RCA

Radiolas 18 D.C. and 51 D.C.

SERVICE NOTES

[First Edition 2½M
Copyright, February, 1929]

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PREFACE

Service goes hand in hand with sales. The well-informed RCA Authorized Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that RCA Loudspeaker and Radiola owners may be entirely satisfied.

Obviously, this service can best be rendered by properly equipped service organizations having a thoroughly trained personnel with a knowledge of the design and operation of RCA Loudspeakers and Radiolas.

Such service organizations have been established by RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

To assist in promoting this phase of the Dealer and Distributor's business the RCA Service Division has prepared a series of Service Notes—of which this booklet is a part—containing technical information and practical helps in servicing RCA Loudspeakers and Radiolas.

This information has been compiled from experience with RCA Dealers and Distributors' service problems and presents the best practice in dealing with them. A careful reading of these Service Notes will establish their value, and it is suggested they be preserved for ready reference.

In addition to supplying the Service Notes, the RCA Service Division maintains a corps of engineers who are qualified to render valuable help in solving service problems. These engineers call upon the trade at frequent intervals to advise and assist RCA Distributors in the performance of service work.

CONTENTS

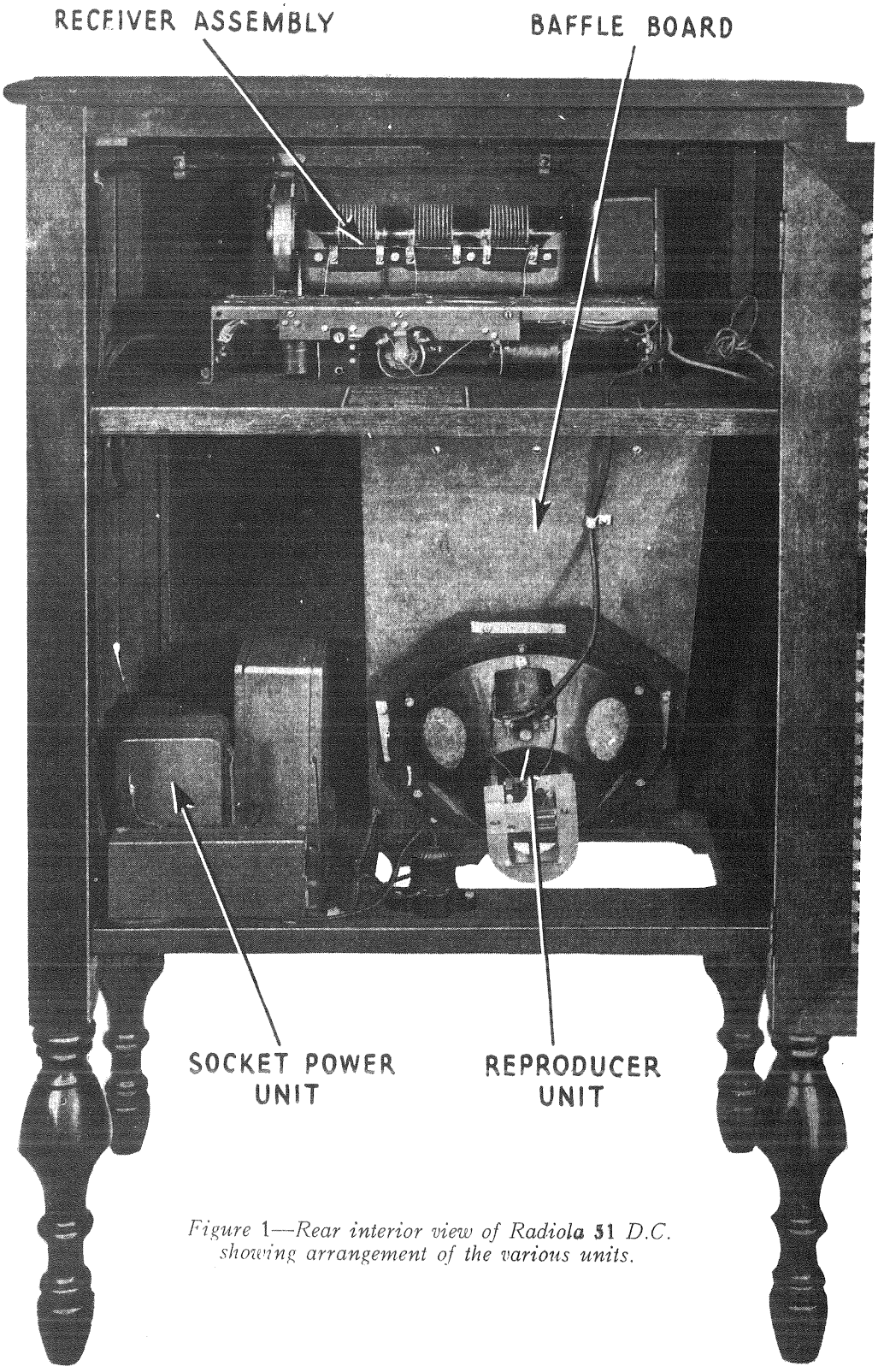


Figure 1—Rear interior view of Radiola 31 D.C. showing arrangement of the various units.

