

R.C.A.

(RADIOLA 30A

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D. C.---(RADIOLA 32

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(LOUDSPEAKER 104

SERVICE NOTES

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RADIO CORPORATION OF AMERICA

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

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A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well informed RCA 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 Radiola owners may be entirely satisfied.

Obviously this service can best be rendered at point of contact and therefore Dealers and Distributors who are properly equipped with a knowledge of the design and operation of Radiolas occupy a favorable position to contract for this work.

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

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

In addition to supplying the Service Notes the RCA, through its Service Stations, has available to Dealer and Distributor the services of engineers who are qualified to render valuable help in solving service problems.

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RADIOLAS 30A D.C., 32 D.C. AND LOUDSPEAKER 104 D.C.
(SOCKET POWER OPERATED)

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION
S.P.-D.C.-1

INTRODUCTION

Radiolas 30A and 32 together with RCA Loudspeaker Model 104 are supplied in models designed for direct current socket operation.

These models using direct current as a source of power differ from those using alternating current only in the construction of the power unit. For service information on the receiver or loudspeaker assemblies the regular Service Notes on these models should be consulted.

The service problems that may be encountered in the power units of these D.C. models are somewhat different from those of A.C. driven machines. Therefore the following notes are published for the guidance of those called upon to locate and remedy any trouble that may occur.

This booklet is divided into four sections, namely;

- Part I - General Service Data
- Part II - Radiola 30A D.C.
- Part III - Radiola 32 D.C.
- Part IV - RCA Loudspeaker 104 D.C.

PART I - GENERAL SERVICE DATA

The power stage in all D.C. models consists of four Radiotrons UX-171A connected in a push-pull amplifying circuit using the 110-volt D.C. line as plate and filament supply and an external battery for grid voltage supply. Due to the greater filament current consumption, the old Radiotrons UX-171 are not interchangeable with the Radiotrons UX-171A used in the D.C. Radiolas. The output of this push-pull amplifier is equal to that of similar A.C. models.

A series parallel filament connection is used, one tube on each side of the amplifier being connected in series and the two series circuits paralleled together. In this circuit arrangement if a filament of one tube burns out the other tube connected in series with it

will also go out, thus throwing the load on the other two tubes of the parallel circuit. In some Radiolas 30A and 32 the result will be a louder signal caused by the increased filament voltage of the two remaining tubes. However, their useful life will be rapidly destroyed under such conditions. In the R.C.A. 104 Loudspeaker and later models of Radiola 30A and 32, due to a different arrangement of the resistance units, the remaining tubes will not receive excessive filament voltage. Filament burn-out in one 171A Radiotron will affect the loudspeaker reproduction only slightly, though the tone quality is not so good. While damage to the two tubes will not be apparent at once, the set should not be operated until the defective Radiotron is replaced. When any D.C. installation is made the customer should be made fully aware of these conditions so as to prevent unnecessary damage to the Radiotrons.

All socket power D.C. model Radiolas and Loudspeakers are provided with a switch for compensating various line voltages. The range over which satisfactory operation is secured is from 105 to 125 volts. There are four positions of the switch, i.e. 105-110, 110-115, 115-120 and 120-125. On making an installation, the voltage of the line should be measured with an accurate voltmeter and the switch set at the correct position for that particular line. On connecting a D.C. Radiola or Loudspeaker to the D.C. lines it will be noticed that at one position of the input plug the set operates correctly and at the other position complete silence results. The correct position must be found by experiment.

An external "C" battery is used to supply the correct negative grid potential to the Radiotrons UX-171A. This is - 16 1/2 or - 18 volts on the tubes already receiving a five-volt bias through the adjacent tube filaments and - 22 1/2 volts for the other two tubes. The correct connections are noted in the schematic circuits on the following pages. It is very important when installing a socket power D.C. Radiola or Loudspeaker to connect these two biasing voltages correctly. Incorrectly connected they will operate apparently O.K. until two of the tubes lose their emission and then the reproduction becomes very poor. As this does not occur immediately the man installing the Radiola should give attention to these connections and make certain they are correct.

