with the same filament current, the same plate voltage, the same milliammeter as were used in taking the characteristic curve. What this curve tells is the actual grid voltage when a certain plate current is flowing.

When the curve has been taken the circuit is changed slightly. The polarizing battery is removed and a resistance R is substituted. This resistance should be accurately known. The small current to be measured is passed through this resistance by connecting the source across its terminals. The completed circuit is then as shown in Fig. 1.

The first observation is made on the plate current of the tube when the grid voltage is zero. This is obtained by connecting the grid to point (1), where the voltage is zero. This reading is taken merely to check up on the tube to make sure that the conditions are the same as they were when the characteristic curve was taken. If the plate milliammeter does not read the same as it did when the curve was taken an adjustment should be made, correcting whatever has changed.

The second reading is taken with the grid connected to point (2). Suppose that the plate meter now gives a reading of 3 milliamperes. The reading is different because the grid voltage has changed by the voltage drop IR in the grid resistance R. What is the value of IR? That question is answered when we learn from the characteristic curve what the grid voltage is when the plate current is 3 milliamperes. The curve gives the value of the grid voltage as —3.1 volts. This is the voltage drop in the resistance R since we started from zero. We then have the equation IR=3.1 from which to determine I. The sign of the voltage can be disregarded. Now if the known resistance has a value of one megohm, the current through the resistance is 3.1 microamperes. If the resistance is half megohm the current is 6.2 microamperes, and if the resistance is 1,000 ohms, the current is 3.1 milliamperes.

Sometimes the current through R is the actual grid current, since the grid takes current when the bias is positive or even when it is a fraction of a volt negative. The same method of measuring the grid current can be used. Suppose that the grid return be so connected that the apparent grid bias is 5 volts positive. The plate current might be 6 milliamperes. What is the actual grid bias when the plate current is 6 milliamperes? The curve shows it is .1 volt positive. The voltage drop in R is then —4.9 volts, since 5+IR=.1. Therefore the current through the grid leak resistance is 4.9 microamperes when the value of the resistance is one megohm. The grid current prevents the grid from going very much positive. This is true even when fairly high positive bias is applied.

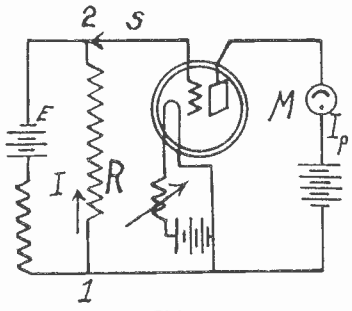


FIG. 1

Diagram showing how to connect up a vacuum tube and a milliammeter so that a very small current (1) through a resistance (R) can be measured. The actual grid voltage corresponding to any plate current (Ip) is read off the characteristic curve of the tube. This is the voltage drop in (R). The drop divided by the known value of (R) gives the current (I).

Human Body As Aerial And Ground Works Well

The human body was used by a Westerner to tune in Lindy's welcome in Washington. J. Gordon Reed of Oakland writes to KGO of this novel reception as follows:

"I wanted to hear the Lindy broadcast, but my aerial was down. Remembering the body to be a conductor of radio energy, I took some copper wire, attached it to the antenna binding post, and placed the other end in my mouth. Then I sat on the radiator, making the ground connection. The program came over clear with loudspeaker volume.

"When I had another party take the ground wire in his hand the volume was so great I had to adjust the rheostat. Thus I received the program on the Pacific Coast through KGO, one man acting as ground and myself doing duty as the antenna."

The stunt may be well applied when your in the country, with your portable receiving set. The earth is used as the ground.

Primary Rheostat Aids Good Voltage Regulation

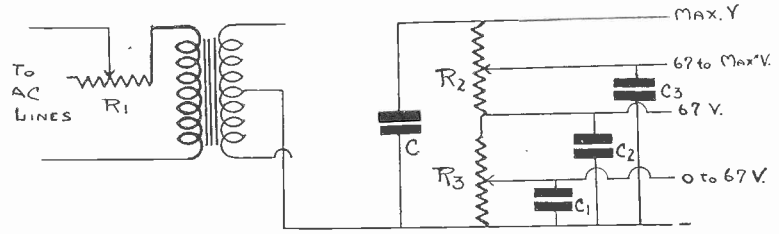


FIG. 1

Circuit illustrating how to hookup two Centralab potentiometers and a power rheostat for voltage control from a B elminator. R1 is a 250-ohm power rheostat. R2 is a 5,000-ohm potentiometer and R3 is a 8,000-ohm potentiometer. C1, C2 and C3 are all 1 mfd. fixed condensers used for bypassing.

Good B power voltage regulation is necessary for good receiver performance. Most sets control volume by reducing the B drain of the RF tubes. Either filament control or a plate circuit variable has this effect. Where a series high resistance is used for B voltage regulation, the value will be about 25,000 ohms. A change in the amplifier current drain of one milliampere will make a change in amplifier pressure of 25 volts. With the new-wire wound potentiometers, as in Fig. 1, only about 2,000 ohms are in series with the amplifier. A change of one milliampere in amplifier current will then cause a change of only two volts in amplifier pressure. To further insure perfect control on the output, a power rheostate may be inserted in series with primary of the power transformer, as shown in Fig. 1.

LIST OF PARTS

R1—One Centralab 250 ohm power rheostat
R2—One Centralab 5,000 ohm potentiometer
R3—One Centralab 8,000 ohm potentiometer
C1, C2 and C3—Three 1 mfd. fixed condensers

Melton, of WSM Fame, Now With Roxy Gang

James Melton, for the past year and a half engaged at various intervals in broadcasting from WSM, Nashville, Tennessee, is now a feature soloist at the Roxy Theatre in New York and appears regularly with Roxy's Gang which broadcasts from WJZ on Sunday afternoons and Monday evenings.

Mr. Melton is the possessor of a tenor voice of excellent quality and has been received with much favor by music critics. He has been for some time a student of Signor G. S. DeLuca, head of the Voice Department of Ward-Belmont Conservatory of Music, of Nashville.

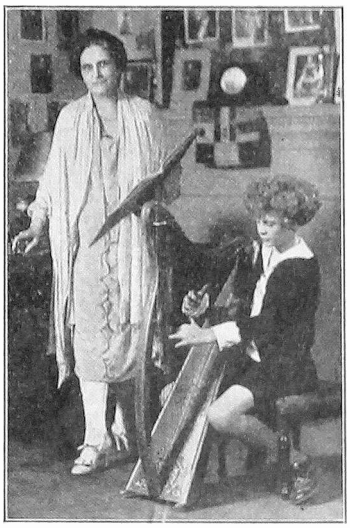
SPLITDORF ANNOUNCES SPEAKER

Splitdorf Radio Corporation announces the Splitdorf Cone Tone, a new loudspeaker of attractive design, with certain features differentiating it from current apparatus. It is 22 inches wide by 25 inches high.

S-S-SH! ORIENTAL WISEACRES WARN!

SANKA, THE SEER, and the musical Sanka Mystics, who collaborate in the unique program given by the Sanka Coffee Company, from WEAF every Tuesday at 7:30 P. M., EDST.

BOY IS HARP VIRTUOSO



"MOTHER" STONER and David Vivian, harpist virtuoso, who are heard in the Royal Rhythmic Rhyme and Reason program, through the red network of the National Broadcasting Company, every Friday at 5 P. M., EDST.

Three N. Y. Stations Pick Site in N. J. Town

Washington

Responding to two applications received from New York broadcasting stations for permission to move their transmitting apparatus from New York City to Secaucus, N. J., O. H. Caldwell, member of the Federal Radio Commission, sent a telegram explaining that no action could be taken until a full quorum of the Commission is present in Washington.

Father James F. Cronin, manager of WLWL, owned by the Paulist Fathers, was the recipient of the telegram. An application similar to that of WLWL was recently received from Franklin Ford, who manages WHAP, New York City. About a month ago permission to remove its transmitter from the roof of the Hotel Majestic in New York City to Secaucus, N. J., was granted Station WGL.

Following is the full text of the telegram to Father Cronin:

"Approval Secaucus, N. J., site cannot be granted without quorum of Commission, available about July 24. Site selected should be at least one wave-length distant from WGL, now under erection at Secaucus. For your information, WHAP also negotiating for Secaucus site. Believe you should all three agree fully before proceeding."

