RADIOLA 33 (D.C.)

107.5—127.5 Volts Direct Current—40 Watts

SERVICE NOTES
Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 33 is manufactured in a model designed for direct current lighting circuit operation. Figure 1 is a top view of the receiver chassis and socket power unit and Figure 2 is a sub-chassis view of both assemblies. While this model is similar to the A.C. model in appearance and performance, electrically it is considerably different. For this reason a special Service Note on this model is issued for the guidance of those called upon to locate and remedy any trouble that may develop.

PART I—GENERAL SERVICE DATA

[1] CIRCUIT CHARACTERISTICS

The following characteristics are incorporated in the design of Radiola 33 (D.C.).

(a) It is a seven-tube tuned radio frequency receiver utilizing five Radiotrons UX-112A and two Radiotrons UX-171A.

(b) A single control, three-gang condenser is employed to tune two of the radio frequency amplifiers and the detector.

(c) The volume control regulates the input grid voltage to the first R.F. amplifier stage. This is a simple and effective method for controlling volume in this type of receiver.

(d) A series filament connection is used for all tubes. This is a simple and practical method for a direct current receiver as the input wattage is at a minimum. The current consumption of these Radiolas is no greater than the same type Radiolas designed for alternating current.

(e) The D.C. house circuit in addition to supplying filament voltages for the Radiotrons used in Radiola 33 D.C. supplies all plate and grid voltages, except the grid voltages used on the two Radiotrons UX-171A in the push pull amplification stage. This latter voltage is obtained from an external "C" battery with taps to provide negative 12 and 18 volts. This battery must be supplied at the time of installation.

Counting from right to left facing the front of the Radiola receiver chassis the Radiotron sequence is as follows:

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground.

Radiotron No. 2 is a stage of tuned radio frequency amplification, and is tuned by the first of the gang condensers.

Radiotron No. 3 is the second stage of tuned radio frequency amplification. It is tuned by the second of the gang condensers.

Radiotron No. 4 is the detector, and is tuned by the third of the gang condensers.

Radiotron No. 5 is the first stage of audio frequency amplification.

Radiotrons Nos. 6 and 7, located in the Socket Power Unit, counting from left to right, are used in push pull connection for the second, or last stage of power audio frequency amplification. This provides for a large undistorted output at the necessarily lower plate voltages for the last audio stage. An output transformer prevents the D.C. plate current from flowing through the loudspeaker windings.

The Radiotron sequence is shown schematically in Figure 3.

The schematic wiring diagram of the receiver and socket power unit is shown in Figure 4.

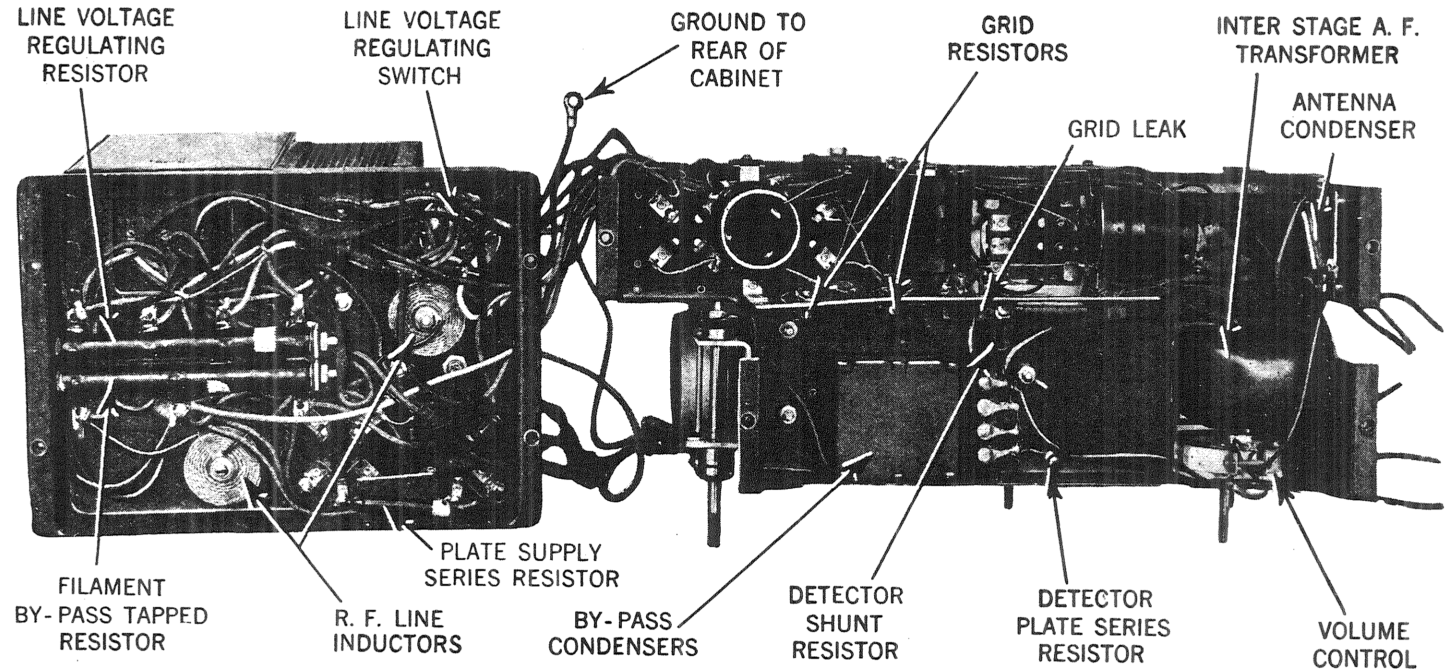


Figure 2—Sub-chassis view of receiver and socket power unit

[2] ANTENNA (Outdoor and Indoor Types)

Due to the high sensitivity of Radiola 33 (D.C.) the length of an outdoor antenna need only be approximately 50 feet long. It should be erected as high as possible and be removed from all obstructions. The lead-in should be a continuation of the antenna itself, thus avoiding all splices which might introduce additional resistance and in time corrode sufficiently to seriously affect reception. If it is absolutely necessary to splice the lead-in to the antenna the joint must be carefully soldered to insure a good electrical contact. Clean off all excess flux and tape the connection to protect it from the oxidation effects of the atmosphere.

High-grade glass or porcelain insulator supports are required and at no point should the antenna or lead-in wire come in contact with any part of the building. Use a porcelain tube insulator where the lead-in wire enters the house.

The antenna should not cross either over or under any electric light, traction or power line and should be at right angles to these lines and other antennas. An outdoor antenna should be protected by means of an approved lightning arrester, in accordance with the requirements of the National Fire Underwriters' Code.

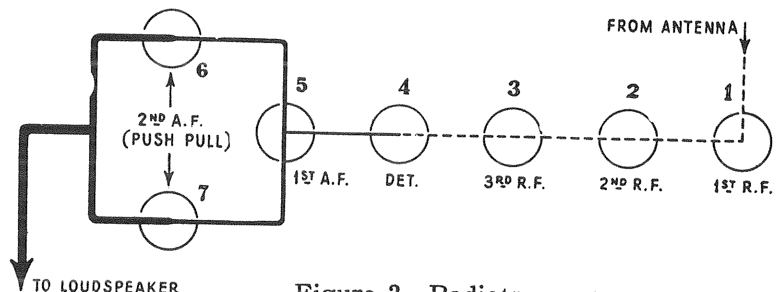


Figure 3—Radiotron sequence

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna of about 20 to 40 feet of insulated wire strung around the picture moulding or placed under a rug. In buildings where metal lathing is employed satisfactory results are not always possible with this type of antenna. Under such conditions various arrangements of the indoor antenna should be tried to secure satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

[3] RADIOTRONS

Five Radiotrons UX-112A and two Radiotrons UX-171A are used. These should be placed in their correct sockets as indicated by the lettering at each socket before the current is turned "on." The current should never be turned "on" unless all Radiotrons are in place.