The following symptoms and remedies apply generally to socket power D.C. Radiolas and Loudspeaker 104.

(1) WEAK SIGNALS

Should the loudspeaker output be weak even at maximum volume, the receiver must first be examined to determine that its output to the power amplifier is normal and then the following points should be examined:

- (a) Line regulating switch not adjusted properly.
- (b) Defective Radiotron. Try substituting a complete new set of Radiotrons.
- (c) Open center tap connection on input transformer. This is accompanied by rough and unnatural reproduction.
- (d) Open center connection to grid resistors.
- (e) Defective grid resistor.

Any adjustments or repairs found necessary should be made.

(2) DISTORTED REPRODUCTION

If the reproduction obtained at the loudspeaker is not of good quality, and the output of the receiver to the Socket Power Unit (S.P.U.) is of good quality the trouble may be due to:

- (a) Defective Radiotrons in S.P.U.
- (b) "C" battery incorrectly connected.
- (c) Defective "C" batteries. Under normal conditions the "C" battery should be replaced once every six months.
- (d) Grid resistors defective or not in their clips.
- (e) Defective input or output transformer. Under certain conditions a signal may be obtained through an open transformer winding, the quality being very poor. Test for continuity of winding.

Any replacement or repair found necessary should be made.

(3) NOISY REPRODUCTION

Sometimes noisy reception may be experienced on these instruments. The proper procedure is first to disconnect the loop or antenna and note whether or not the trouble is due to pick-up or is internal to the instrument itself. In most cases the trouble is due to pick-up caused by interfering electrical machinery connected to

the same D.C. line. All commutators on D.C. motors used in connection with electrical appliances may arc or spark sufficiently to cause noisy reception in a nearby receiving set. The remedy in cases of this kind is to provide filters and chokes for the interfering apparatus or to select another antenna location that is not as susceptible to pick-up of this character. In apartments and hotels or other city locations, often an outdoor antenna substituted for an indoor antenna will eliminate the objectionable pick-up.

On Radiolas 30A and 32 there is provided a link by which the lines may be grounded through two condensers. Experimenting with the two positions of this link will determine which position gives the better results with least pick-up noise.

If the trouble is found to be internal to the Radiola the following points should be checked:

- (a) Defective Radiotrons. Try replacing all Radiotrons and then isolate the defective one or the pair by interchanging with the ones formerly used.
- (b) Defective grid resistors. Replace with new ones of good quality and the same rating. Only grid resistors of good construction should be used as those absorbing moisture or otherwise having changes of resistance will give noisy or distorted reproduction.
- (c) Dirty line switch contacts. A dirty or high resistance contact of the line switch may cause noisy reception.
- (d) Dirty or poorly soldered connections. Examine all connections in the Socket Power Unit and heat any dirty or poor connection until a new joint is formed.

(4) GRADUALLY DEVELOPED DISTORTED REPRODUCTION

Should the Radiola or Loudspeaker output become poor with distorted reproduction check the following:

- (a) Incorrectly connected "C" battery. Connect "C" battery correctly and replace damaged Radiotrons.
- (b) Shorted 2 Mfd. condenser. A shorted 2 Mfd. condenser will cause the wrong "C" bias to be applied to one tube with possible damage to the Radiotron. Replace the condenser and replace the Radiotron if it has become damaged.

(c) Defective or open grid resistor. This would cause one of the Radiotrons to become defective through receiving an improper grid bias in the case of a defective grid resistor or no bias in the case of an open grid resistor.

(5) RADIOTRONS UX-171A LIGHT BUT RADIOTRONS UX-199 IN RECEIVER DO NOT LIGHT

If the Radiotrons UX-171A in the socket power unit light, and the Radiotrons UX-199 in the receiver do not light the trouble is due to a shorted filter condenser in the socket power unit. This would be the 7 MFD. condenser in the RCA 104 Loudspeaker or the 6 Mfd. condenser in the Radiola 30A and 32. The defective condenser must be replaced.