May Export Report

A rise in the export values of electrical equipment is noted for May in the monthly compilation by the electrical equipment division, Department of Commerce. Radio equipment shared in the increase.

The full text of the statement follows:

"May exports of electrical equipment at $8,835,563 show an increase of $1,371,265 over May, 1926, and $153,605 over April of this year.

Exports of radio apparatus registered a $262,252 increase during May of this year as compared with the same month a year ago but decreased $58,361 as compared with April of this year. There was a gain in receiving sets and receiving set components and accessories but a decline in tubes and transmitting sets and parts."

Buick Uses 3 Big Chains Same Night, Sets Record

For the first time in the history of the National Broadcasting Company its facilities have been engaged on a nationwide scale for the distribution of a "sponsored program" to all three of its networks, the "Red," "Blue" and "Pacific," on the same evening, officials of the company announced. These three networks, estimated by N. B. C. officials to be capable of carrying radio presentations to every listener in the United States, will be utilized on Saturday evening, July 23, for the distribution of three separate and distinct special programs sponsored by the Buick Motor Company of Flint, Michigan.

Each of the three networks maintained by the National Broadcasting Company will distribute to its associated stations, the total numbering 40, a radio presentation of one hour's duration direct from the studios of the "key" station of each chain.

The Blue Network, headed by WJZ, New York, will broadcast from 9 to 10 P. M., Eastern Daylight Saving Time, a program featuring Arthur Pryor and his band.

The Red Network, with WEAF, New York, as its "key" station, will function from 10 to 11 P. M., Eastern Daylight Saving Time. "Roxy" will give a "super-presentation" for the occasion. Of interest in this connection is the fact that "Roxy" announces that the fee which he is receiving from the Buick Motor Company will be turned over to charity.

The Pacific Network, consisting of seven leading broadcasting stations on the Pacific Coast and in the Northwest, will simultaneously broadcast a sixty-minute radio presentation from 9 to 10 P. M., Pacific Time (12 P. M. to 1 A. M., E. D. S. T.), direct from the National Broadcasting Company's studios in San Francisco.

Message Communication Established to Manila

Radio communication was recently established between the United States and the Philipines by the Radio Corporation of America. General James G. Harbord, president of the R. C. A., sent the first messages of greeting to Manuel Quezon, president of the Philippine Senate and Colonel C. H. Nance, vice-president of the R. C. A.

The greetings of General Harbord were transmitted by wire from New York to San Francisco, and then sent over the direct radio circuit to Manila. The transmitting station at the Philippines is stationed just outside Manila, on an eight-acre tract of land. The short short-wave transoceanic and marine transmitters, as well as a broadcast transmitter which supplies the Philippines populace with regular program service, are housed here. Two steel towers, 300 feet high and 700 feet apart, support the antennae used for the marine and broadcasting service. Four steel towers, 165 feet high and 290 feet apart, support the antennae of the transoceanic set.

Weaning Away the Rattles

A Discussion of Parasitic Effects In Speakers

By H. B. Herman

Acoustical Expert

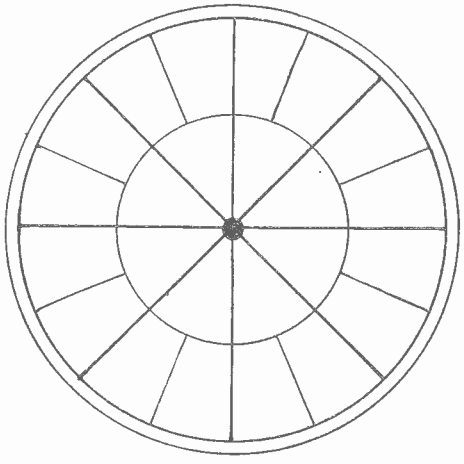


FIG. 1

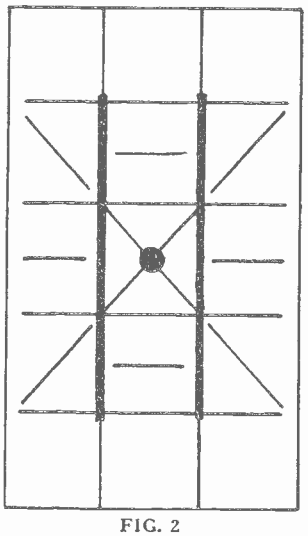


FIG. 2

The radial method of ribbing the radiating surface, particularly suitable for circular structures in which there is no pronounced grain in the material. (Fig. 1, at left.) The edge of the circle is supposed to be comparatively rigid and the driving force is supposed to be applied in the center of the black spot. The midway ring may represent the outer periphery of an inner strengthening circle or it may be a circular rib. Fig. 2, at right, illustrates one way of ribbing a rectangular radiating surface made of Lata Balsa wood. There are four long crosswise ribs running three-fifths the length of the surface. Then there are two lengthwise ribs on top of these, designed to distribute the vibrations to the crosswise ribs. The driver is connected to the center and the force is communicated to long ribs by cross ribs. The short crosswise and diagonal ribs are intended for breaking up parasitic vibrations.

THE search for the perfect loudspeaker goes on unabated. Apparently it will go on for some time to come. It seems that most speakers have some objectionable features, though many of the present speakers when operating in conjunction with a good audio amplifier are very good.

Sound radiation efficiency at low frequencies is one of the aims which experimenters strive to attain. They have found that one of two conditions must be satisfied if the low frequencies are to be brought out. One of these is that the sounding board or radiator should be large, that is, it should be of the same order of size as the length of the sound wave which is to be radiated from it. The other condition is that the amplitude of the vibration of the radiator should be great. If the amplitude is great enough the radiation efficiency will be satisfactory even with a small sound board.

It is a rather simple matter to satisfy either one or both of these conditions. But it is not sufficient to have a loudspeaker which is efficient at low frequencies alone. It must also be efficient and faithful at the higher audio frequencies. If the speaker is made efficient at the low, it will be very likely deficient at the high. It will not do to make a speaker which is partial to either the high or the low.

Great Mass Lags

The mechanical impedance of the sounding board has a great deal to do with the efficiency of the radiator at different frequencies. If the vibrating mass of the radiator is very great the sounding board cannot follow the higher frequencies. These frequencies are suppressed by a heavy mass just as they are suppressed by a high series inductance. Hence to bring out the high notes the sounding body must be very light. The low notes will be brought out very well even when the vibrating body is heavy, rather than because of the fact.

It is also necessary to have some rigidity in the sounding board. But if this rigidity be too great it will be impossible to bring out the low notes. No appreciable amplitude can be imparted to the sounding board by the driving unit. Hence to bring out the low notes the rigidity must not be too great. The high notes will be brought out well when the radiator is fairly rigid. The effect of rigidity of the radiator is similar to the effect of a series condenser.

Must Compromise

It is obvious that if a single speaker is to handle both the high and the low notes fairly well a compromise is necessary. The radiator must be made light in weight and at the same time rigid. This combination of lightness of weight with fair rigidity is equivalent to a series circuit of a small inductance and a large condenser. Such a circuit offers no extremes in reactances and neither does the sound radiator.

The amplitude of vibration is usually limited by the structure of the driving unit. The amplitude cannot be greater than the distance between the armature and the pole pieces of the driver. This distance in turn cannot be made very large and retain the sensitivity of the unit. This limiting condition leaves us only the size of the radiator to play with. It must be made large if the low tones are to be brought out.

When the sounding board is made large it is difficult not to gain size at the sacrifice of rigidity or the increase of mass. It is usually better to increase the mass and gain rigidity than the reverse. To make the sounding surface large and flexible favors the low notes too much and militates against the high to such an extent that they are almost absent. But the high notes must be present for intelligibility. Therefore we must maintain the rigidity even if mass has to be added to get it.

Why a Cone Is Used

The object of the conical structure in speakers is to get rigidity out of a very light material of large radiating surface. But the conical structure is not the only way to compromise, though it may be the simplest. The method of ribbing in a flat structure can also be used to good advantage, as in the Lata Balsa wood speakers. The ribs serve to distribute the force applied at a point over the whole surface.