After placing the Radiola in operation it is well to interchange the Radiotrons in the R.F. stages for best performance. The most critical of these stages is the second (Radiotron No. 2, counting from right to left facing the front of the Radiola), and the Radiotron selected for this socket should be one giving the loudest signal on a weak station. It should not go into oscillation at any position of the volume control, or station selector.

If no tube is found satisfactory for this socket, or the Radiola is insensitive, a readjustment of the R.F. compensating condenser may be necessary. The correct method for making this adjustment is described in Part I, Section 7.

Radiotrons UX-171A should be chosen for best combination to give the most undistorted output.

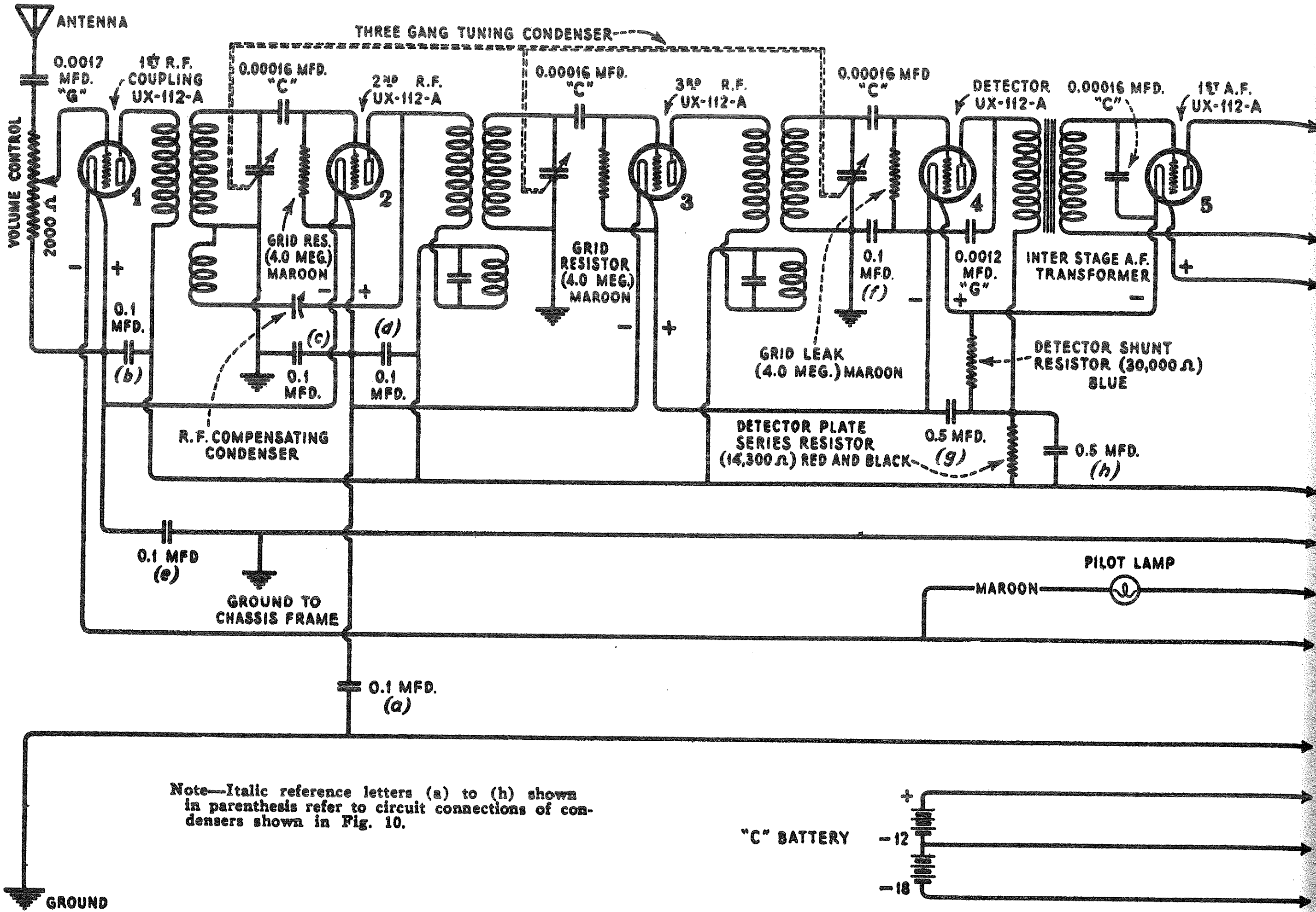


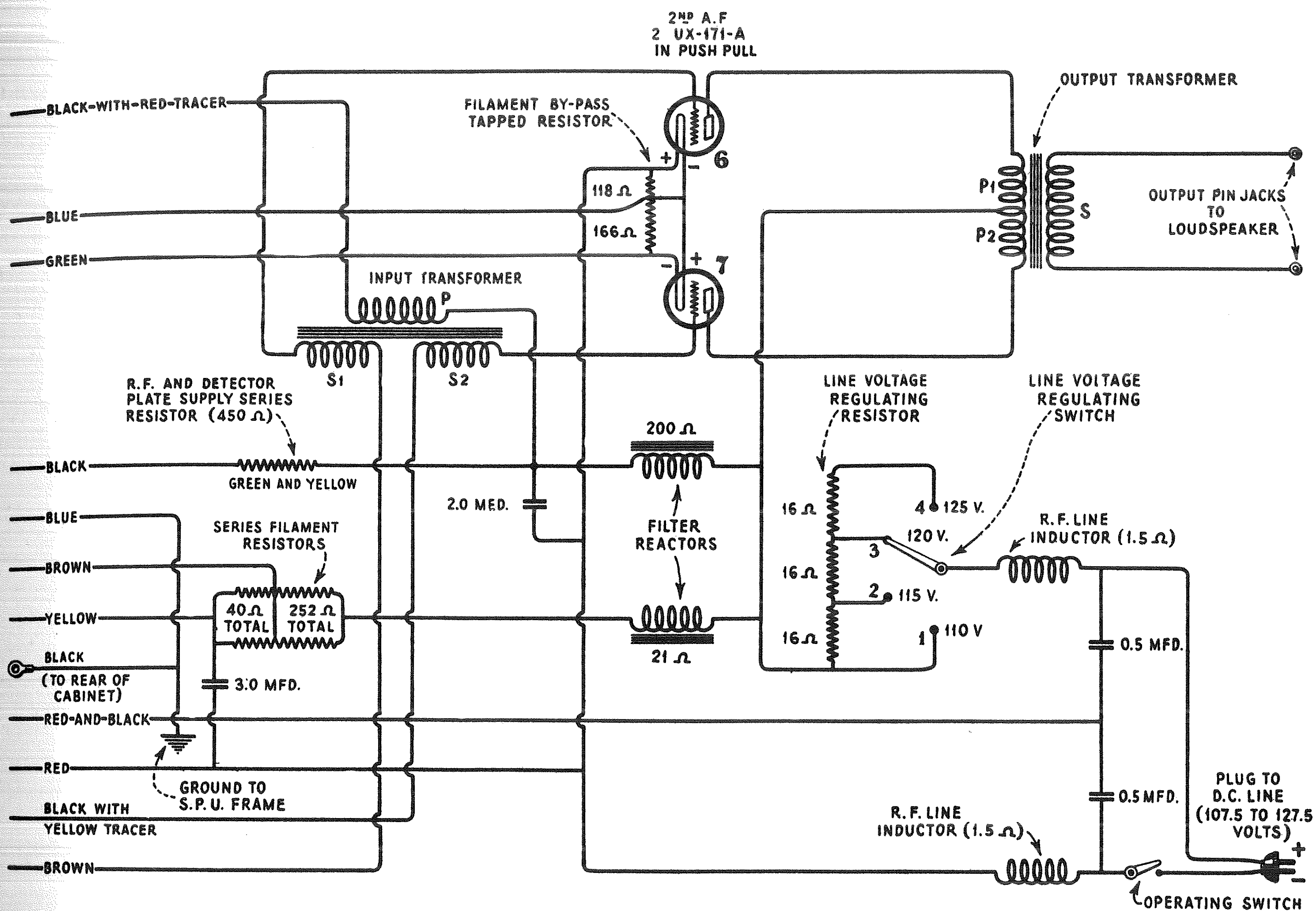
Figure 4—Schematic circuit diagram of

[4] LINE SWITCH

A four-position switch is provided on the S.P.U. for adjusting the Radiola to various line voltages over a range of 107.5 to 127.5. (See Figures 1 and 7.) The line voltage should be measured by an accurate D.C. voltmeter, and the switch placed at the correct position for this voltage. The different positions of the switch are as follows:

Position	*For Line Voltages of*
1	107.5 to 112.5
2	112.5 to 117.5
3	117.5 to 122.5
4	122.5 to 127.5

The line switch is accessible by removing the switch cover. The operating switch should always be turned "off" when the switch cover is removed to adjust for line voltage.



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receiver and socket power unit

[5] "C" BATTERY

An external "C" battery is used to bias the grids of the two Radiotrons UX-171A used in the push pull power audio stage of amplification. The use of this battery allows the use of the highest possible plate voltage on the Radiotrons UX-171A which gives a maximum undistorted output. The brown lead of the "C" battery leads should be connected to the negative terminal of a 22½ "B" battery tapped at +6 and +18. The black with yellow tracer should be connected to the +6 tap, and the red lead connected to the +18. If a "C" battery of 22½ volts is used with taps at —4½ and —16½, the brown lead should be connected to —22½, black with yellow tracer to the —16½ tap and the red lead to the —4½ tap.

[6] RADIOLA 33 WAVE TRAP

Due to wide variations in broadcast receiving conditions in different sections of the country, the performance of any radio receiver in any given location depends upon the local receiving conditions.

Receivers located in the vicinity of powerful broadcasting stations receive the signal from such stations with great intensity over a large number of scale divisions of the receiver. If it is desired to receive a relatively distant station whose frequency assignment is comparatively close to that of the local station, it is impossible to do so without interference.

To satisfy the Radiola 33 (D.C.) user located in districts where bad receiving conditions exist, the Radiola 33 (D.C.) Wave Trap has been designed and will be carried in stock by RCA as an accessory.

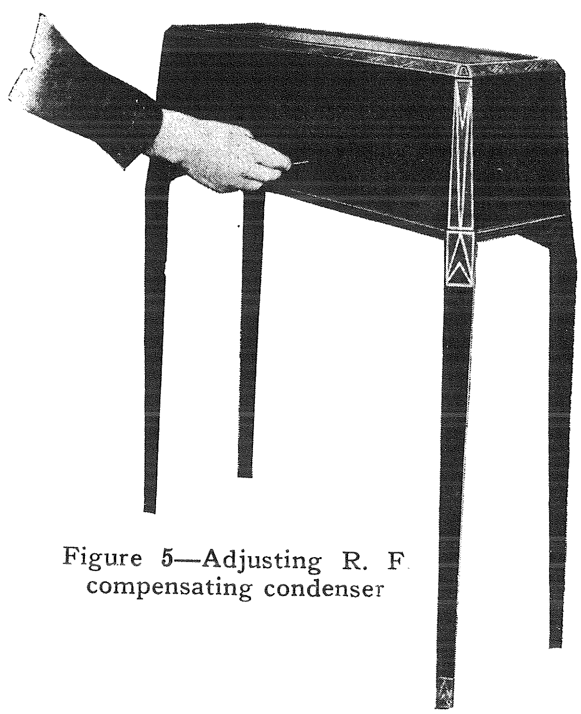

Figure 5—Adjusting R. F compensating condenser