PART II - D.C. SOCKET POWERED RADIOLA 30A

D.C. socket powered Radiola 30A is identical to the A.C. Model in all respects with the exception of the Socket Power Unit consisting of four Radiotrons UX-171A connected in a push-pull amplifying circuit. The output transformer is designed for use with RCA Loudspeaker 100A.

The serviceman is referred to the regular RCA Radiola Service Notes for information about the receiver assembly. The present Service Notes deal only with the socket power unit used in the D.C. Radiola 30A.

(1) FUSE BLOCK

The fuse block is placed in the circuit to prevent a possible short in the S.P.U. from blowing the house fuses and also to prevent damage to the Radiola from such a short circuit. This fuse block contains two 3-ampere fuses and larger fuses should never be inserted in this block.

Should a fuse blow on being inserted in its socket or when the input plug is connected, disconnect the Radiola immediately from the lighting circuit and look for:

(a) Shorted input plug. Examine input plug

mounted on Socket Power Unit for a possible short.

- (b) Shorted or grounded wiring. The negative side of the line is not grounded and therefore all wires should be examined for a possible short or ground. Special attention should be given to the various connections.
- (c) Shorted 2 Mfd. grounding condensers. Should both of these condensers become shorted they would constitute a dead short across the line. Such defective condensers must be replaced.

(2) LINE SWITCH

The line switch on D.C. socket powered Radiola 30A has four positions, the correct voltage for each position being stamped on the cover adjacent to each contact. Facing the rear of the Radiola from left to right the positions are 120-125, 115-120, 110-115, 105-110. When making an installation it is very important to measure the line voltage with a D.C. voltmeter and set the switch at the correct position for that particular voltage. If a voltmeter is not obtainable, the power company can furnish the correct rating.

(3) CONDENSER BANK

Two condenser banks are incorporated in D.C. socket powered Radiola 30A, one 10 Mfd. and one 12 Mfd. The 12 Mfd. condenser block consists of one 6 Mfd. filter condenser and two 2 Mfd. grid blocking condensers and two 1 Mfd. grounding condensers. The 10 Mfd. condenser block contains the extra filter condensers normally in the A.C. package used with the eight-tube catacomb. The internal connections of each condenser bank are shown on a diagram mounted on the side of each unit. To properly test any condenser charge it with the 110-volt line current and after waiting 30 seconds discharge it with a screw driver. A defective condenser will be identified by its inability to hold a charge.

(4) VOLTAGE READINGS

The following voltage readings should be obtained at the terminal strip located at the rear of the Socket Power Unit. The terminal numbers are shown in Figure 2 and are numbered consecutively from left to right, facing the rear of the Radiola.

VOLTAGE READINGS

Terminals	:	Correct Effect
1 to 2	:	31 volts with all Radiotrons lit and battery setting near "Soft"
2 to 3	:	21.5 volts normally
3 to 4	:	41 volts normally
11 to 12	:	16 1/2 or 18 volts with new "C" battery
11 to 13	:	22 1/2 volts with new "C" battery. If this voltage is below 20, the "C" battery should be replaced

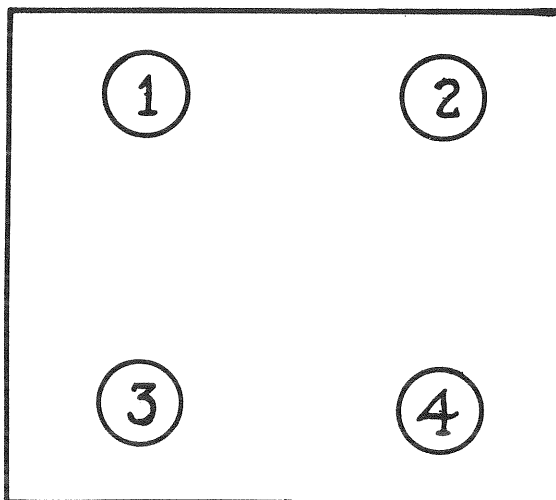


Figure 1 -- Reference numbers used in continuity test table showing location of tube sockets in S.P.U. when viewed from the rear of the Radiola.