RADIOLAS 18 D.C. and 51 D.C.

107.5-127.5 Volts Direct Current

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

RCA Radiola 18 and 51 are manufactured in models designed for direct current lighting circuit operation. While these models are similar to the A.C. models in appearance and performance, electrically they are considerably different. For this reason a special Service Note on these models is issued for the guidance of those called upon to locate and remedy any trouble that may develop.

RCA Radiola 51 D.C. is a cabinet model combination of the RCA Radiola 18 D.C. and Loudspeaker 100A. See rear interior view Figure 2 and top view of receiver Figure 3. Service work in connection with the loudspeaker is covered in the regular RCA Loudspeaker 100A Service Notes. Due to the location of the S.P.U., there is a slight mechanical difference in the location of wiring and arrangement of the terminal strip, as compared with Radiola 18 D.C. These various changes are shown in the circuit diagrams and also in the continuity tests. In other respects, both Radiolas are identical.

These notes are divided into two parts, namely: Part I—General Service Data; Part II —Radiola 18 D.C. and 51 D.C. Electrical Tests, and a Service Data Chart, applicable to both Radiolas. The general instructions given in the Radiola 18 A.C. Service Notes may be used when replacement is desired as the general arrangement of parts is the same.

PART 1—GENERAL SERVICE DATA

(1) CIRCUIT CHARACTERISTICS

The following characteristics are incorporated in the design of Radiolas 18 D.C. and 51 D.C.:

(a) Each is a six-tube tuned radio frequency receiver, utilizing five Radiotrons UX-112A and one Radiotron 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 current for the Radiola supplies all plate and grid voltages except the grid voltage used on the Radiotron UX-171A. This is supplied by an external "C" battery of 18 volts which must be supplied at the time of installation.

(f) Counting from right to left facing the front of the Radiola, the Radiotron sequence is as follows:

(1) Radiotrons Nos. 1, 2 and 3 are successively the first, second and third stages of radio frequency amplification.

(2) Radiotron No. 4 is the tuned detector.

(3) Radiotrons Nos. 5 and 6 are the first and second audio stages respectively.

Figure 4 shows the schematic circuit of Radiola 18 D.C. and Figure 5 shows the schematic circuit of Radiola 51 D.C.