The function of the wave trap is to absorb a large portion of the energy of the powerful local signal picked up by the antenna, thereby reducing the effect of the signal to a value comparable with that of more distant stations.

This wave trap is very efficient in design, is neat in appearance, and is simple to install and adjust. It may be adjusted to absorb a strong signal at any point on the Radiola 33 (D.C.) dial scale. After it has once been adjusted to absorb the strong local signal causing interference at a particular location, it needs no further adjustment or attention.

Due to the location of the "C" battery in Radiola 33 D.C. it is not possible to locate the wave trap at the end of the gang condenser as in the Radiola 33 A.C. It must therefore be located outside of the cabinet in any convenient location. Using small brackets and attaching it to the bottom of the cabinet is quite convenient.

[7] ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The R.F. compensating condenser in Radiola 33 (D.C.) is provided to allow adjustment of the receiver to compensate for variations of tube characteristics and thereby allow the receiver to function in its most sensitive condition. Before readjusting this condenser, the Radiotrons should be interchanged and satisfactory operation secured by this means if possible. The interchanging of tubes should be made with the idea of getting a tube in socket No. 2 that will not go into oscillation and giving the loudest signal on a weak station. If satisfactory sensitivity cannot be secured by this means an adjustment of the compensating condenser may be made as follows:

(a) Put receiver in operation in usual manner and tune in a station preferably at the middle or upper wave lengths.

(b) Locate the position of the compensating condenser adjusting screw at the rear of the receiver assembly. (See Figure 5.)

(c) With the volume control at the position of maximum intensity, turn the screw to the right until the set goes into oscillation. Then turn the screw to the left until all oscillation and howl is eliminated with the volume control at maximum. In some cases interchanging the tubes in the R.F. stages will facilitate this adjustment. Tune in stations at maximum volume and minimum volume control positions and note if receiver goes into oscillation at any wave length. If it does, turn screw still further to the left. If this adjustment does not prevent oscillation refer to Part I Sec. 9.

(d) When the adjusting screw has been turned to the right as far as possible without oscillation occurring at any wavelength, or any volume control position, the correct adjustment has been found for best sensitivity with necessary stability.

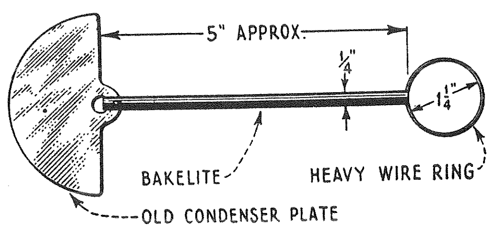

Figure 6—Aligning tool

[8] TUNING CONDENSERS OUT OF ALIGNMENT

If the tuning condensers are out of alignment, line up as follows:

(a) Procure or construct a tool as illustrated in Figure 6.

(b) Remove the receiver assembly and S.P.U. from the cabinet (see Introduction Part III), and place in operating condition. Tune in a signal, either broadcast or a modulated oscillator of about 1400 K.C. and adjust the volume control so that the signal is very weak.