(5) CONTINUITY TESTS FOR SOCKET POWER UNIT

The following continuity test table covers all circuits of the D.C. socket powered Radiola 30A S.P.U. The terminal numbers in the first column refer to terminal connections in the S.P.U. viewed from the rear counting from left to right. (See Figure 2.)

CONTINUITY TESTS FOR SOCKET POWER UNIT

<u>Terminals</u>	<u>: Correct</u>	<u>: Incorrect Effect Caused by</u>
	<u>: Effect</u>	<u>:</u>
	<u>:</u>	<u>:</u>
Outside contacts of line switch	: closed	: Open line resistance unit
One side of input plug to + F1	: closed	: Open resistance unit
One side of input plug to + F2	: closed	: Open resistance unit
4 to 5	: closed	: Open primary of input transformer
6 to 7	: closed	: Open secondary of input transformer
4 to 8	: open	: Shorted 1 Mfd. condenser
1 to 9	: open	: Shorted 1 Mfd. condenser
1 to 10	: open	: Shorted 1 Mfd. condenser
9 to 10	: open	: Shorted 1 Mfd. condenser
12 to G1	: closed	: Open 1/2 sec. input trans.
12 to G2	: closed	: Open 1/2 sec. input trans.
G1 to G3	: open	: Shorted 2 Mfd. condenser
G2 to G4	: open	: Shorted 2 Mfd. condenser
13 to G3	: closed	: Open grid resistor
	: (weak)	:
13 to G4	: closed	: Open grid resistor
	: (weak)	:
P1 to P2	: closed	: Open primary of output transformer
	:	:
P3 to P4	: closed	: Open primary of output transformer
	:	:
14 to Frame	: closed	: Open ground connection
Frame to one side of input plug	: open	: Shorted 1 Mfd. condenser
	:	:
Frame to other side of input plug	: open	: Shorted 1 Mfd. condenser
	:	:
	:	:

PART III - D.C. SOCKET POWERED RADIOLA 32

D.C. Socket powered Radiola 32 is identical to the regular A.C. model with the exception of the socket power unit. In the D.C. Model the power amplifier consists of four Radiotrons UX-171A connected in a parallel push-pull circuit, giving an output equal to the Radio-

tron UX-210 used in the A.C. Models. Parts other than the S.P.U. are identical in both models and any service information needed will be found in the regular "Radiola 32 Service Notes."

The present Service Notes deal only with the Socket Power Unit used in the D.C. Radiola 32.

(1) FUSE BLOCK

The fuse block in the D.C. socket powered Radiola 32, as in the D.C. socket powered Radiola 30A already noted, is placed in the circuit to prevent a possible short in the S.P.U. from blowing the house fuses and also to prevent damage to the Radiola from such a short circuit. Two 3-ampere fuses are used and larger fuses should never be inserted in this block.

Should a fuse blow on being inserted in its socket or when the input is connected disconnect the Radiola immediately from the lighting circuit and look for:

- (a) Shorted input plug. Examine input plug mounted on Socket Power Unit for a possible short.
- (b) Shorted or grounded wiring. The negative side of the line is not grounded and therefore, all wire should be examined for a possible short or ground. Special attention should be given to the various connections.
- (c) Shorted 2 Mfd. grounding condensers. Should both of these condensers become shorted, they would constitute a dead short across the line. Such defective condensers must be replaced.

(2) LINE SWITCH

The line switch on D.C. socket powered Radiola 32 has four positions, the correct voltage for each position being stamped on the cover adjacent to each contact. Facing the rear of the Radiola and reading from left to right the positions are 120-125, 115-120, 110-115, 105-110. When making an installation it is very important to measure the line voltage with a D.C. voltmeter and set the switch at the correct position for that particular voltage. If a voltmeter is not obtainable the power company can furnish the correct rating.