Flexibility in the radiating structure is ruinous to radiation efficiency. An extreme case of flexibility is an elastic rubber membrane moderately stretched over a drum head. If a loudspeaker unit is coupled to this no more sound will be radiated than that radiated by the moving parts of the unit itself. The rubber is only moving at a point. Stretch the rubber a little more and the radiating efficiency is slighly improved. Substitute a stretched animal membrane for the rubber and the radiating efficiency is still more improved. Now if very light but rigid ribs be cemented radically to the membrane and the driving rod of the unit be connected firmly to the common center of the ribs without adding appreciable weight to the assembly, the radiation efficiency will be very good. Do the same with light and very thin wood and the same radiation efficiency will be obtained.

Peaks at Various Points

The lighter and thinner the wood is, the more thorough will the ribbing have to be in order to distribute the force uniformly over the radiating surface. If the force is not well distributed the effect will be like the elastic rubber membrane, or very nearly as bad.

It is well known that most speakers have many frequencies of intense response, that is, natural frequencies of vibration. In some forms of structure these frequencies fall at simple harmonic intervals, while in others they fall at intervals which are not simple harmonic but of more complex relationship. If the response at these frequencies is not greatly exaggerated it is not noticeable except by measurement, but if it is very intense, unpleasant blasting and overloading of the speaker will result. The intensity of the response at the various natural frequencies of vibration will depend on the rigidity and the mass of the vibrating body as well as on the radiation efficiency or power absorption of the radiator.

If the mass of the radiator is great and if the stiffness of the structure is also

(*Continued on next page*)

Earpieces as Microphones

May Be Used for Input to AF Channel

By Peter Mack

A SINGLE earphone can be employed, with excellent results, as a microphone. Phonograph music or voice can be reproduced through the audio end of your set in this way. Ways of hooking up the phone unit are shown in Fig. 1.

In all cases it is necessary to have a sensitive phone unit, e. g., a pair of Frost fones, while the diaphragm must vibrate very freely. When speaking, the unit should be placed quite close up to the mouth. When using the phonograph, the unit should be placed as far in the sound box as possible. Otherwise nothing will be heard.

In the top diagram of Fig. 1, the simplest way of hooking up the unit is shown, e. g., by just connecting the phone cord tips directly across the P and B post of the transformer. This may also be the input circuit of a resistance, impedance or double impedance audio circuit. Below this circuit diagram to the left, the exact connections are exemplified. To the right of this circuit, the connections for a double circuit jack which can be used in for the insertion of the phone unit are shown. The last circuit on the bottom shows how two double circuit jacks may be utilized, one for inserting the phone unit at the audio input and the other for inserting a pair of phones for listening in at the detector output. When using these double circuit jacks, the connections to the inner and outer terminals should be made carefully. The outer terminals of the double circuit jacks used for the purpose of connecting in the phone unit as a mike, always go to the input posts of the amplifier. In the circuit, where the detector output is being listened to, the outer terminals are brought to the plate post of the socket

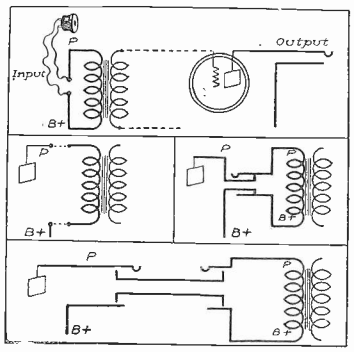


FIG. 1

How a phone unit, used as a mike, is hooked up to the input circuit of audio amplifier.

and to the B plus post of the battery. The inner terminals of both jacks in this arrangement are connected together.

Should you find that the signals are not loud enough, apply more B voltage to the plates of the tube. Do not expect good results, unless you use at least two stages of transformer coupling, or three stages of any other type of coupling. A power tube in the last stage, will not only boost the intensity of the signals, but also help to clarify it to a great extent.

The leads from the phone unit should not be too long, for the longer they are the more energy you use, and consequently the more B voltage it is necessary to apply.

WBAL Broadcasting Amplified in Park

Baltimore.

Extending its programs to include the outdoor public, WBAL broadcasts to one of Baltimore' biggest parks, so that 10,000 persons there hear the musical features.

A few weeks ago WBAL, of which Frederick R. Huber is director, purchased an amplifying system, known technically as a No. 1 Public Address System.

The first big event which Baltimoreans generally were enabled to enjoy via this amplifying system was the inaugural ceremony of Mayor William F. Broening, last May. This civic ceremony was amplified with much satisfaction.

Announcement that the first radio park concert in the history of the city would take place, attracted wide attention and the musical experiment was watched with interest. As a special feature for this initial park radio concert, Mr. Huber arranged a patriotic program, with singing by a male quartet; also a violin recital.

Four Here, Three There, Daily Ocean Phoning

London.

About three calls a day are now being made from London and vicinity on the trans-Atlantic telephone to America. From the United States, about four a day are made. It is said expenses are being met, but that profitable business soon will be attained.

Sectional Vibration Chief Cause of Rattles

(*Continued from preceding page*)

very great, the response at the various natural frequencies of vibration will be exaggerated. On the other hand, if the mass is small and the structure is not too rigid the responses at the natural frequencies will be only slightly greater than at other frequencies.

The Case of Rattles

Power losses due to friction of various types will help to smooth out the response characteristic by cutting more off the peaks than off the troughs. These losses may be in the form of electric resistance in the wiring, in eddy current losses in the magnetic structure, of friction in the vibrating material.

As is well known, rattles develop in many sounding surfaces. It is the custom to attribute these either to blasting of the speaker unit or to loose parts in the sounding board. They are almost invariably due to sectional vibration of the sounding body, and they correspond to parasitic resonance circuits in complex hook-ups. For example, at some frequency the inductance of a coil may form a resonant circuit with its own distributed capacity or with some other capacity with which is is coupled. Again, the dead end turns of a radio frequency coil may form a power absorbing circuit because their inductance and distributed capacity will resonate with some frequency impressed upon it in some manner. It may be a harmonic of the frequency to which the main coil is tuned. The rattle in the speaker is due to the fact that some portion of the unit or the sound board resonates with the frequency at which the whole should vibrate as a unit.

The Location of the Rattle

This form of rattle is invariably heard when a flat piece of wood of large dimensions is the sounding board. It can also be heard frequently in paper cones and cylinders used as radiators. Usually when the latter are used the frequency at which the rattle is likely to develop is much higher than when a heavier wooden board is used as the radiator. In either case it is usually possible to detect what part of the radiating surface which is responsible for the mutinous vibration. It is then a simple matter so to rib the offending section as to break up the vibratory tendency. The rattles will disappear.

When the driving rod connecting the unit with the sounding board is long and slender it will sometimes vibrate transversely. This vibration of course will be communicated to the sounding board and a rattle will develop. This can be remedied by rapping a little rubber or friction tape around the driving rod. It can also be stopped by shortening and stiffening the rod, if that is possible.

In ribbing wood sounding boards to stop parasitic vibrations due attention should be paid to the grain of the wood and to the direction of the vibration. The disturbance is not likely to occur lengthwise with the grain because the structure in that direction is stiff, but is more likely to occur across the grain where the stiffness is less. The ribs then should be placed across the grain of the wood in those sections which happen to be unruly.

Where Center Should Be

It is also well to remember that the point of application of the driver unit is the source of the sound and that ribs should be placed radially with respect to this point. The requirement might modify the crosswise placement of the section ribs somewhat. Therefore, in some cases the section ribs would be placed diagonally with the grain.

In the case of paper sounding boards there may or may not be a grain which must be considered. If there is any grain it will not be so pronounced as to require a change in the direction of ribbing. The radial direction with respect to the point of application of the loudspeaker unit is the main consideration.

SIXTH YEAR

RADIO WORLD

The First and Only National Radio Weekly

Member, Radio Publishers Association

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

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

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

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

Noon-Time Orchestra Surprisingly Popular

Chicago.

The fallacy that there are very few radio listeners at "noon" has been brought home by WBBM, Chicago. Several weeks ago the station began its noon program which opens at twelve-forty Chicago time and continues until 2 P. M. The outstanding event on the program is the playing of Gus C. Edwards and his orchestra from the Terrace Gardens. On this short program the orchestra presents some forty minutes of the latest dance selections.