(c) With the condenser plate end of the tool touch the rotor of each of the three tuning condensers and note if an increase of signal is experienced. If the condensers are in alignment the signal should decrease. If the signal increases, that particular condenser is slightly low in capacity, which can be corrected by bending the two end rotor plates toward their adjacent plates slightly until the test with the "paddle" gives a decrease rather than an increase in signal.

(d) After checking the condensers for low capacity they may be checked for high capacity by taking the ring of the tool and inserting it successively in the center of the three R.F. coils. This should give a decrease of signal. If it increases then the end rotor plate of the condenser that tunes the coil should be bent away from its adjacent plate. This should be bent until inserting the ring in the coil will give a decrease of signal rather than an increase. The detector tuning condenser is provided with a gang condenser trimmer for aligning this circuit. (See Figure 1.) Instead of bending the plate of the condenser, adjustment should be first attempted at the gang condenser trimmer by careful bending. In most cases this will cover all aligning adjustments required in the detector stage.

(e) After checking at 1400 K.C. a station or oscillator signal about 600 K.C. should be tuned in and the condensers completely checked at this frequency. Any additional necessary adjustments should be made.

(f) After completion of all tests, return the receiver to its cabinet in the reverse manner of that used to remove it.

[9] UNCONTROLLED OSCILLATION

Uncontrolled oscillations in Radiola 33 (D.C.) may be caused by:

(a) Incorrect adjustment of the R.F. compensating condenser. Adjust compensating condenser as described in Part II, Sec. 10.

(b) An open of the several grounding leads in the receiver. Check all ground connections.

(c) Defective R.F. coil system. A short or open in the condensers connected across the concentrated primary coils may cause the receiver to go into oscillation. Adding another condenser similar to the one already connected across the concentrated primary coil in the third R.F. stage (0.00016 mfd., RCA part No. 2010) will also help to prevent uncontrolled oscillation at the higher wave lengths.

(d) A defect in the R.F. line filtering system may cause uncontrolled oscillation as well as excessive line noise pick-up. Check for shorted or grounded R.F. line inductors, and open or shorted 0.5 mfd. filter condensers.

(e) Bending the first R.F. coil in the direction of its free end closer to the chassis should be tried in extreme cases. Also the ground lead which comes from the pigtail of the gang variable condenser should be changed from its normal position at the terminal of one of the R. F. coils to a point on the uninsulated ground bus bar approximately half way between the second and third R.F. coils.

[10] HUM OR LINE NOISE

Since the Radiola 33 (D.C.) is to be used only on D.C. lines of 107.5 to 127.5 volts, practically no hum should be experienced. However if any disturbing hum or line noise, as may come from generator brushes, is heard, check the following:

(a) Open 2.0, 3.0 or 0.5 mfd. filter condensers.

(b) Shorted or grounded filter reactors, or R.F. line inductors.

(c) A 0.05 mfd. fixed condenser shunted across the tapped primary (P_1 and P_2) of the output transformer will help reduce line noise. To conveniently do this the condenser may be connected across the plate contacts of Radiotron sockets Nos. 6 and 7 after receiver chassis with socket power unit has been removed from the cabinet. Insulated leads and tape should be used to prevent a short circuiting to other parts.

[11] DISTORTED REPRODUCTION

Under normal conditions Radiola 33 (D.C.) will deliver a strong signal of good quality to the loudspeaker. The high sensitivity of Radiola 33 (D.C.) makes it undesirable to operate the set at full volume when receiving from a nearby broadcasting station. The volume control should be adjusted to secure best quality, with the desired volume. If the loudspeaker reproduction is poor, test the loudspeaker output from the receiver. A pair of phones or loudspeaker of known quality may be used for this purpose. If the loudspeaker is O.K. poor quality or distortion may be due to any of the following causes:

(a) Defective Radiotrons. Though the Radiola may be in operating condition a defective Radiotron in any stage will cause distortion. This is especially true of the detector, 1st or inter-stage of audio amplification and push pull stage of audio amplification.

(b) High or low plate and grid voltages. The cause may be a defective resistance unit. Check the various resistances for a possible short, open or ground. A defective "C" battery will cause distortion.

The cause of noisy operation and intermittent signals with periods of hum or no reception may be traced in the following manner:

(a) Disconnect the antenna and ground leads. If the Radiola becomes quiet and signals from local stations, though weak, are received the trouble is in the antenna system, or is caused by nearby interfering electrical apparatus. In the first case repair the antenna system and in the second case place radio frequency chokes with associated filter condensers on any offending nearby apparatus. The location of interfering electrical machinery will require patience, skill and experimenting.

(b) If disconnecting the antenna and ground does not eliminate the noise, the trouble is in the Radiola. A defective tube, one having poorly welded elements will cause a disturbance of this kind, and this point should be checked by interchanging the Radiotrons in the Radiola with others of the same type. If it is definitely established that the Radiotrons are O.K. the Radiotron prongs and the socket contacts should be examined for dirt or poor contact. Use only fine sand paper when cleaning Radiotron prongs or socket contacts, cleaning excess sand off before inserting Radiotrons. The volume control should be examined for poor contact between the contact arm and the resistor strip.

[12] AUDIO HOWL OR GROWL

Either a low or high frequency howl originating in the receiver assembly may be caused by:

(a) Open by-pass condenser. An open by-pass condenser may cause an audio howl.

(b) Vibrating elements in the receiver Radiotrons. A gradually developed howl is probably due to the loudspeaker causing the receiver Radiotron elements to vibrate. To overcome this condition interchange the Radiotrons in the receiver, or change the relative angle between loudspeaker and Radiola. In extreme cases it will be necessary to increase the distance between the Radiola and the loudspeaker.

(c) Open A.F. condenser connections. An open connection to either of the A.F. condensers, one connected from plate to cathode of the detector, and the other from grid to filament of the first A.F. tube may cause a howl.

(d) An audio growl may be experienced if the .05 mfd. condenser across the detector shunt resistor is open.

(e) Interchanging Radiotrons UX-112A in the 1st A.F. and detector socket may help to stop audio growling.

(f) A high pitched whistle on loud local stations is probably due to detector overloading. Reducing volume control will usually remedy this. Natural heterodyning of stations close in frequency, of course, cannot be prevented.

[13] PILOT LAMP

Radiola 33 (D.C.) is equipped with a small pilot lamp operating from the filament resistor. Its purpose is to illuminate the tuning dial and act as a current supply indicator.

The pilot lamp is mounted on a small lever that can be pulled clear of the dial for inserting the lamp and then pushed in place to give proper illumination to the translucent dial. If the lamp is not in its proper place, insufficient illumination of the dial will be experienced.

[14] INPUT TRANSFORMER, OUTPUT TRANSFORMER AND FILTER CONDENSERS

The input transformer, output transformer, and filter condensers are located in one container in the S.P.U. Figure 8 shows the connecting leads with internal connections of each unit.

The input transformer winding resistances are as follows: P—1400 ohms; S—3500 ohms; S2—4500 ohms. (See Figure 8.)

The output transformer winding resistances are as follows: P1—154 ohms; P2—184 ohms; S—624 ohms. (See Figure 8.)

The filter condenser capacities are shown in Figure 8.

Methods for testing condensers and measuring resistances are outlined in Part II, Sections 4 and 5.