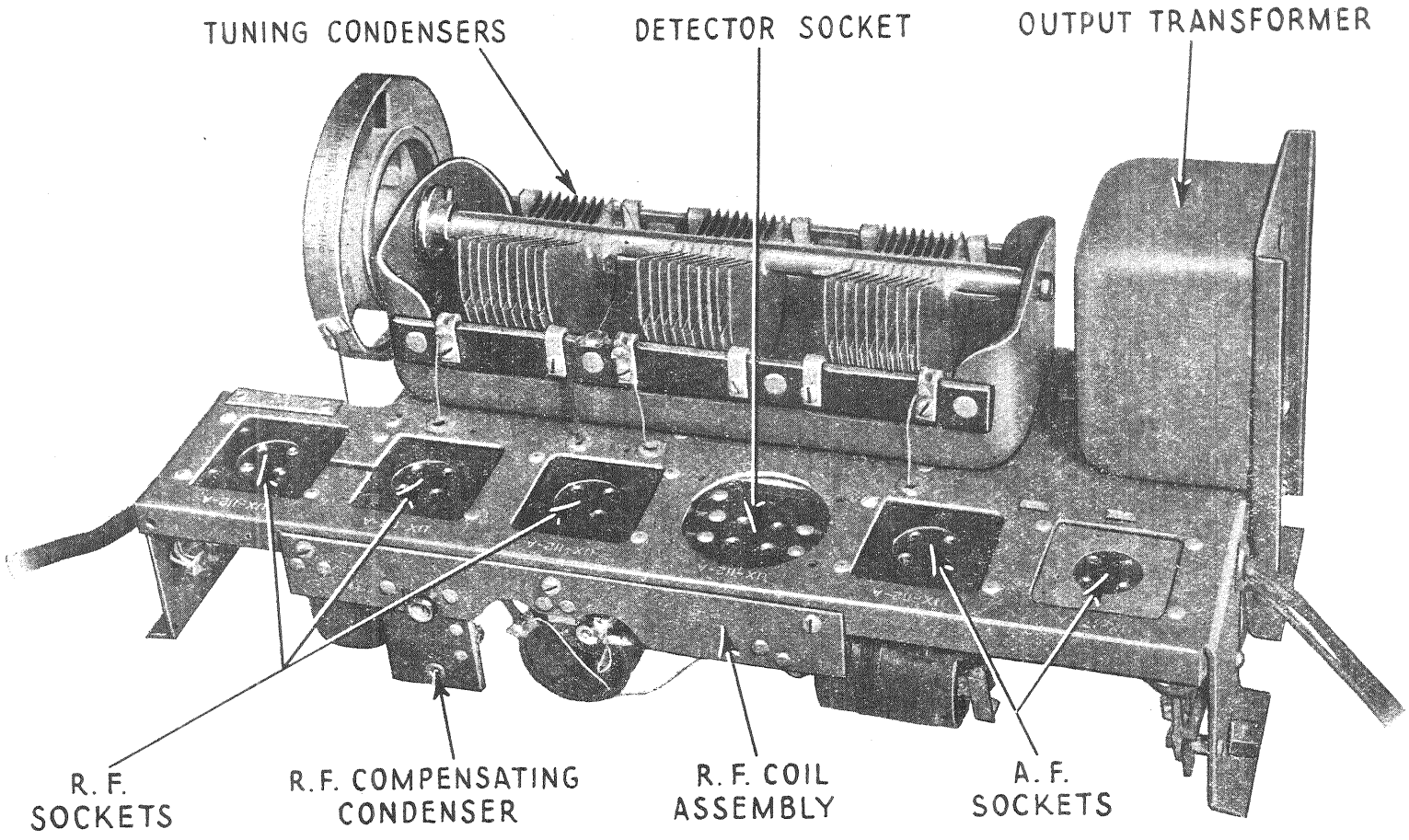


Figure 3—Top view of Radiola 51 D.C. receiver assembly, showing various parts

(2) ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiolas 18 D.C. and 51 D.C. the antenna length 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.

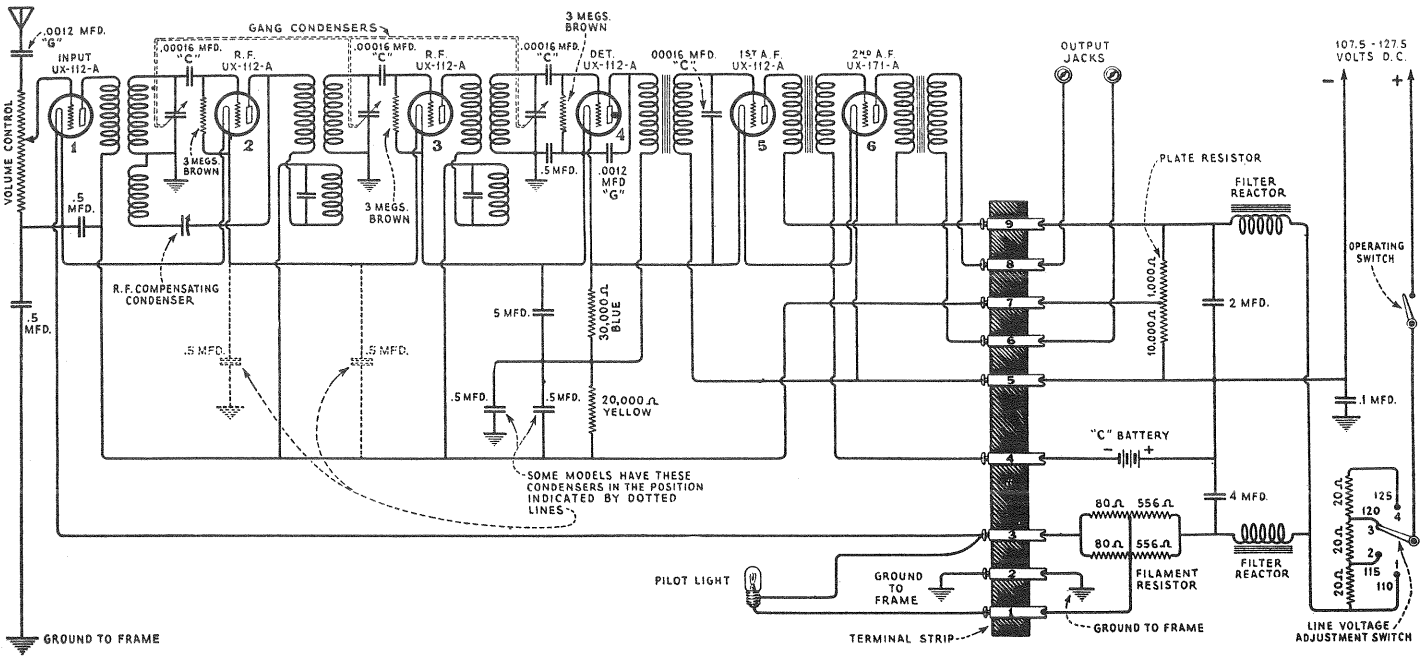


Figure 4—Schematic circuit diagram of Radiola 18 D.C.

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.

(3) ANTENNA (Indoor Type)

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.

(4) RADIOTRONS

Five Radiotrons UX-112A and one Radiotron 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 and it should not go into oscillation. 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.

(5) 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. 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 terminal strip cover. The operating switch should always be turned "off" when the terminal cover is removed.

(6) "C" BATTERY

An external "C" battery is used to bias the Radiotron UX-171A power amplifier in these Radiolas. The use of this battery allows the highest possible plate voltage on the tube which gives a maximum undistorted output. The black lead is connected to the negative side of the battery either minus or minus 22½ terminal on the battery. The green lead is connected to the positive side of the battery either + 18 or —4½. The result is that an 18-volt bias is applied to the grid of the Radiotron UX-171A. This battery should be replaced about once a year.

(7) ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The R.F. compensating condenser in Radiolas 18 D.C. and 51 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 gives 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) In Radiola 18 D.C. remove the rear cover from the cabinet. In Radiola 51 D.C. open the rear door.