The public response to this program has been beyond the greatest expectations of the station. Never was more fan mail received on any program of like duration presented during the most popular evening hours. The country folk, smaller towns and the surrounding cities are equally enthusiastic over the noon-day broadcast—and so of course WBBM, Chicago, will continue this popular feature.

DIFFERENCE OF OPINION

There is a difference of opinion as to whether a more practical way of building a resistance coupled amplifier is by using smaller condensers and larger grid leaks or smaller grid leaks, and larger condensers,, some favoring condensers of .006 mfd., because they produce only a 10% cut-off of 30 cycles, and others preferring higher values of capacity because of the greater facility for changing the value of the grid leak to meet a required condition.

Dead Spot of Stations Is Still a Live Issue

By Carrol J. Burnside

Staff Engineer, Westinghouse Electric & Mfg. Co.

Generally speaking, the reason for broadcasting is to gain an audience. The idea is much the same as that behind a newspaper. The paper prints news and other interesting information to draw the attention of the reader and gain an audience with him, so that advertising or news of commercial value may be set before him in a pleasant and inviting way. So it is with the broadcaster.

He gains the atention of the public and pleases by means of entertaining and educational programs and then commercializes this attention by advertising in an agreeable and engaging way.

The value of the newspaper as a commercial medium lies in its audience, its circulation. And in the case of the broadcasting station its value lies in the size of its audience, its "coverage"—the territory over which it can be reliably heard.

Station Must Reach Out

Good programs, well presented, are worthless commercially if they do not reach the listeners. Therefore, coverage is important above all else. It is useless to go on with the play if the curtain is not raised, even though the house be "sold to the doors."

Coverage depends upon the power of the broadcasting station and the density of population of the territory surrounding the station. These factors can be taken into consideration when the station is erected but there is one "joker" to the proposition that never shows up until the station is completed and in operation. That is the elusive "dead spot." Because of this phenomenon the broadcasting stations whose programs are heard in foreign countries are sometimes unheard in certain localities only a few miles distant from the station.

Reason Still a Mystery

Why? Well, at present no particular reason for these so-called "dead spots" has been demonstrated. Several theories have been advanced to prove that the cause may be laid to mineral deposits at or near the dead spot, radio "shadows" caused by mountain ranges, etc. over the dead spot, and other ideas, numerous but unsubstantiated. But, while the reasons and proofs are lacking, the "dead spots" are very much in evidence. The solution is not to worry about why they are present, but how to get around their detrimental effects .

In 1921 the Westinghouse Electric and Manufacturing Company erected its New England station, WBZ, in Springfield, Mass. This station was to have the New England states for its coverage, as well as adjacent Canadian provinces. The station met with popular approval and its signals were often heard in every State of the Union and province of Canada.

Dead Spot in Boston

The coverage was much better than expected, except for one spot and this, ironically, was the most important and densely populated spot in New England—the City of Boston. WBZ's signal, while loud and clear on all sides of this great city, was weak and unreliable on the loudspeakers of the listeners in Boston.

First, the power of WBZ was increased and though this added to the reports of reception in distant places it did not appreciably affect the reception in Boston. The final solution to the problem was an engineering feat of no small importance. A second station, WBZA, was erected with only sufficient power to reach the listeners of Boston. The program being sent out from WBZ in Springfield was simultaneously transmitted from WBZA so that Boston was receiving the program sent out by WBZ, but the signal was actually coming from WBZA. This WBZA was just an auxiliary or "booster" station.

Congestion Caused Change

This booster was temporarily operated on a different wave-length than that of WBZ and the system then operated as two stations putting out the same program at the same time but on different frequencies.

About this time the wave-band crowding situation arose and the synchronization of WBZ-WBZA released the extra wave channel occupied by WBZA, yet, still retaining the advantage of this station's booster action.

Thus the first successful operation of two stations in synchronism on the same wavelength was achieved. WBZ in Springfield and WBZA in Boston are now operated in synchronism, transmitting the same program on the same wavelength simultaneously. Another so-called impossibility had been accomplished and another milestone in radio and scientific history had been passed.

Set to Every 20 Persons, Is Canada's Record

Ottawa, Ont.

Canada ranks second to the United States in the per capita ownership of radio receiving sets, according to figures compiled by the Radio Branch of the Department of Marine and Fisheries. There is one radio to every thirty persons in the Dominion, the department estimates, while the United States record is one to every twenty inhabitants.

Radio sets in Canadian homes number 300,000, a bulletin of the department sets forth. Radios in the United States total 6,000,000. Ontario leads in radio ownership, followed by the prairie provinces of Manitoba, Saskatchewan and Alberta. Settlers in pioneer areas keep in touch with centers of population by radios which have banished the traditional isolation of farm life.

There are fifty-five commercial broadcasting stations in the Dominion, according to the bulletin. In addition, the Government has established a chain of forty-eight coast stations on the Pacific, the Atlantic and the Great Lakes to provide communication facilities with 500 miles of the Canadian coast. These stations give aid to navigation, communicate with ships in distress and broadcast information to navigators covering weather forecasts, hurricane warnings, and dangers to navigation in particular areas.

Grateful Fans Send Logs to Commission

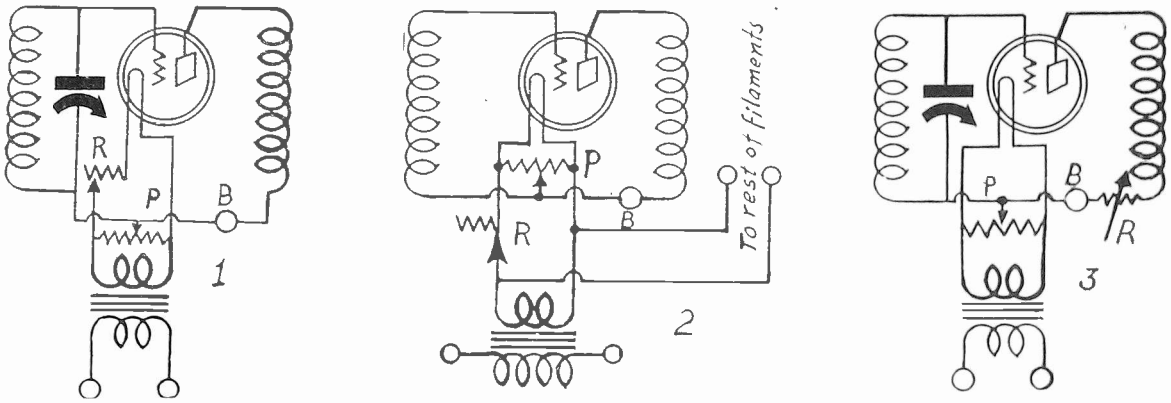
General conditions on the air have been improved considerably, according to advices received by the Federal Radio Commission. No radical changes are expected when licenses are renewed.

Many fans, especially the DX ones, are enthusiastic over reception at this time of the year. Many of them are sending in their logs to the Commission.

Volume Control in AC Sets

DC Practices Ruled Out In Most Cases

By Dragman Ferrup



A RADIO FREQUENCY stage in a circuit in which the filaments are heated by alternating current (Fig. 1). The rheostat R which is ordinarily used as a volume control cannot be used for that purpose when placed as in this arrangement. It unbalances the circuit and introduces hum. Fig. 2 is an arrangement of the volume control rheostat and the potentiometer that can be used because changes in the rheostat setting will not upset the balance of the potentiometer. Other tubes can be heated by the same transformer if the leads are taken off as shown. Fig. 3 illustrates a radio frequency stage with AC on the filament and a variable high resistance R in the plate circuit for controlling the volume. This method is not suitable because it will introduce hum.

THE methods used for controlling volume in sets operating with direct current on the filaments are not always applicable when AC is used to heat the filaments. Particularly, some of the methods for volume control which have come to be regarded as standard are not at all suitable when AC is used on the filaments.

Suppose that Fig. 1 represents a radio frequency amplifier using AC on the filament. B is the plate battery, P a potentiometer by means of which the potential of the mid-point of the filament is found, and R is a rheostat. Let us assume first that the rheostat is set with zero resistance in. Normal volume is the result. The position of the slider of the potentiometer is set so that there is a minimum of hum, that is, the slider is set at the electrical center of the potentiometer resistance, which is at the same potential as the mid-point of the filament.