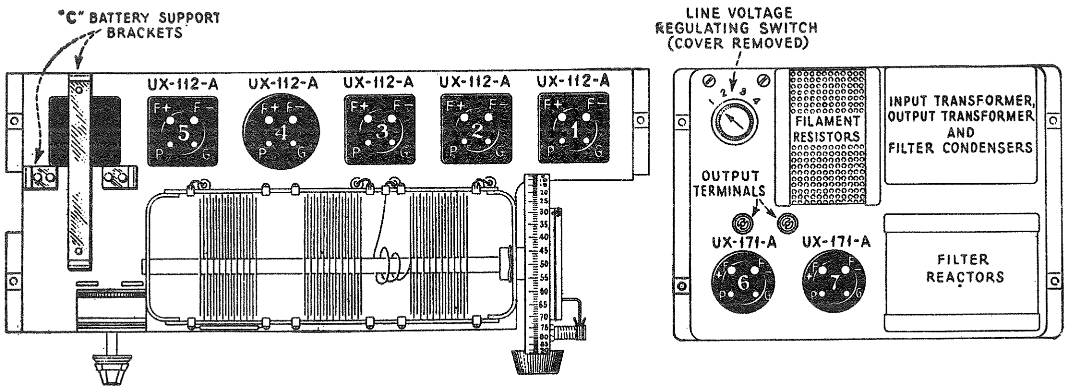

Figure 7—Radiotron socket layout showing filament, plate and grid terminals

PART II—ELECTRICAL TESTS

[1] VOLTAGE READINGS

Voltage readings of Radiola 33 (D.C.) may best be checked at individual tube sockets with a Weston Model 537, Type 2, test set or others giving similar readings. The following readings taken at the sockets are correct for Radiola 33 (D.C.) when connected to a 118-volt D.C. line and with the proper "C" battery. Line voltage regulating switch at position No. 3.

Tube No.	*Filament to Grid Volts*	*Filament to Plate Volts*	*Plate Current Milliamperes*	*Filament Voltage*
1	3.5	50	5.0	4.6
2	3.5	58	5.5	4.8
3	3.5	60	6.5	5.0
4	3.5	25	1.5	5.1
5	10.	75	7.0	5.25
6	23.	95	11.0	4.5
7	21.	95	11.0	4.75

The above readings were taken with average Radiotrons. Conditions may arise where high filament voltages are experienced. In such cases the line voltage switch should be adjusted to the tap that will give the above readings approximately.

[2] VOLTAGE SUPPLY SYSTEM

Figure 9 shows the abridged schematic circuit of the voltage supply system. The filaments of the Radiotrons are all connected in series. A by-pass resistor is used across the

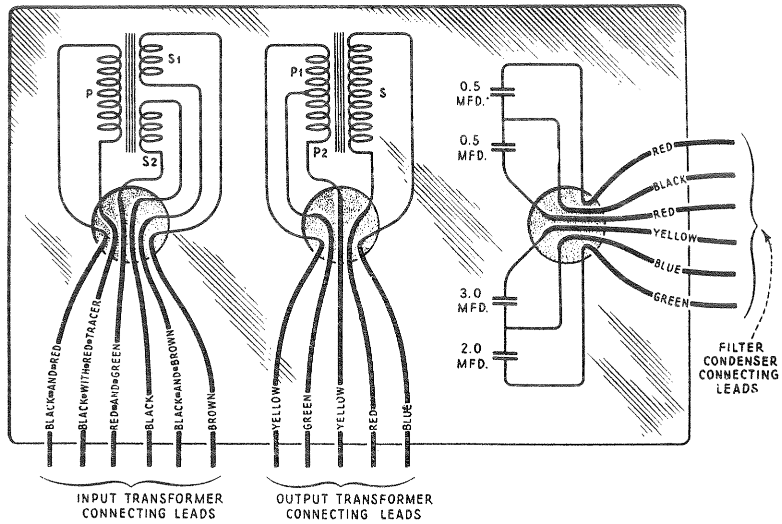

Figure 8—Internal connections of input transformer, output transformer and filter condenser

UX-171A to by-pass the accumulated plate current from the UX-112A's as well as supply a tapped connection to supply correct grid bias for the first, or interstage, A.F. Radiotron UX-112A. Necessary plate and grid resistors are used as shown to supply the correct re-

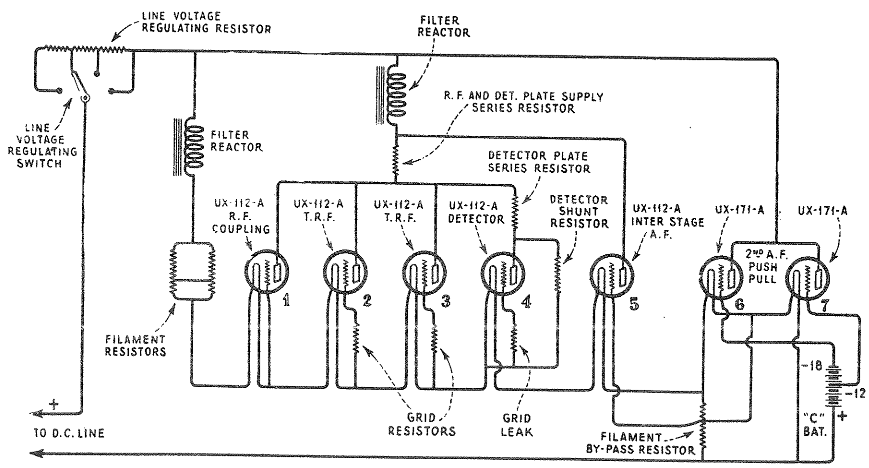

Figure 9—Schematic circuit diagram of voltage supply system

spective plate and grid voltages to the remaining UX-112A's—Due to the limiting value of D.C. line voltage, the highest possible plate voltage is desired for the UX-171A, so to keep this in reasonable limits an external "C" battery is necessarily used as shown.