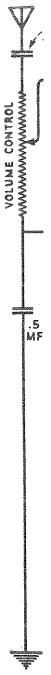
(b) Put receiver in operation in usual manner and tune in a station preferably at the middle or upper wave lengths.

(c) Locate the position of the compensating condenser adjusting screw at the rear of the receiver assembly. (See Figure 2.)

(d) 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.

(e) Tune in stations with maximum volume and note if the receiver goes into oscillation at any wavelength. If it does, turn the screw still further to the left.

(f) When the receiver does not oscillate at any wavelength the correct adjustment has been found for best sensitivity and tone quality.



(8) AUDIO GROWL OR HOWL

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

(a) Open by-pass condensers. 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 in the case of Radiola 18 D.C. change the relative angle between the set and speaker. In Radiola 51 D.C. examine the mounting of the loudspeaker and see that the speaker is entirely suspended from the baffle board by means of its felt ring.

(c) Defective resistance in S. P. U. A short or open in any section of the plate resistor may cause inoperation or howl.

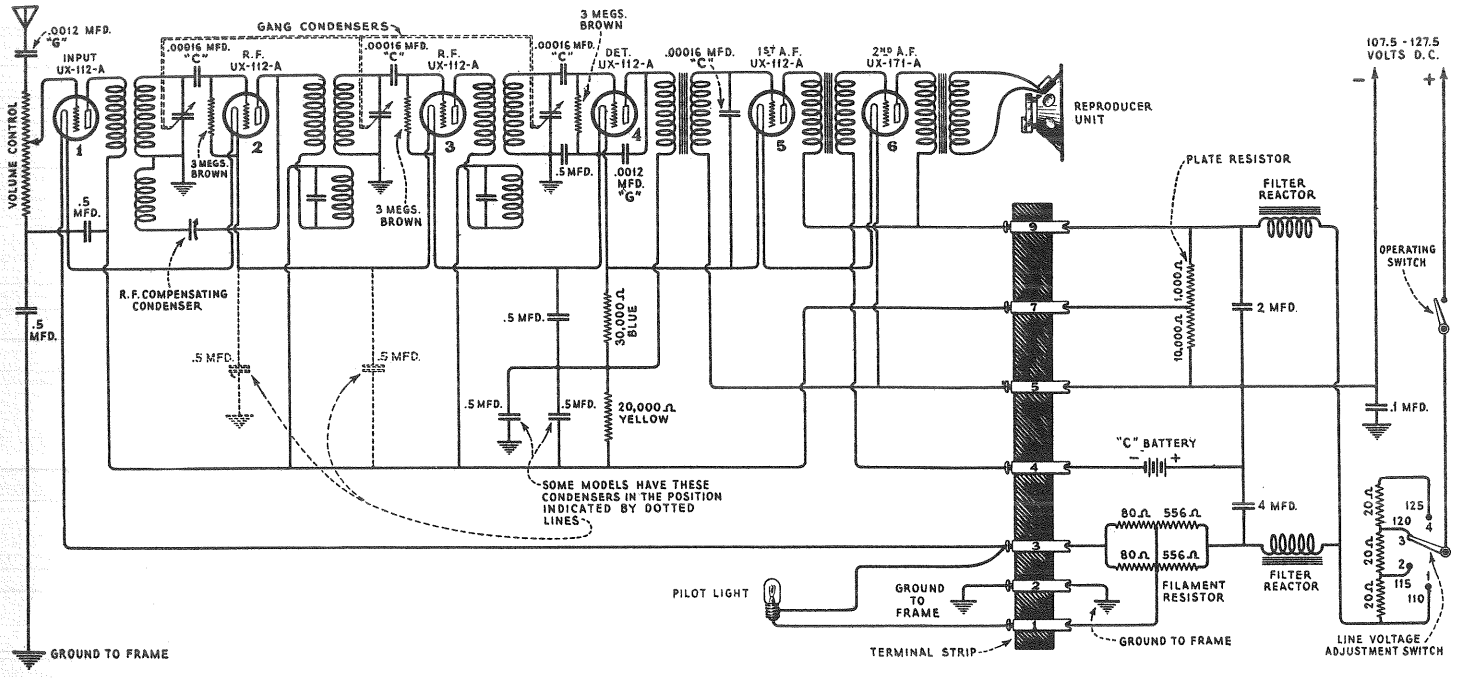


Figure 5—Schematic circuit diagram of Radiola 51 D.C.

(d) In some receivers, especially those connected to lines having the positive side grounded, an audio howl may be experienced even though everything is O.K. The remedy in this case is to shift the two condensers to the position indicated in Figure 4 so that a ½ mfd. condenser will be shunted across the 20,000 ohm resistor in the detector plate supply. Some receivers have this connection already made and it is very unlikely this audio howl trouble will be experienced.

(9) UNCONTROLLED OSCILLATION

Uncontrolled oscillations in Radiolas 18 D.C. and 51 D.C. may be caused by:

(a) Incorrect adjustment of the R.F. compensating condenser. Adjust compensating condenser as described in Part II, Section 7.

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

(c) Defective R.F. coil system. A short in the condensers connected across the concentrated primary coils may cause the receiver to go into oscillation.