Now it may be that the volume is too great and it must be reduced. One of the most satisfactory volume controls in a radio frequency amplifier operated on direct current is a rheostat in the filament lead by means of which the heating current can be cut down. Suppose we attempt to control the volume the same way in the AC heated set. As the slider of the rheostat R is moved, resistance is introduced in one leg of the filament circuit.

Balance Is Upset

The volume is cut down just as if the filament had been heated with direct current, but the potentiometer's balance is upset and a hum is introduced. The more the volume is cut down the worse is the unbalance and hence the worse is the hum. Not only does the rheostat increase the absolute value of the hum but also the relative value, because as the hum increases the volume decreases. This method of volume control is therefore wholly unsuitable.

An improvement in the rheostat method of control as applied to AC heated tubes is shown in Fig. 2. The circuit is essentially the same as shown in Fig. 1 except that the potentiometer has been placed above the rheostat so that a change in the setting of the rheostat does not change the balance of the potentiometer with respect to the filament. This method of connection limits the use of the potentiometer to a single tube. If the same heating transformer secondary winding is to be used for other tubes in the set, the leads for the filaments of these tubes will have to be taken off the transformers below the rheostat. Thus the same winding can be used for all the tubes in the set, provided that the rheostat is used for one tube only. Also, the rheostat method of volume control can be used provided that the potentiometer is connected above the rheostat. It also appears from Fig. 2 that a separate B battery will have to be used for the tube in which the volume is controlled with a rheostat. If not, true balance cannot be obtained.

The Plate Circuit Rheostat

One of the favorite methods of volume control in the radio frequency level is a variable high resistance in the plate lead to the tube. This method is shown for an AC heated circuit in Fig. 3. A true balance can be obtained for the RF tube by means of the potentiometer P, and a change in the setting of the plate resistance R will not affect the balance so long as the grid bias for any of the tubes in the circuit is not obtained from a voltage drop.

If a resistance is placed in the common plate return of several tubes the plate DC currents from these tubes will cause a drop in the resistance and this drop can be used as a grid bias. However, the common resistance will cause interaction between the several circuits which will give rise to a hum, or regeneration will take place in the circuit as a result of the coupling in the common resistance, and this regeneration will accentuate any hum present.

It might be pointed out that the arms of the potentiometer will constitute a common resistance of high enough value to cause hum, although this resistance cannot be used for obtaining a grid bias. There is one method of volume control apparently available in a set using AC on the filaments which is not available when DC is used, and that is control of the power in the primary of the heating transformer, as shown in Fig. 4. Three different methods can be used. The first is by means of taps on the primary winding. When it is desired to increase the volume the number of turns used in the primary is reduced, and conversely, when it is desired to decrease the volume the number of primary turns is increased. This method is not illustrated in Fig. 4.

The second method is to employ a rheostat in the primary winding, shown at R in Fig. 4. When it is desired to increase or decrease the volume, resistance is thrown out or in respectively, by means of R. This involves power loss, just as rheostat control does anywhere. The third method is the use of a variable inductance choke coil in the primary, as Ch in Fig. 4. The primary current can be throttled down to any desired value by means of this variable choke and the volume controlled accordingly. The advantage of using a choke coil in this manner is that the volume can be controlled without loss of energy.

At first though it would seem that one of the three methods of controlling volume by varying the primary current would be ideal. But not so, not unless the transformer so operated supplied the filament current for a single tube. If the transformer also supplied the filament current for the other tubes in the circuit as well as the power for the B eliminator, any operation on the primary current would affect the filament currents in all the tubes in the set as well as all the plate potentials. To control volume by throttling down the filament current in the audio amplifier tubes is the worst way it can be done. To control volume by reducing the plate potentials is not much better. Hence the method for volume control that seemed so satisfactory at first

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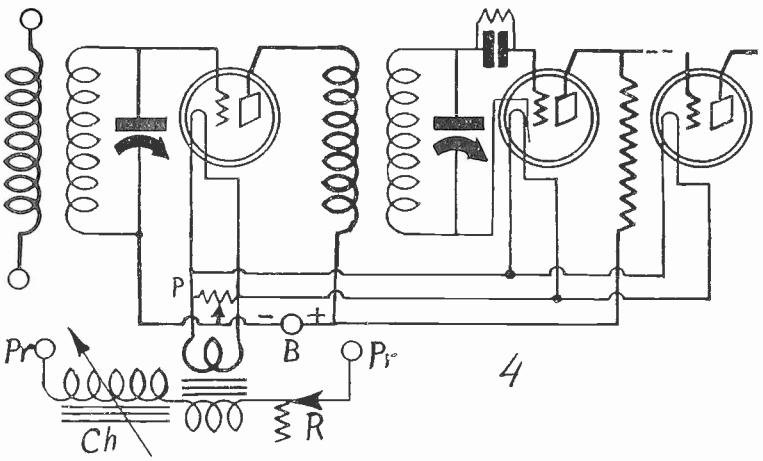

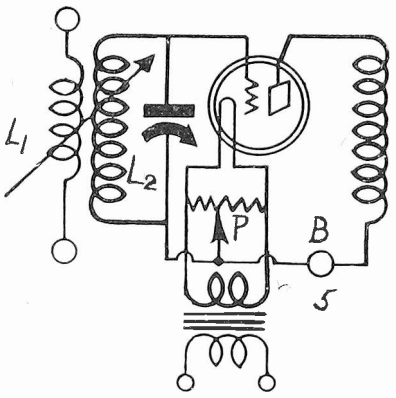

THE volume in a receiver in which the filaments are heated by AC can be controlled from the primary of the supply transformer as shown in Fig. 4. Three variations are available. The first is by means of taps on the primary of the transformer, not shown, the second is by means of a rheostat R, and the third is by means of the variable choke coil Ch. Any one of the methods can be used for varying the primary current and hence for varying the output power. Fig. 5 depicts a very good method of controlling volume in a set using AC on the filaments. L1L2 is a variocoupler. By adjusting the coupling between the two coils any desired volume can be obtained without introducing any undesirable effects.

(*Concluded from preceding page*)

is really not available at all unless a transformer is used separately for the filament current of the radio frequency amplifier alone.

Any successful volume control, whether in DC or AC sets, should be so arranged that the filament currents and the plate potentials of the audio frequency amplifier tubes remain unaltered when the control is adjusted. Only the grid AC potentials should be altered.

In Fig. 5 we have the radio frequency stage of a circuit in which the filaments are heated with alternating current, and in which a suggestion is made for controlling the volume without tampering with the filament currents or the plate potentials. It is simply a variocoupler between the antenna and the first tube. The coupling between the antenna coil L1 and the tuning coil L2 can be made as loose or as close as desired, within reasonable limits, of course. By means of this control it is possible to vary the radio frequency input to adjust the volume to almost any desired value without in the slightest altering the filament current and the plate potential. Only the signal level is changed when the coupling is changed.

The variocoupler has long since passed out of popularity and therefore not many will take kindly to the suggestion. Most persons probably will dismiss it as a retrogression. Nevertheless the scheme works where many other and more popular devices fail.

Why Shielding is Necessary

If the variocoupler method of control is to be successful, certain precautions must be observed. The variocoupler controls the amount of energy that is transferred from its primary to its secondary. It does not control the amount of radio frequency energy that gets to the detector. The precaution necessary in building the set is to see that the detector does not get any radio frequency energy from stray sources. In other words, if the variocoupler is to be successful as a volume control the circuit as a whole must be completely shielded from external radio disturbances, except the antenna and ground. Not only should the set as a whole be shielded but if there are several radio stages in the receiver, each one should be carefully shielded from the rest. The response of the volume to changes in the coupling between L1 and L2 depends directly on the thoroughness with which the shielding has been done.

One method of volume control which is not available when AC is used is the potentiometer for varying the grid bias. That is fortunate. This method of volume control is used particularly in Super-Heterodynes.

But there is one method of controlling volume which is equally applicable to sets operating on AC and on DC on the filaments. That method is the high resistance potentiometer in the grid circuit of one of the audio tubes. It should be placed in the grid circuit of the first audio frequency tube in the circuit. It should have a total resistance of .5 megohm or more. It is best used in the audio end of the circuit, but if the receiver is a Super-Heterodyne, and an additional control is necessary, one can also be placed in the grid circuit of the first intermediate frequency amplifier.