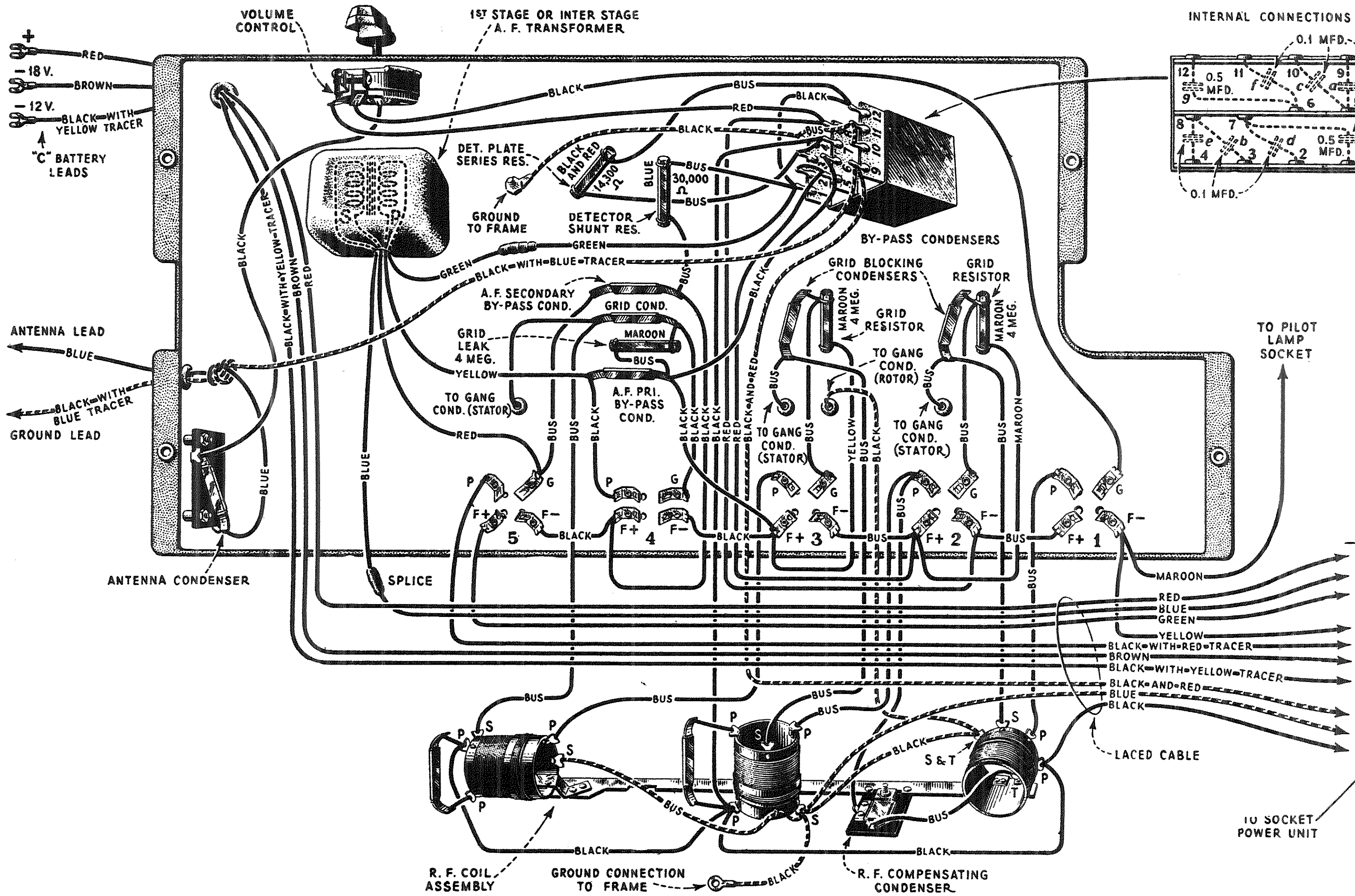

Figure 10—Continuity wiring diagram of receiver

[3] RADIOLA 33 (D.C.) CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly (Figure 10), and the Socket Power Unit (Figure 11).

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient voltage to give a full scale deflection when connected directly across the battery terminals should be used in making these tests. Flexible leads should be used with partially insulated testing tips. Keep hands free from frame to avoid false tests. The socket layout is shown in Figure 7.

The winding lugs on the coils of the R.F. coil assembly are coded "P" for primary, "S" for secondary, and "T" for tertiary, or third winding (used as a feed back coil for the 1st R.F. coil). These should be checked to show closed windings in making continuity tests.

Disconnect the antenna and ground leads. Disconnect "C" battery. Remove all Radiotrons and Pilot Lamp. Disconnect D. C. Input Plug. Resistances given are approximate in value. Reference letters in last column refer to Figure 10.

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
Antenna and Ground	Ant. lead (Blue) to G1 (V. C. at max. position.)	Open	Closed	Shorted antenna condenser.
	Ground lead (Black with blue tracer to +F2.)	Open	Closed	Shorted 0.1 mfd. (a) cond.
Grid	G1 to +F1 (V. C. at max. position.)	Closed (2000 ohms)	Open	Open connection, or volume control arm, or resistance.
	G2 to +F2.	Closed (weak) 4.0 meg.	Open	Open grid resistor or connection.
	G2 to receiver chassis frame (ground).	Open	Closed	Shorted or grounded grid condenser.
	G3 to +F3.	Closed (weak)	Open	Open grid resistor or connection.
	G3 to receiver chassis frame (ground).	Open	Closed	Shorter or grounded grid condenser.
	G4 to —F4.	Closed (weak) 4.0 meg.	Open	Open grid leak or connection.
	G4 to receiver chassis frame (ground).	Open	Closed	Shorted or grounded grid condenser.
	G5 to +F6.	Closed (5750 Ohms)	Open	Open filament by-pass resistor, 1st A. F. transf. secondary, or connection.
	G6 to brown "C" battery lead.	Closed (3500 Ohms)	Open	Open secondary winding (S_1) of input transformer, or connection.
	G7 to black with yellow tracer "C" battery lead.	Closed (5000 Ohms)	Open	Open secondary winding (S_2) of input transformer, or connection.
	P1 to P2.	Closed (27 Ohms)	Open	Open connections, or open 1st R. F. tranf. primary, or 2nd R. F. tranf. primaries.
			(1.6 Ohms)	Shorted cond. across 2nd R. F. tranf. primary.
	P1 to +F1.	Open	Closed	Shorted 0.1 mfd. (b) cond.
	P2 to +F2.	Open	Closed	Shorted 0.1 mfd. (d) cond.
	P2 to P3.	Closed (51 Ohms)	Open	Open connections, or open 2nd R. F. (tranf. primaries, or open 3rd R. F. tranf. primaries.
			(26.5 Ohms)	Shorted cond. across 3rd R. F. tranf. primary.
	P3 to P4.	Closed (15000 Ohms)	Open	Open 3rd R. F. tranf. primaries det. plate resistor, or 1st A. F. tranf. primary.
			(1100 Ohms)	Shorted 0.5 mfd. (h) cond.
	P4 to +F4.	Closed (31000 Ohms)	Open	Open det. shunt resistor, or open 1st A. F. tranf. primary.
	P4 to —F4.	Open	Closed	Shorted A. F. tranf. primary cond.
	P2 to receiver chassis frame (ground.)	Open	(1070 Ohms) Closed)	Shorted 0.5 mfd. (g) cond. Shorted R. F. comp. cond.
	P3to P5.	Closed (1880 Ohms)	Open	Open input tranf. primary or open 3rd R. F. tranf. primaries, or Det. and R. F. plate supply resistor in SPU.
	P6 to P7.	Closed (338 Ohms)	Open	Open output tranf. primary (P_1 or P_2).
Filament	—F1 to maroon lead on pilot lamp socket.	Closed	Open	Open connection.
	+F1 to —F2.	Closed	Open	Open connection.
	+F1 to receiver chassis frame (ground).	Open	Closed	Shorted 0.1 mfd. (e) cond.
	+F2 to receiver chassis frame (ground).	Open	Closed	Shorted 0.1 mfd. (c) cond.
	+F2 to —F3.	Closed	Open	Open connections.
	+F3 to —F4.	Closed	Open	Open connections.
	—F4 to receiver chassis frame (ground).	Open	Closed	Shorted 0.1 mfd. (f) cond.
	+F4 to —F5.	Closed	Open	Open connections.
	—F5 to G5.	Open	Closed	Shorted A. F. tranf. sec. cond.
	+F5 to —F7.	Closed	Open	Open connections.
	+F7 to —F6.	Closed	Open	Open connections.
	—F7 to +F6.	Closed (284 Ohms)	Open	Open filament by-pass resistor.