(d) In some cases, even though everything is O.K., oscillation will occur. Should this condition exist one of the following remedies will prove effective.

(1) Bend the first R.F. coil in the direction of its free end closer to the end of the chassis. (Away from the other R.F. coils).
(2) Remove the ground lead which comes from the pigtail of the gang variable condenser 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.
(3) Addition of a .5 mfd. condenser from the positive terminal of the bias battery to an external ground connection such as a water pipe or steam radiator. This will also help reduce undesirable back ground noises that are present in some locations. This is most effective on installations that have the positive side of the 110-volt D.C. line grounded.

PART II—ELECTRICAL TESTS

(1) VOLTAGE READINGS

When checking Radiola 18 D.C. or 51 D.C. for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man should have a good D.C. voltmeter, preferably of 600 ohms per volt or higher in resistance. The following voltages at the S.P.U. terminal strip are correct with the voltage adjustment switch set at the correct position for the particular line to which the Radiola is connected and all tubes in operating condition and in their correct positions. The terminal numbers are indicated in Figures 8 and 9.

TERMINALS	VOLTAGE
1 to 3	5 volts
3 to 5	30 volts
4 to 5	18 volts
5 to 7	75 volts
5 to 9	100 volts
7 to 9	25 volts

If it is desired to check the voltages at the individual sockets the following readings are correct. The readings are taken with a Weston Model 537 Type 2 test set or others giving similar readings.

Tube No.	Filament to Grid Volts	Filament to Plate Volts	Plate Current Milliamperes	Filament Voltage
1	5	45	4.5	4.7
2	4	50	5.0	4.8
3	4	55	5.5	5.0
4	4	21	1.0	5.1
5	10	90	3.5	5.2
6	22.5	90	10.0	5.3

(2) CONTINUITY TESTS

The following tabulated continuity tests cover the receiver assembly and S.P.U. of both Radiolas 18 D.C. and 51 D.C. Before making tests disconnect the antenna lead, the D.C. supply cord at the socket outlet, remove the terminal strip shield and all connections to the terminal strip. The terminal and lug numbers, socket contacts and socket numbers referred to are shown in the continuity diagrams, Figure 6, 7, 8, and 9.