It is not recommended in any of the radio frequency stages, although it will work there too. It will not work so well at high frequency because of capacity effects which tend to short-circuit the radio frequency circuits.

Radio Gets Big Credit for Hawaiian Flight

Persons interested in aviation as well as the general public hailed the successful flight by Ernest L. Smith and Emery B. Bronte, civilian pilots, from Oakland, Cal., to one of the Hawaiian Islands as a triumph of modern mechanism and science. It was further evidence of the reliability of modern planes, of motors, of navigating equipment, and of radio.

Lloyd Bertaud, who is preparing to fly to Rome in the Fall in a multimotored plane: "What stands out about this flight is the way radio showed what it could do. Wherever Smith and Bronte landed they would have done a good job, considering the work of the radio. I am completely sold on radio and would not think of making a flight without one. Radio and an adequate cruising margin in the case of adverse weather are the two most important factors in long-distance flights."

Elmer Sperry, inventor: "This flight emphasizes the importance of radio equipment in long flights."

Captain Rene Fonck, French war ace, who plans a flight to Paris in a heavy multimotored plane this Fall: "The radio is one of the most important adjuncts of a transoceanic flight and will have its place on my Sikorsky plane when I fly over in a few weeks. There is no question that, if these men had come down at sea as reported, the radio would have meant the saving of lives."

Walter Hinton, pilot of the U. S. Navy seaplane that made the first transatlantic flight in the Spring of 1919: "The future of air navigation depends on radio, and Smith and Bronte's flight vindicates this belief. The radio is of far more importance in aerial navigation than it is on ships because the danger from a plane wreck at sea is greater than the danger from shipwreck. In passenger airplanes traveling over great distances the radio will be used as a means of communication with ships and land; but its real importance lies in its use as a means of determining direction and bearings."

Chance Vought, airplane manufacturer: ". . . As important as anything are the instruments used in this sort of navigating, and radio is one of the most important, if this flight is any criterion, and I think it is."

WHAM in New Home To Use 5,000 Watts

Rochester.

With the work on the huge antenna masts and the operating quarters for the new broadcasting station of WHAM (Stromberg-Carlson Telephone Manufacturing Company) being rushed to completion on Phillips Hill, near Victor, fourteen miles from this city, the arrival at the site of a carload of new equipment was accompanied by an announcement that the new station will employ five kilowatts of power (5,000 watts).

The Federal Radio Commission has granted the construction permit for the erection. It is expected that the new station will be on the air by the middle of next month.

Radio University

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

When writing for information give your Radio University subscription number

INFORMATION regarding the three-tube regenerative set using a loop, described on page 18 of the June 25 issue of RADIO WORLD, is desired.

(1)—Is the rheostat inserted in series with the minus A, minus B lead?

(2)—Could an —01A tube be used in the first AF stage and a 112 in the second? Using this combination, what B and C voltage, would you suggest?

(3)—Could the variable condenser in the grid and plate circuits be placed on a common shaft?

(4)—Is it possible to use a loop, which is untapped, the tap being made?

—CHAS. HARTELLMAN, Falkland, N. C.

(1)—Yes.

(2)—Use one hundred and thirty-five volts on the plate of the —01A tube and use a nine volt C battery. Use one hundred and fifty-seven and one-half volts on the plate of the 112 and a ten-and-one-half-volt C battery. The same B and C voltage as used for the —01A may also be used for the 112, the volume being only a trifle less. Be sure that the rheostat is capable of passing one ampere.

(3)—No.

(4)—Yes.

* * *

I HAVE a five-tube set. In it, a regenerative radio-frequency amplifier, a non-regenerative detector and two stages of transformer coupled audio amplification are used. The results are good. I would, however, like to get more distant reception. Would you suggest adding another radio-frequency amplifier tube?

—L. J. MULWARD, Atlantic City, N. J. No.

* * *

WHERE CAN I get reliable information on how to design radio frequency coils, how to calculate the inductance of coils and how to measure the efficiency of tuned circuits?

—FRANCIS TALLEY, Seattle, Wash.

In Bureau of Standards Circular No. 74, which can be obtained for 60 cents from the Superintendent of Documents, Government Printing Offices, Washington, D. C.

* * *

I HAVE a Superdyne receiver which has given me god service for several years, but now I desire to bring it up to date. Will you kindly give me your suggestions how to improve its selectivity, sensitivity, and the quality of reproduction.

(1)—Which are better, SLF or SLW condensers?

(2)—How can I increase the sensitivity of the receiver without adding more stages?

3)—Will transformer coupling in the audio amplifier give me good quality if I use up-to-date transformers?

(4)—Is it necessary to use a grid bias to get the best results out of the receiver?

—SHELDON WILSON, Emporia, Kansas.

(1)—There is no difference between the two types of condensers as far as efficiency is concerned, but it is somewhat easier to tune in short wave stations with the SLF condenser.

(2)—By using some form of regeneration and by employing higher plate voltages on the amplifiers.

(3)—Yes.

(4)—Absolutely.

See Fig. 554 for a good diagram to follow in rebuilding your receiver.

* * *

I HAVE a five-tube battery operated receiver which has worked fine for several years, but recently it has lost volume and at times it howls loudly. What can I do to restore it to its former condition?

—DAVID A. FRANKS, Winnipeg, Manitoba, Canada.

The loss in volume is no doubt due to a gradual decrease in the efficiency of one or more of the tubes. Replace with new tubes. The howling is probably due to the combination of exhausted tubes and exhausted B batteries. A large by-pass condenser, at least 1 mfd., across the plate battery, should stop the squeal.

* * *

I AM contemplating building a portable receiver to entertain the gang in camp this Summer but I am undecided what type of receiver to build. Will you please answer the following questions to help me decide?

(1)—What is the best type of circuit to use for reliable reception of stations about 100 miles distant?

(2)—Can dry cell tubes be used throughout the receiver? Is it necessary to include power tubes?

(3)—Which is better, a loop or an antenna for picking up the signals?

—JOHN CLIFFORD, Bronx, N. Y. City.

(1)—The Super-Heterodyne is the best type for portable use because it is the most sensitive and selective.

(2)—Yes, you can use dry cell tubes throughout. A UX120 tube may be used in the last stage.

(3)—An open circuit antenna always picks up more energy than a loop and is therefore preferable when extreme sensitivity is required. It is much easier to install a first rate open circuit antenna in camp than it is in a crowded city.

* * *

WHAT is the best intermediate frequency to use in a Super-Heterodyne receiver? I have decided to build such a receiver but don't know what intermediate transformers to use.

—CHARLES HUBBARD, Houston, Texas.

The choice of intermediate frequency is always a compromise. The lower the frequency, the greater is the amplification. Hence a low frequency is desired. It cannot be lower than about 20,000 cycles because lower frequencies are audible. When low frequencies are used the receiver becomes too selective, yet more interference is encountered. Hence high frequencies are gaining in favor. Frequencies lying between 60,000 and 150,000 cycles are suitable, with 110,000 a satisfactory frequency in New York City.

* * *

I HAVE a five-tube resistance coupled receiver built according to the plans of a well-known manufacturer. At first this receiver gave excellent results and the quality was all that could be desired. But recently it started to stutter. What can I do to make the set work right again? I use 180 volts of dry cell batteries on the circuit, with 45 volts on the detector.

—EDWARD HIGGINS, Boise, Idaho.

You are experiencing the trouble called "motorboating," which is caused by the resistance in the B battery. A new B battery would be the simplest cure, but not the most economical. The following are some of the remedies for the trouble in your case:

(1)—A large condenser across the B battery, at least 1 mfd.

(2)—Put the detector as well as the three audio amplifier tubes on 180 volts, increasing the coupling resistor to the detector to about .5 meg.

(3)—Adjust the grid bias on the audio amplifiers to the proper value—from 3 to 4½ volts on the Daven mu 20 tubes or at least 2 volts on the CX340 or UX240, or 4½ on 301A or 201A.

(4)—If a high pitched squeal develops when suggestion (2) is followed, a 1 mfd. condenser across the B battery will stop it.