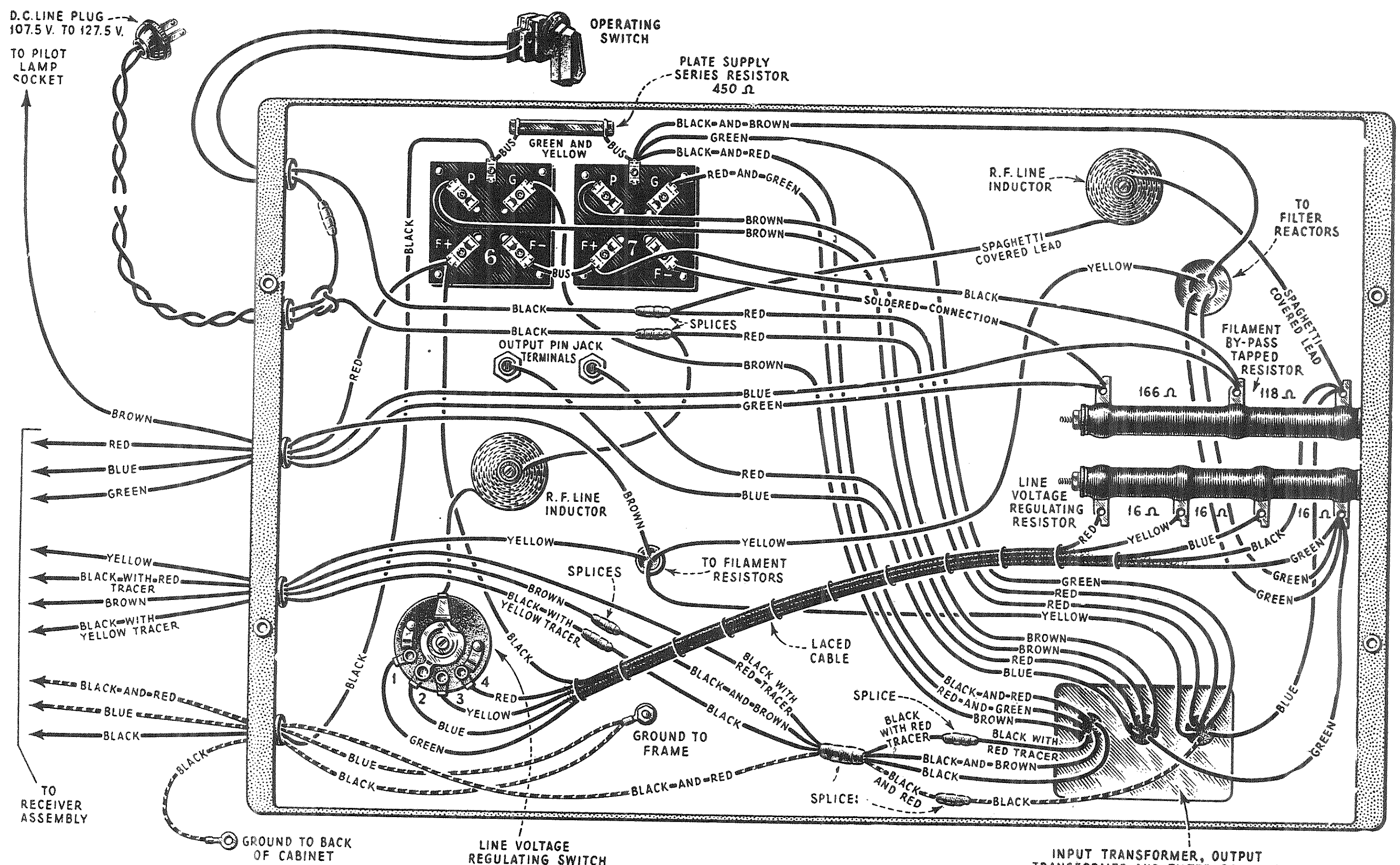

Figure 11—Continuity wiring diagram of socket power unit

Radiola 33 (D. C.) Continuity Tests—Continued

PLACE LINE VOLTAGE SWITCH ON POSITION No. 4—REMOVE KNOB

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
Miscellaneous and S. P. U.	Switch shaft to + blade on line plug.	Closed (1.5 Ohms)	Open	Open R. F. line inductor. D. C. line cond. or connection.
	Switch shaft to red "C" battery lead.	Open	Closed	Shorted 2.0 mfd. or 3 mfd. filter cond. or both .5 mfd. condensers.
			(248 Ohms)	Shorted 2.0 mfd. cond.
			(361 Ohms)	Shorted 3.0 mfd. cond.
	Switch shaft to P5.	Closed (1640 Ohms)	Open	Open input tranf. primary; open filter reactor, or open line voltage regulating resistor.
	Switch shaft to brown lead on pilot lamp socket.	Closed (321 Ohms)	Open	Open sections of filament resistor, open filter reactor, or open line voltage regulating resistor.
			(575 Ohms)	One section only of filament resistor open. Reactor and resistor O. K.
	—F1 to brown lead on pilot lamp socket.	Closed (40 Ohms)	Open	Open sections of filament resistor, or connections.
			(80 Ohms)	Only one section of filament resistor open.
	Red "C" battery lead to — blade on line plug; operating switch "on."	Closed (1.5 Ohms)	Open	Defective operating switch or open R. F. line inductor.
	Receiver chassis frame (ground) to S. P. U. frame (ground).	Closed	Open	Open connections.
	Ground lead (Black with blue tracer) to + blade on line plug.	Open	Closed	Shorted 0.5 mfd. cond.
	Ground lead (Black with blue tracer) to — blade on line plug.	Open	Closed	Shorted 0.5 mfd. cond.
	One output terminal to other.	Closed (625 Ohms)	Open	Open output tranf. secondary winding (S) or connections.

[4] TESTING CONDENSERS AND TESTING FOR DEFECTIVELY GROUNDED PARTS

The large by-pass condensers (from 0.1 mfd. up) and the filter condensers may be checked by charging them with a D.C. supply up to 150 volts, and then after a slight wait discharging them with a screw driver to note if a strong spark occurs. If a spark occurs (strength depending on condenser size), condenser is O.K. If no spark occurs the condenser is probably leaky or open. With the smaller condensers, simple trial replacement will prove helpful.

In order to avoid false tests on condensers or parts in the chassis due to one side being normally grounded it is recommended that the three ground connections to the frame (shown by broken line in Figure 10) be removed temporarily and the rotor connection to the gang condensers be unsoldered. This isolates every part from normal ground. If a defective ground is causing trouble, a test from the suspected part to ground should uncover the defect.

[5] RESISTANCE TESTS

The values of the various resistance units of Radiola 33 (D.C.) are shown in the schematic diagram, Figure 4. When testing a receiver for defects the various values of resistance should be checked. This may be done by a resistance bridge; the voltmeter-ammeter method shown in previous Service Notes; or by the following method, the results depending upon the care exercised in using the prescribed method.

For resistances of low value, 5000 ohms or less, use a voltmeter not greater than 100 ohms per volt. The rating of 100 ohms per volt means that a meter with 50 volts maximum scale reading, has a total resistance of 50 times 100, or 5000 ohms, when the 50-volt scale is used. For high values of resistance use a meter of 1000 ohms or more per volt. The Weston Meters, Type 301 and 280, each have a resistance of 62 ohms per volt and are satisfactory for low values. For very low resistances below 100 ohms, it is best to use a dry cell —1½ volt—with the 3-volt scale of a Weston, Model 280. For higher resistances up to 5000 and above use sufficient battery to give a good deflection on the meter, for example, a 45-volt "B" for a 0-50 unit meter. Then take two readings, one of the battery alone, and one of the battery with the unknown resistance in series. Then apply the following formula:

$$\left(\frac{\text{Reading obtained of battery alone}}{\text{Reading obtained with resistance in series}} - 1 \right) \text{Resistance of meter} = \text{Unknown resistance}$$

Example—Using a Weston, Type 301, 30-volt scale, 22½-volt "B" battery, resistance of meter equals 30x62 or 1860 ohms.

$$\left(\frac{22.5}{8.45} - 1 \right) 1860 = 3091, \text{ or unknown resistance in ohms approx.}$$

The above method may be used in checking the resistance values of the correct closed circuits as shown in the Continuity Test Tables in Part II, Section 3.