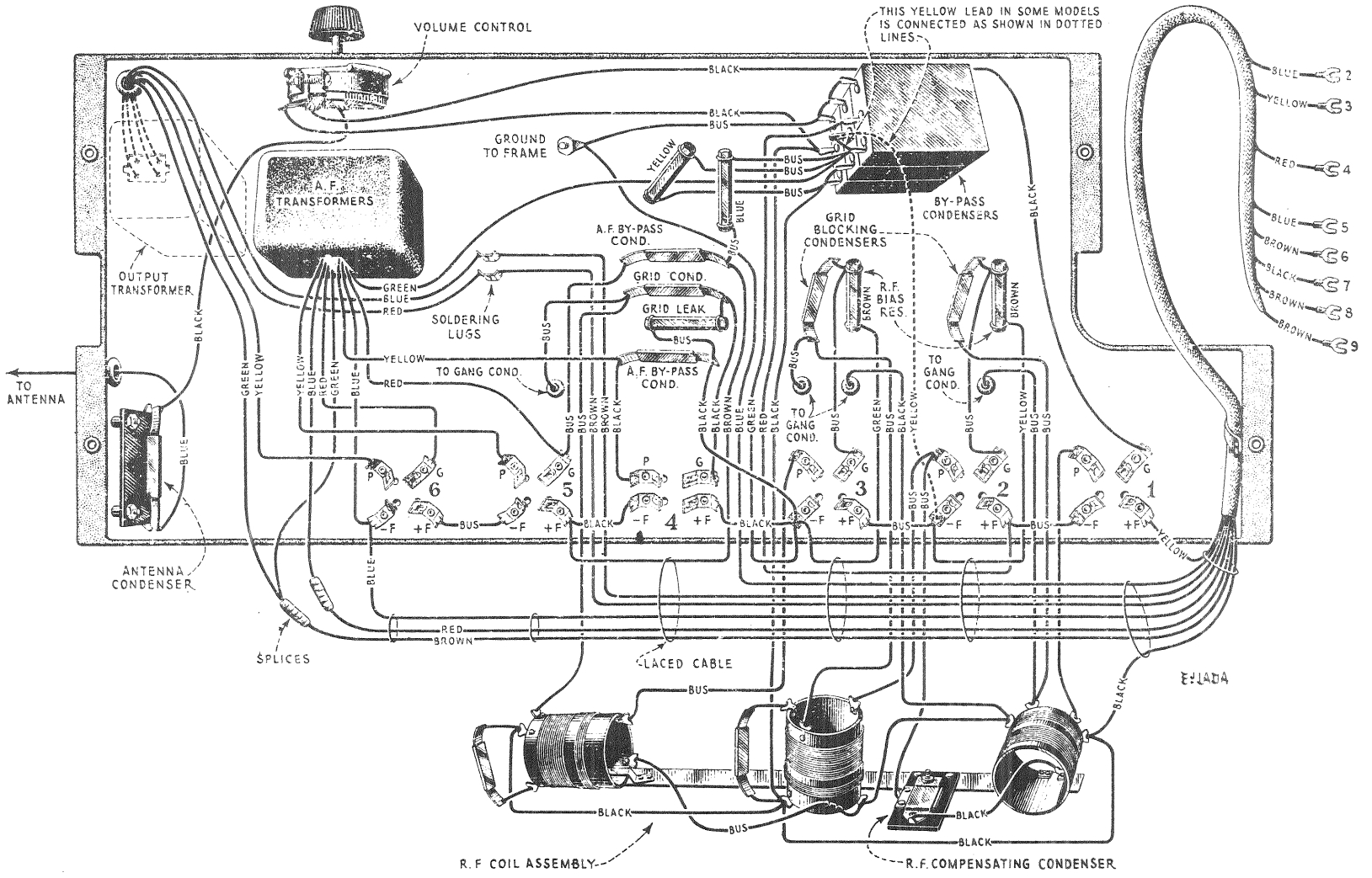


Figure 6—Wiring diagram of Radiola 18 D.C. receiver assembly.