(5)—If a very slow fluctuation in the signal intensity occurs when suggestion (2) is followed, decrease one of the grid leaks in the audio amplifier. Sometimes this fluctuation is so slow and complete that the set is silent one minute and loud and clear the next, and so on.

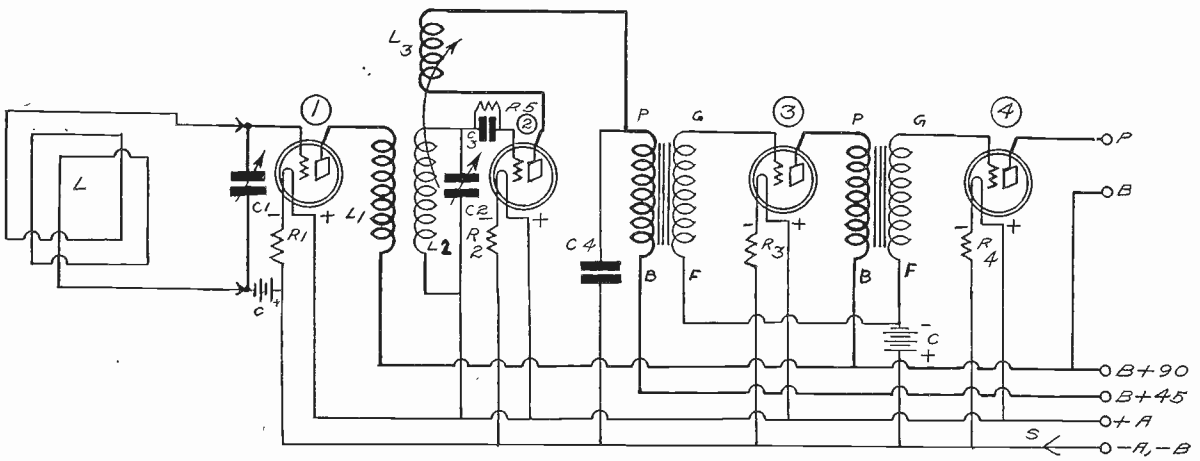

FIG. 554

Boldest Ideas Win, Aylesworth Asserts

Recent successful experiments in television in which persons were seen in the act of telephoning by the ones spoken to, are by no means the end of wonders that may be accomplished by the radio. To the contrary, the wildest dreams for its development are not nonsense, said Merlin H. Aylesworth, president of the National Broadcasting company in an exclusive interview given to the "American Magazine" for August.

"Radio has shaken off the handicap of taking limitations for granted. In radio, and in pretty much everything else, the men who dare to think most boldly, even most absurdly, have been more nearly right than those who have believed that only the little things were possible," said Mr. Aylesworth. He continued:

"We know for a certainty that big things are just around the corner. We expect that we shall live to see motion pictures flashed onto the walls of our homes. Science may even find a way to break down food into electrons and transmit them to our kitchens by radio and there reassemble them for nourishment. This sounds like the wildest nonsense at the moment but the radio itself seemed like nonsense only a couple of decades ago.

Hopes to Enrich People

"Our hope for radio is that it will make the people of the United States feel that they have 'been some place'; that their lives will be richer, their experience wider, their appreciation of life more satisfying because they have been in touch, through this magic, with the wisest, the most talented and the most high-thinking folks of their time.

"We are just beginning to find out about it ourselves," continued Mr. Aylesworth. "But we already know some things that have human interest. We know that there were 5,200,000 radio receiving sets in the country last June, which means, if you assume five listeners to every set, a total radio audience of 26,000,000 people. New York State, with 654,000 sets has the most listeners, and Nevada, with 7,200 sets, and New Mexico, with 7,800, the fewest. The four cities that have the largest number of listeners in proportion to their population are Los Angeles, San Francisco, Chicago and New York, in the order named.

"So far as we can discover, the male and the female audience is about evenly divided. For instance, a recent mail canvas conducted through station WEAF brought 1,943 letters signed by men, 2,190 letters signed by women, and 929 signed by 'Mister' and 'Misses.' Naturally, the daytime audience will consist almost entirely of women, though it might surprise you to know how many offices of busy executives now have radio sets—a few minutes of orchestra music with the after-luncheon cigar before the afternoon grind begins.

Talks About Sets

"The good sets are now so nearly foolproof that almost anybody ought to be able to get good results from them. However, here are the three most common mistakes: (1) Not learning to tune the set properly so as to shut out 'cross talk'; (2) Forcing sets to produce the last possible bit of volume; (3) Carelessness in jarring or dropping what is, of course, a very sensitive and highly technical piece of apparatus.

"And here are your five suggestions: (1) Keep the batteries adequately charged; (2) Burn the tube filaments at the specified voltage; (3) Keep antenna and leadin tight; (4) Keep all connections tight and clean; (5) Leave the set alone and call in a competent repair man when anything goes wrong."

Mr. Aylesworth went to Colorado from

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Iowa with his parents as a boy and at twenty-four was admitted to the bar. With the formation of the National Electric Light Association, he was asked to go to New York as an executive secretary and there made contacts with Owen D. Young and others which resulted in his becoming head of the newest huge industry of America.

He described himself in his interview as being one of the exceptions to the rule that only the most forward looking young men become successful.

"There are thousands of young chaps," he said, "who are looking so hard at the future they fail to make a dent in the present. I suppose I used to wonder sometimes what would become of me, but how could I plan to become president of a company operating in an industry that didn't even exist? All I kept busy at was doing the next thing that had to be done.

"I started in the old profession, law, and here I am in the newest business, radio."

More Restrictions For South Africa

According to a report to the Department of Commerce by Floyd E. Sullivan, Assistant Trade Commissioner at Johannesburg, the Minister of Posts and Telegraphs has placed before the House of Assembly a proposed amendment to the 1926 radio laws as follows:

Any person who sells, gives or in any manner whatever supplies any valve, loudspeaker, or telephone receiver for radio to any person who is not a licensed listener under this Act shall within seven days after such supply notify the Postmaster General thereof by written notice setting out the name and address of the person so supplied. Failure to comply with the provisions of this subsection shall constitute an offense.

HOW TO BUILD RADIO WORLD'S Four-Tube Universal Receiver fully described by Herman Bernard in the March 12, 19 and 26 issues of RADIO WORLD. Send 45c and get these three numbers. RADIO WORLD, 145 West 45th Street, New York City.

Byrd Return Treat to Fans

The several million persons who sat comfortably in their homes and with the aid of their radio set followed the triumphal homecoming of Commander Richard E. Byrd and his crew and pilot Chamberlin were luckier than those who went down town to see and hear for themselves, for they did not have their enthusiasm dampened by a downpour of rain.

The listeners followed the progress of the march up Broadway from the time the fliers stepped on Pier A until the official welcome was dissolved by Hector Fuller in Madison Square.

At Pier A, Graham McNamee who was announcing at that point, got the aviators to say a few words to the radio audience. Byrd was the first to speak, who said: "Hello, New York, you are giving us a great reception." Balchen and Noville followed with a "Hello." Then came Chamberlin. He said: "Hello—this is Chamberlin." Finally Acosta said: "Hello, glad to be back with my friends. This is Acosta speaking."

NEW DE LUXE BST RECEIVER—5-Tube Set, resistance coupled audio, built-in C eliminator, genuine mahogany cabinet. Price, $60. Five-day money-back guarantee. GUARANTY RADIO GOODS CO., 145 W. 45th St., N. Y. City.

VALET AUTOSTROP RAZOR—The only razor that sharpens its own blades. Highly polished, nickel-plated, self-stropping Valet AUTOSTROP Razor, with one blade, in velvet lined metal case. Leather strop especially prepared, and complete outfit in neat, lithographed carton. Mailed postpaid on receipt of 50c. SPECIAL: Send $2 for one-third of a year subscription for Radio World (yearly price $6), mention this particular ad, and complete "Pal" set will be sent as a premium. If already a subscriber, your subscription will be extended three months. THE COLUMBIA PRINT, 145 West 45th Street, New York City.

LINDBERGH PLANE SPEAKER. Pictures and explanatory article appeared in Radio World dated June 25, 1927. Sent on receipt of 15 cents or start your subscription with that number. Radio World, 145 W. 45th St., N. Y. C.