In addition to the resistances shown in Figure 4 the 1st, or inter-stage, audio frequency transformer primary resistance is 1070 ohms and secondary resistance is 5630 ohms. All resistances given are approximate in value.

PART III—MAKING REPLACEMENTS

Introduction

Since the Radiola 33 (D.C.) receiver chassis is very similar to the Radiola 33 A.C. the replacement of its component parts will not be discussed, as this subject is covered sufficiently in the Radiola 33 A.C. Service Notes. However there is some difference in the construction and parts used in the Socket Power Unit. The replacement procedure of these parts follows:

[1] REPLACING VOLTAGE REGULATING RESISTOR OR FILAMENT BY-PASS RESISTOR

(a) Remove S.P.U. and receiver chassis from cabinet as outlined in Radiola 33 A.C. Service Notes.
(b) Unsolder connections to resistor being replaced.
(c) Unscrew nut from rod supporting the resistor. Pull rod clear, saving the insulating and lock washers.
(d) Replace in the reverse order, making sure resistor is carefully tightened with insulating and lock washers in place, and resistor lugs are clear from the S.P.U. frame. Correct connections are shown in Figure 11.
(e) Replace S.P.U. and receiver chassis in reverse manner making sure that the S.P.U. asbestos pad is in place under S.P.U.

[2] REPLACING FILAMENT RESISTORS

(a) Remove S.P.U. and receiver chassis as in Part III, Sec. 1.
(b) In order to prevent damage to the R.F. Line Inductor it should be removed carefully by unsoldering its leads and removing the supporting screw. (See also Part III, Sec. 3.)
(c) Carefully unbend tabs holding the perforated cover for the filament resistors and remove cover.
(d) Unsolder the connecting leads to the filament resistors, saving the bus bar connections paralleling the resistors themselves.
(e) Unscrew nuts holding the rods with insulating washers supporting the resistors.
(f) Replace resistors in reverse manner, being sure to connect the two resistors in parallel by means of the bus-bar wires unsoldered when the defective resistors were removed. Be sure insulating washers are in place before the holding unit is carefully tightened on the rod to avoid breakage. Replace the cover over the filament resistors after carefully straightening the tabs so they can fit into their respective slots and be bent over securely.
(g) Replace S.P.U. and receiver chassis in the reverse manner, making sure that the the S.P.U. asbestos pad is in place under the S.P.U.

[3] REPLACING THE R. F. LINE INDUCTORS

(a) Remove receiver chassis and socket power unit as outlined in Part III, Sec. 1.
(b) Unsolder leads of R.F. line inductor to be replaced.
(c) Remove machine screw or bolt holding defective unit to S.P.U. frame.
(d) Replace in the reverse manner, being sure to cover soldered splice connections with rubber tape and friction tape, and keep the R.F. Line Inductor leads insulated with spaghetti tubing.
(e) Replace the S.P.U. and receiver chassis in the reverse manner making sure that the S.P.U. asbestos pad is in place under the S.P.U.

[4] REPLACING UX-171A SOCKETS

The two UX type sockets for the UX-171A Radiotrons may have to be replaced for bent or broken contacts, etc.

(a) Unsolder the connections to the socket. Unsolder plate series resistor.
(b) Carefully drill out the rivets holding the socket.
(c) Replace socket and fasten to S.P.U. frame by suitable machine screws, lock washers and nuts to fit.
(d) Solder connections as shown in Figure 11.
(e) Replace S.P.U. and receiver chassis in the reverse manner making sure that the S.P.U. asbestos pad is in place under the S.P.U.

[5] REPLACING THE VOLTAGE REGULATING SWITCH

(a) Remove S.P.U. and receiver chassis as outlined in Part III, Sec. 1.
(b) Remove knob on Voltage Regulating Switch by loosening its set screw.
(c) Unsolder connections to switch contacts.
(d) With proper wrench or pliers remove single nut holding the switch in place. Save insulating washers for replacing.
(e) Replace in reverse order. Proper connections are shown in Figure 11.
(f) Replace S.P.U. and receiver chassis in the reverse manner, making sure S.P.U. asbestos pad is in place under S.P.U.

[6] REPLACING FILTER REACTORS, OR INPUT TRANSFORMER, OUTPUT TRANSFORMER AND FILTER CONDENSERS

(a) Remove receiver chassis and S.P.U. as outlined in Part III, Sec. 1.
(b) Remove R.F. Line Inductor under filter reactor unit if filter reactors are to be replaced. Refer to Part III, Sec. 3.
(c) Remove the perforated cover over the filament resistors as outlined in Part III, Sec. 2. This allows unsoldering of connections from the unit.
(d) Remove the by-pass filament resistor and the voltage regulating resistor in order to insure minimum chance of breakage. This is outlined in Part III, Sec. 1.
(e) Unsolder connections from unit being replaced.
(f) Unbend tabs so unit may be pulled clear.
(g) Replace new unit and bend tabs securely to hold.
(h) Resolder all leads to their proper connections (See Figure 11).
(i) Replace in reverse manner any of items mentioned in (b), (c) and (d) above.
(j) Replace S.P.U. and receiver chassis in reverse manner making sure S.P.U. asbestos pad is in proper place under the S.P.U.

SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for *defective tubes, or a poor antenna system.* If imperfect operation is not due to these causes, the "Service Data Chart" should be consulted for further detailed causes. Reference to Part No. and Section No. in the "Service Notes" is also noted for further details.

Indication	*Cause*	*Remedy*
No signals	Socket plug in reversed position. Defective operating switch. Loose volume control arm. Defective power cable. Defective R.F. transformer. Defective A.F. transformer. Defective By-pass condenser. Defective input or output transformer. Defective receiver chassis or socket power unit.	Reverse socket plug. Repair or replace switch. Tighten volume control arm. Replace Power Cable. Replace R.F. transformer assembly. Replace A.F. transformer assembly. Replace By-pass condenser. Replace input or output transformer. Check by means of continuity tests and make any repairs or replacements necessary, PII,S3.
Weak signals	Compensating condenser out of adjustment. Defective power cable. Defective R.F. transformer. Defective A.F. transformer. Defective By-pass condenser. Defective main tuning condensers. Low voltages from socket power unit. Defective receiver chassis or socket power unit. Defective input or output transformer.	Adjust compensating condenser correctly, PIS7. Repair or replace cable. Replace R.F. transformer assembly. Replace A.F. transformer assembly. Replace defective By-pass condenser. Replace or align defective tuning condensers. Check socket voltages with high resistance D.C. voltmeter PII,S3. Check by means of continuity test and make any repairs or replacements necessary, PII,S3. Replace input or output transformer.
Poor quality	Defective A.F. transformer. Defective By-pass condenser. Defective input or output transformer.	Replace A.F. transformer assembly. Replace defective By-pass condenser. Replace input or output transformer.
Howling	Compensating condenser out of adjustment. Defect in audio system. Open grid circuit in any stage. Receiver in oscillation.	Adjust compensating condenser correctly, PI,S7. Check and repair any defect. Check circuit and repair defect. Check and repair, PI,S9.
Radiotrons fail to light	Operating switch not "ON." Defective operating switch. Defective input cord. No. D.C. line voltage. Defective resistor in SPU.	Turn operating switch "ON." Replace operating switch. Repair or replace input cord. Turn D. C. line voltage "ON." Replace defective resistor.
Play in station selector	Loose knob. Slack cable caused by defective tension spring.	Tighten or replace knob. Replace defective tension spring.

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