(3) CONDENSER BANK

The condenser bank of D.C. socket powered Radiola 32

consists of a 6 Mfd. filter condenser, two 2Mfd. grid blocking condensers and two 1 Mfd. line condensers all contained in one metal container. The internal connections of this condenser bank are shown on a diagram attached to the side of the container. To test these condensers the 110-volt D.C. line is used to charge each condenser and, after waiting 30 seconds, the condenser is discharged by short circuiting the terminals with a metal screw driver. A condenser that will not hold its charge is defective and should be replaced.

(4) VOLTAGE READINGS

Referring to Figure 3, the following voltages should be obtained at the terminal strip of the Socket Power Unit. The terminals noted in the first column of the tabulated text refer to the terminals viewed from the rear of the S.P.U. counting from left to right and omitting the first four terminals which are for the input and output of the S.P.U.

Terminals	Correct Voltage
1 to 3	31.0 volts, normally with all Radiotrons lit and battery setting near "Soft"
3 to 4	21.5 volts normally
4 to 5	41 volts normally

The "C" battery terminals are located on the fuse block. A check of the voltages should be made as indicated at the terminals. If the 22 1/2 volt terminal reads less than 20 volts the battery should be replaced.

(5) CONTINUITY TESTS FOR SOCKET POWER UNIT

The following continuity test table covers all circuits of the D.C. Radiola 32 S.P.U. The terminal numbers in the first column refer to terminal connections in the S.P.U. viewed from the rear counting from left to right and omitting the first four terminals which are the input and output terminals. (See Figure 3.) Tube socket contacts (F1, G3, P4, etc.) noted in column one refer to location of tube sockets in S.P.U. counting from left to right when viewed from rear of Radiola. Before running this test remove all connections from the terminal.

board at the rear of the S.P.U. and also the input plug and Radiotrons. See that fuses are screwed tight into their respective sockets.

The testing equipment consists of a D.C. voltmeter with battery voltage sufficient to give approximate full