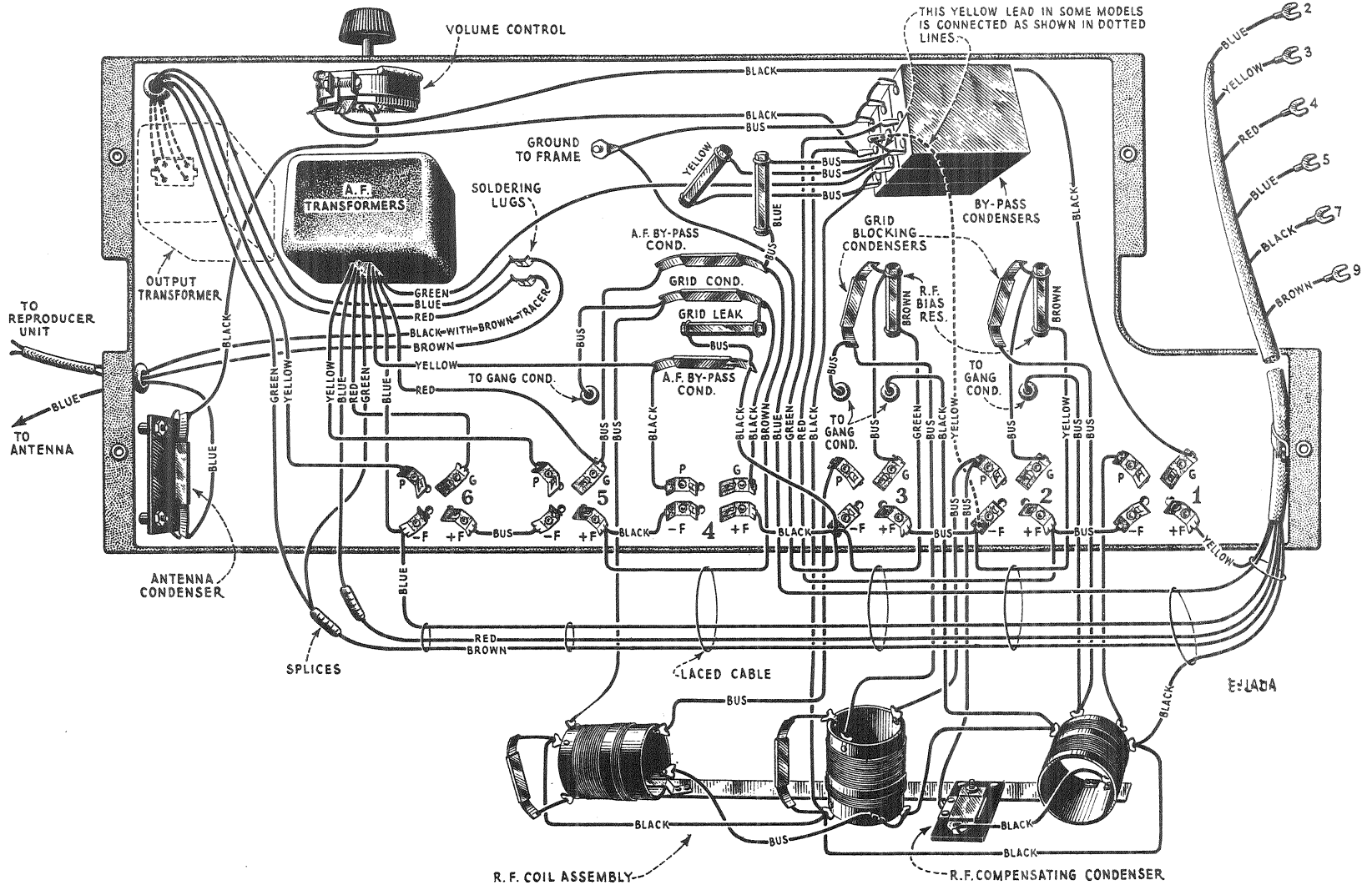


Figure 7—Wiring diagram of Radiola **51** *D.C. receiver assembly.*

RADIOLA 18 D.C. and 51 D.C. RECEIVER ASSEMBLY CONTINUITY TESTS

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna to G1	Open	Shorted antenna condenser
	—F1 to frame	Open	Shorted grounding condenser or wiring
	Stator condenser No. 1 to frame	Closed	Shorted secondary 1st R.F. transformer
	G2 to +F2	Closed (Very Weak)	Open grid bias resistance or if loud, shorted grid resistance
	Stator condenser No. 2 to frame	Closed	Open secondary of 2d R.F. transformer
	G3 to —F3	Closed (Very Weak)	Open grid resistance or if loud, shorted grid bias resistance
	Stator condenser No. 3 to frame	Closed	Open secondary of 3d R.F. transformer
	G4 to one F4	Closed (Very Weak)	Open grid leak or if loud, shorted grid leak
	G5 to Lug No. 5	Closed	Open secondary of 1st A.F. transformer
	G6 to Lug No. 4	Closed	Open secondary of 2d A.F. transformer
Plate	P1 to Lug No. 7	Closed	Open primary of 1st R.F. transformer
	P2 to Lug No. 7	Closed	Open primary or concentrated coil of 2d R.F. transformer
	P3 to Lug No. 7	Closed	Open primary or concentrated coil of 3d R.F. transformer
	P4 to Lug No. 7	Closed	Open primary of 1st A.F. transformer or detector plate resistor
	P5 to Lug No. 9	Closed	Open primary of second A.F. transformer
	P6 to Lug No. 9	Closed	Open primary of output transformer
Misc.	Lug No. 2 to frame	Closed	Open connection
	Lug No. 3 to +F1	Closed	Open connection
	Lug No. 6 to Lug No. 8 (R 18 D.C. only)	Closed	Open secondary of output transformer
	Disconnect cable on Loudspeaker and test across leads (R 51 D.C. only)	Closed	Open Secondary of output transformer
	—F1 to P1	Open	Shorted .5 mfd. condenser
	+F4 to frame	Open	Shorted .5 mfd. condenser
	Some Models —F2 to frame	Open	Shorted .5 mfd. condenser
	Some Models —F2 to Lug No. 7	Open	Shorted .5 mfd. condenser
	Some Models —F3 to P4	Open	Shorted .5 mfd. condenser
	Some Models P4 to frame	Open	Shorted .5 mfd. condenser
	+F4 to frame	Open	Shorted .5 mfd. condenser

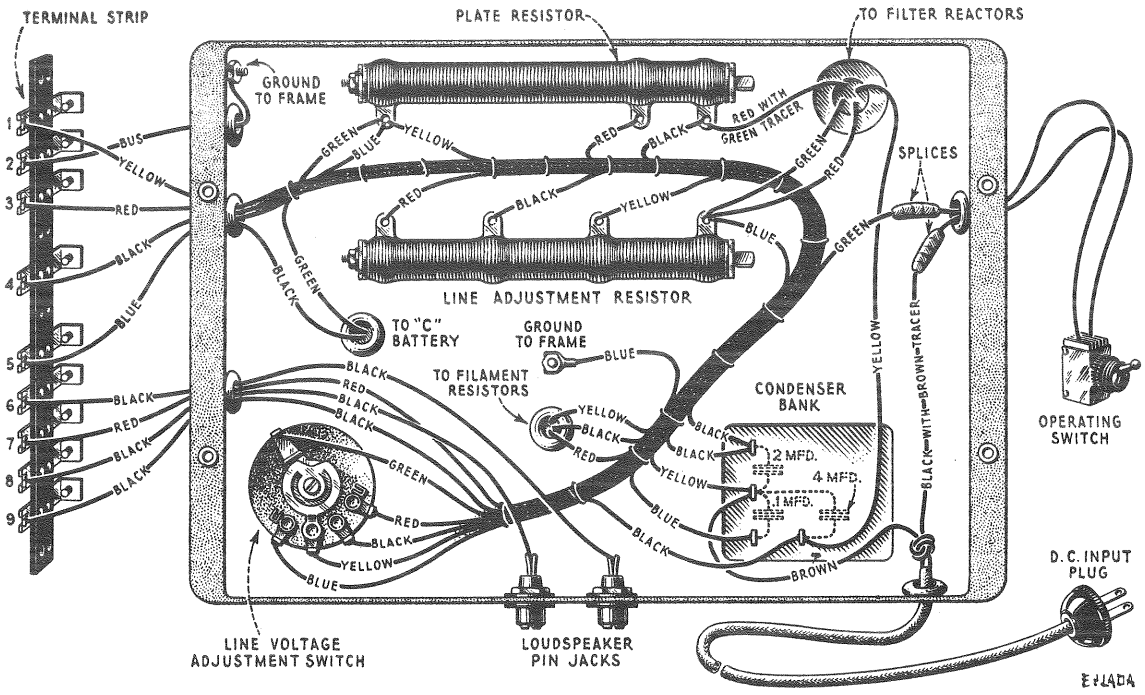


Figure 8—Wiring diagram of Radiola 18 D.C. socket power unit.

RADIOLA 18 D.C.—S. P. U. CONTINUITY TESTS

Remove terminal cover and lugs from all terminals. See Figure 8 for reference numbers. Close switch.