THE 5-TUBE DIAMOND

Fully described by Herman Bernard in a booklet, with diagrams, including blueprint, and sent on receipt of 25 cents. The Diamond is automatically adaptable to phonograph pickup. RADIO WORLD 145 West 45th St., N. Y. City.

COMPLETE DETAILS on what ohmage resistances may be used with B eliminators to also obtain C bias, were given by Frank Logan in the March 12 issue of RADIO WORLD. Either send 15c for his issue or begin your subscription with this issue. RADIO WORLD, 145 West 45th St., New York City.

COMPLETE LIST OF BROADCASTING STATIONS appeared in RADIO WORLD, dated July 2. 15c per copy, or start subscription with that number. RADIO WORLD, 145 West 45th St., New York City.

Be sure to take RADIO WORLD along with you on your vacation, or read it while you are at your summer home so that you will not miss a copy; send $1.50 for three months subscription and RADIO WORLD will be sent to you all summer. RADIO WORLD, 145 W. 45th St., N. Y. C.

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in back issues of RADIO WORLD, 1926-1927:

1926

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.

Dec. 4—The regenerative 5-tube Set, by Cap. P. V. O'Rourke. The 8-tube Lincoln Super, by Sidney Stack.
Winner's DC Eliminator, by Lewis Winner.

Dec. 18—Selectivity on One Tube, by Edgar Speare. Eliminating Interference, by J. E. Anderson.

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

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

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Santa Maria Model Vitalitone Speaker

A new Vitalitone ship model speaker is now ready for distribution. This is even more beautiful than the preceding models and is a realistic reproduction of the flagship of Christopher Columbus, the "Santa Maria." A spirited illusion of a ship at sea is produced in magnificent coloring and the detail of the ship is followed absolutely.

Another Santa Maria model is available in antique plain bronze, without color, which is equally beautiful. The powerful, well-known Vitalitone unit is used. This unit is free from rattle or buzzing even with 350 volt power input. Full information on this and other models may be had for the asking from the Vitalitone Radio Corporation, 88 University Place, New York City.—J. H. C.

Egert Displays Line Of Ward Leonard

A display may be seen in the window and store of Wireless Egert, 179 Greenwich Street, New York City, of a full line of Ward Leonard resistances of every kind, for eliminator, power or "ham" use and for every radio service. The Ward Leonard products for the coming season are shown.

Wireless Egert is one of the oldest pioneers in radio and is widely known and liked by radio fans and "Hams," and this display is particularly apropos in his store as the Ward Leonard Company has always shown a similar kindly spirit in its dealings with the public.

Any fan who wants advice on how to find the proper resistance for any particular purpose will receive prompt assistance upon application to the Ward Leonard Electric Co., 31 South Street, Mount Vernon, N. Y.—(J. H. C.)

Polymet Announces Metal Resistors

Among the various items which the Polymet Manufacturing Corporation, 599 Broadway, New York City, have added to their line is a new type of grid leak and resistor known as Poly pure metal power grid.

These new grid leaks and resistors differ from any others on the market in that they are not metallized but pure metal. This type construction permits a very high current carrying capacity and dissipates two and one-half watts to the square inch. Poly power grids are made in various values ranging from 5,000 to 100.000 ohms, and ¼ to 10 megohms.

BUILD THE NEW Universal, described in the March 12, 19 and 26 issues. Send 45c for these copies, or $1 extra for blueprint, or $1.30 for all four. RADIO WORLD, 145 West 45th Street, New York City.

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British Engineer Gives Resistor AF Constants

Philip R. Coursey, chief engineer of the Dubilier Condenser Company of England, writes:

"We note that the maximum value for the anode (plate) resistance in a resistance-capacity coupling unit in most American hookups is .1 meg., and that the maximum value of the grid leak is given as 1 megohm. We notice also that the capacity for the coupling condenser is suggested as 1 mfd., or even as large as .5 mfd.

"In our research laboratory we have been carrying out a number of tests occupying a considerable period of time, to determine the best values of the components of such a coupling arrangement, and we find that a capacity even of the order of .01 mfd. is rather large for such a unit, as it results in an uneven amplification over a large frequency band. The usual value which we use is of the order of .005 mfd.

Have 50 Mu Tube

"We also observe that you state that a value of 30 for the mu of the valve (tube) used is exceedingly high, whereas we are, at present, using a valve with a mu of the value of 50. However, we would point out that even using a valve which has a mu of only 30, we have found a considerable increase of amplification per stage may be obtained by using a much higher anode (plate) resistance than you suggest, and a much higher value grid leak. In our standard coupling unit, we use an anode (plate) resistance of 1 meg. and a grid leak of 3 meg.; and although this reduces the anode current to a very small value, usually 40 or 50 microamperes, on careful test we have found that it is not necessary to use an extremely high anode voltage to obtain good operation. In fact, in the case of the detector valve by means of a resistance—capacity coupling, anode voltages of the order of 50 to 60 volts are ample, the anode current being only of the order of 40 or 50 microamperes.

Can Be Duplicated Here

"We think that these figures may be of interest to you as indicating the values that are used at the present time in this country and indicating the results that we have obtained so far with this excellent method of audio-frequency coupling."

Mr. Coursey's company is one of the licensees of the International Resistance Company of Philadelphia, Pa., and uses the metallized filament in making its own resistors which are sold throughout Great Britain. Hence the corresponding Durham resistors, together with the corresponding Dubilier mica condensers available over here, and not forgetting the very high mu tubes now being offered, such as the UX240 and CX340, permit of virtually duplicating the British in resistance-coupled AF.

KFUO Church Music Quiets a Speakeasy

A listener to KFUO, Concordia Seminary, St. Louis, reported in a letter to the station that one Sunday evening he was called to repair a receiving set in a speakeasy. Having repaired the radio, he tuned in KFUO, from which they heard good music and singing, and then a fine Gospel sermon. In less than 10 minutes the whole crowd was so quiet and interested that you could hear a pin drop on the floor. The correspondent stated that KFUO certainly effected a remarkable change in that establishment that evening.

WABC BROADCASTS THURSDAY

Programs from the Atlantic Broadcasting Corporation's Studios are now broadcast over WABC instead of WBOQ for Thursday evenings.

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The New De Luxe Model Bretwood With Condenser Attached

WHEN you are deciding on what parts are to go into the receiver you are about to build, under no circumstances dismiss the grid leak with only casual consideration. Respect the grid leak as something well worthy of expert choice.

The best course is to select a variable grid leak with an ample resistance range, one that may be mounted on baseboard, sub-panel or front panel, as you prefer.

Such a leak is the BRETWOOD VARIABLE GRID LEAK which is now on the market in new de luxe style representing improvements in mechanical strength, electrical efficiency and appearance.

Higher Efficiency

You use a variable grid leak like the BRETWOOD VARIABLE GRID LEAK in a set you are about to build, or should put one in your present receiver because it will enable you to get highest operating efficiency from the detector tube. Furthermore, all tubes used as detectors draw grid current, the resistance value of the leak is important for biasing and discharge purposes. Only can exactly the right degree of flow be established to discard excess electrons but the grid to filament impedance is so affected as to afford best selectivity under the circumstances. Only a variable leak gives this precision choice.

You prevent overloading of the detector tube by correct leak setting. This improves tone quality considerably. Often if your set sounds distorted this is immediately and permanently remedied. Hence you reap greater volume, better selectivity and purer tone quality—all by the simple insertion of a BRETWOOD DE LUXE MODEL VARIABLE GRID LEAK.

Selected by Bernard

This efficient instrument as struck Herman Bernard that he prescribed it for the latest and most popular circuit, Radio World's Universal Four Tube Receiver.

The BRETWOOD DE LUXE MODEL VARIABLE GRID LEAK costs $1.75, a small enough price for so much efficiency. If desired a .00025 mfd. BRETWOOD CONDENSER is supplied mounted on the leak at 50 cents extra.

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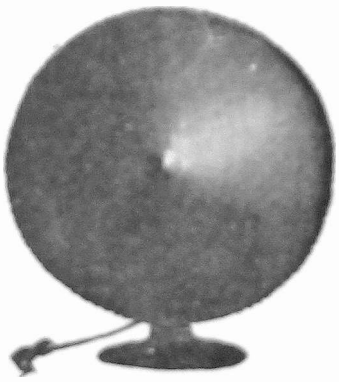

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