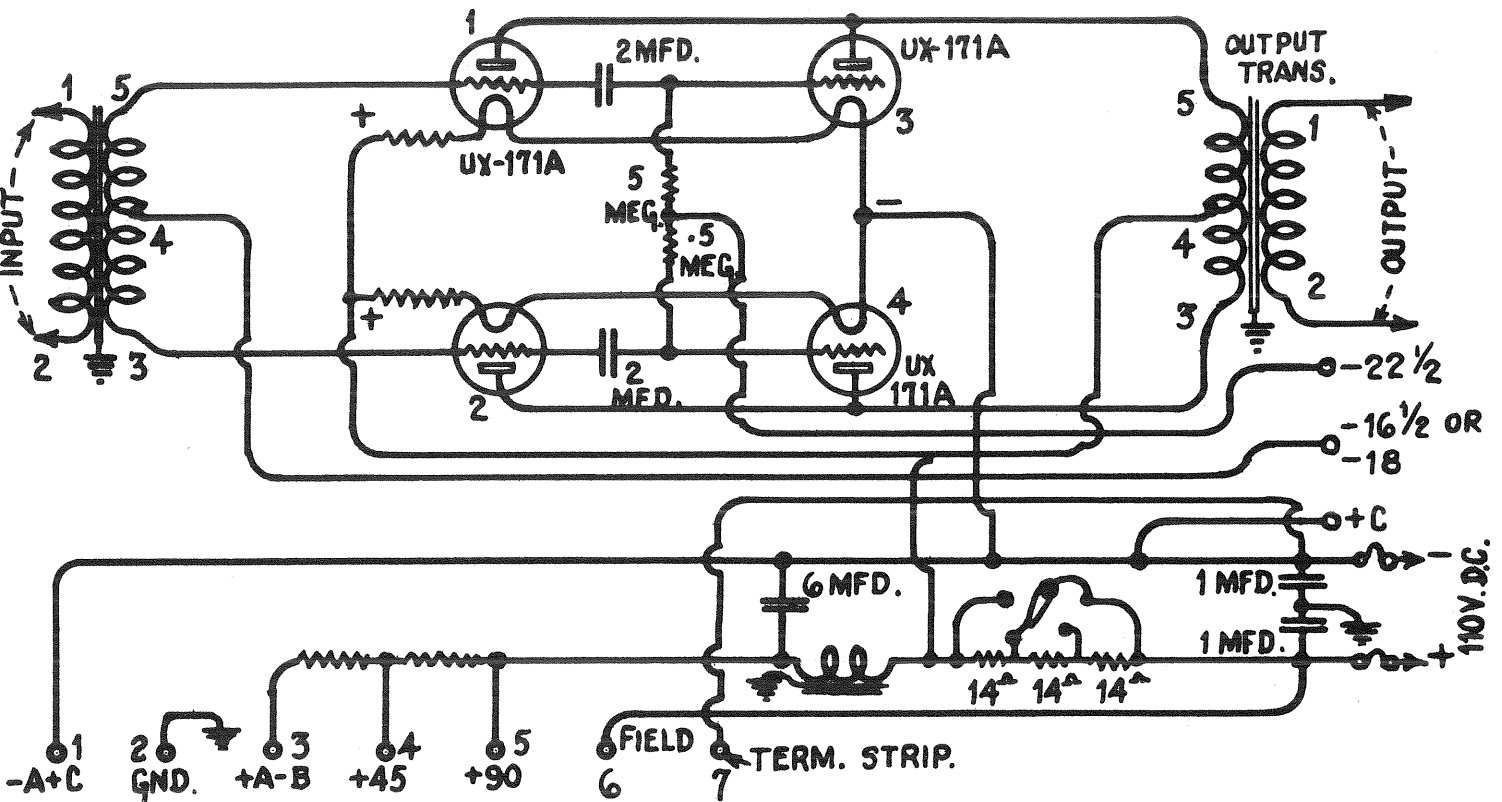


Figure 3 -- Radiola 32 D.C. socket power unit schematic circuit with terminal connections and voltages.

scale deflection when connected directly across battery terminals - for example, a 45 volt "B" battery unit connected in series with a voltmeter having a zero to 50-volt scale. A pair of headphones connected in series with a 4 1/2 volt "C" battery may also be used. Discharge the filter condensers by short - circuiting their terminals with a screw driver before starting test.

CONTINUITY TESTS FOR SOCKET POWER UNIT

<u>Terminals</u>	<u>: Correct</u>	<u>: Incorrect Effect Caused by</u>
	<u>: Effect</u>	<u>: Effect</u>
Across input terminals	: Closed	: Open primary of input transformer
Across output terminals	: Closed	: Open secondary of output transformer
3 to 5	: Closed	: Open tapped resistance unit
One side of input plug to ground	: Open	: Shorted 1 Mfd. condenser
Other side of plug to ground	: Open	: Shorted 1 Mfd. condenser
5 to † of input plug	: Closed	: Open filter reactor or tapped resistance unit
† of input plug to P1 or P3	: Closed	: Open 1/2 primary of output transformer
† of input plug to P2 or P4	: Closed	: Open 1/2 primary of output transformer
- 16 1/2 to G1 or G3	: Closed	: Open 1/2 of secondary of input transformer
- 16 1/2 to G2 or G3	: Closed	: Open 1/2 of secondary of input transformer
G1 to G3	: Open	: Shorted 2 Mfd. condenser
G2 to G4	: Open	: Shorted 2 Mfd. condenser
- 22 1/2 to G3	: Closed	: Open grid resistor or if loud (Weak) click, shorted grid resistor
- 22 1/2 to G4	: Closed	: Open grid resistor or if loud (Weak) click, shorted grid resistor
† F1 to † of input plug	: Closed	: Open filament resistance or line resistance
† F2 to † of input plug	: Closed	: Open filament resistance or line resistance

PART IV - RCA D.C. SOCKET POWERED LOUDSPEAKER 104

RCA D.C. Socket Powered Loudspeaker 104 is identical to the regular A.C. model with the exception that the Socket Power Unit is designed to operate from the regular 110-volt D.C. lines. This loudspeaker contains a power amplifier consisting of four Radiotrons UX-171A connected in a push-pull circuit and furnishes a "B" voltage supply

to any receiver and complete plate grid and filament voltages for Radiolas 25 or 28 when used in conjunction with the proper A.C. Package.