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across input supply plug (switch closed)	Closed	Open filter reactor or plate voltage dividing resistor or line adjustment resistor
Terminal No. 3 to one input plug connection	Closed	Open line adjusting resistor, filament filter reactor, or filament voltage resistance
Terminal No. 6 to one Loudspeaker jack	Closed	Open connection
Terminal No. 8 to other Loudspeaker jack	Closed	Open connection

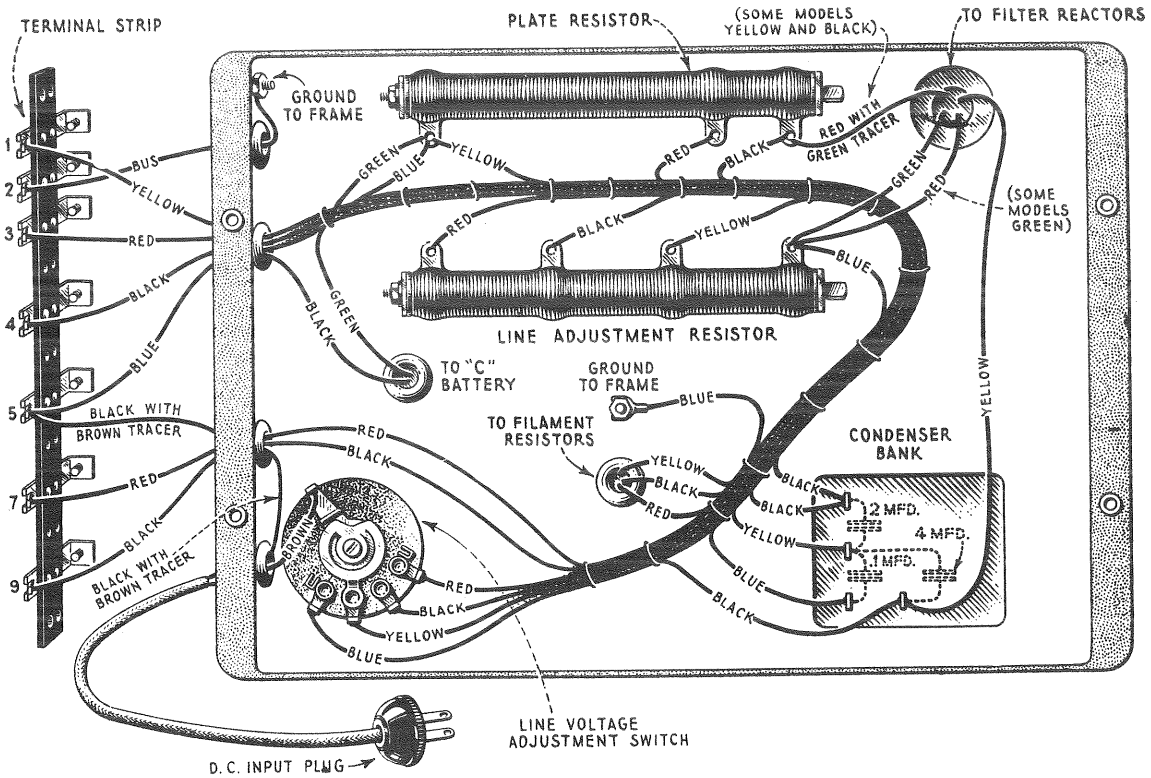


Figure 9—Wiring diagram of Radiola 51 D.C. socket power unit.

RADIOLA 51 D.C.—S. P. U. CONTINUITY TESTS

Remove terminal cover and lugs from all terminals. See Figure 9 for reference numbers. Close switch.

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across input supply plug (switch closed)	Closed	Open filter reactor or plate voltage dividing resistor or line adjustment resistor
Terminal No. 3 to one input plug connection	Closed	Open line adjusting resistor, filament filter reactor, or filament voltage resistance

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	Defective operating switch	Repair or replace switch
	Loose volume control arm	Tighten volume control arm
	Defective power cable	Replace power cable
	Defective R.F. transformer	Replace R.F. transformer assembly
	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective By-pass condenser	Replace By-pass condenser
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 2
	Socket plug in reversed position	Reverse socket plug
Weak signals	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. I, S. 7
	Defective power cable	Repair or replace cable
	Defective R.F. transformer	Replace R.F. transformer assembly
	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective By-pass condenser	Replace defective By-pass condenser
	Defective main tuning condensers	Replace or align defective tuning condensers
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter, P. II, S. 1
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 2
Poor Quality	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective By-pass condenser	Replace defective By-pass condenser
	Defective output transformer	Replace output transformer
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. I, S. 7
	Defect in audio system	Check and repair any defect
	Open grid circuit in any stage	Check circuit and repair defect
	Receiver in oscillation	Check and repair, P. I, S. 9
Radiotrons fail to light	Operating switch not "ON"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input cord	Repair or replace input cord
	No. D.C. line voltage	Turn D.C. line voltage "On"
	Defective resistor in SPU	Replace defective resistor
Play in Station Selector	Loose knob	Tighten or replace knob
	Slack cable	Take up on cable adjusting screw