The reproduction obtained and the general appearance is the same as that of the A.C. Models.

While the present Service Notes cover problems that may occur it will be found that very little service work will be required on this loudspeaker because of its excellent design and good construction.

(1) LINE SWITCH

A line switch is provided for adjusting the Loudspeaker to various line voltages - satisfactory operation being secured over the range of 105-125 volts. The knob of this switch is located on top of the Socket Power Unit and the various positions are numbered from 1 to 4. The correct voltages for these various positions are as follows:

1. 120-125
2. 115-120
3. 110-115
4. 105-110

When an installation is made the voltage of the line should be measured and the switch set at the correct position for the particular line in use. If a voltmeter is not obtainable the correct voltage may be secured from the power company. If neither can be readily obtained the switch should be set at the lowest point at which satisfactory operation may be secured.

(2) CONDENSER TESTS

The 7 Mfd. filter condenser and the two 2 Mfd. grid blocking condensers can be tested by disconnecting them from the circuit and charging them with the 110-volt D.C. line. After charging wait 30 seconds and discharge them by short circuiting their terminals by means of a screw driver. A condenser that will not hold its charge is defective and should be replaced.

(3) VOLTAGE READINGS

The following voltages should be obtained at the terminal strip located at the rear of the Socket Power Unit. The terminal strip numbers shown in Figure 4 are located consecutively from left to right when facing the Loudspeaker from the rear, omitting the first four terminals which are for the input and output of the loudspeaker. With the loudspeaker and receiver in normal operation the following readings should be obtained on a D.C. voltmeter.

VOLTAGES FOR LOUDSPEAKER SUPPLYING "B"
CURRENT ONLY. LINK BETWEEN TERMINALS
1 AND 2

Terminals	:	Correct Voltage
1 to 4	:	45
1 to 5	:	90
1 to 6	:	16 1/2 or 18
1 to 7	:	22 1/2

VOLTAGES FOR LOUDSPEAKER SUPPLYING
"A", "B" AND "C" POWER TO RADIOLAS
25 OR 28. LINK BETWEEN TERMINALS 2 AND 3

Terminals	:	Correct Voltage
1 to 3	:	31
3 to 4	:	21.5
4 to 5	:	41
1 to 6	:	16 1/2 or 18
1 to 7	:	22 1/2

Should the readings on the "C" battery terminals 1 to 7, show less than 20 volts replace the "C" battery.

(4) USING RCA D.C. SOCKET POWERED LOUDSPEAKER 104
WITH RADIOLA 25 OR 28 FOR COMPLETE SOCKET
POWER OPERATION

RCA D.C. Socket Powered Loudspeaker 104 may be used in conjunction with Radiolas 25 and 28 by using the regular A.C. Package furnished for this purpose. However, when making an installation of this kind the following deviations from the procedure outlined in A.C. Package Instruction Book should be observed:

1. Resistor Unit UP-591 is not used.
2. Instead of opening the link as on an A.C. machine, the position of the link is changed to terminals 2 and 3 (Figure 4).

(5) CONTINUITY CIRCUIT TESTS

The tabulated continuity tests cover all circuits of the Socket Power Unit. The terminal numbers in column one refer to the terminals in the S.P.U. viewed from the rear counting from left to right and omitting the first four terminals which are the input and output terminals, (See Figure 4). Tube socket contacts (G1, F2, etc.) noted in column one refer to location of tube sockets counting

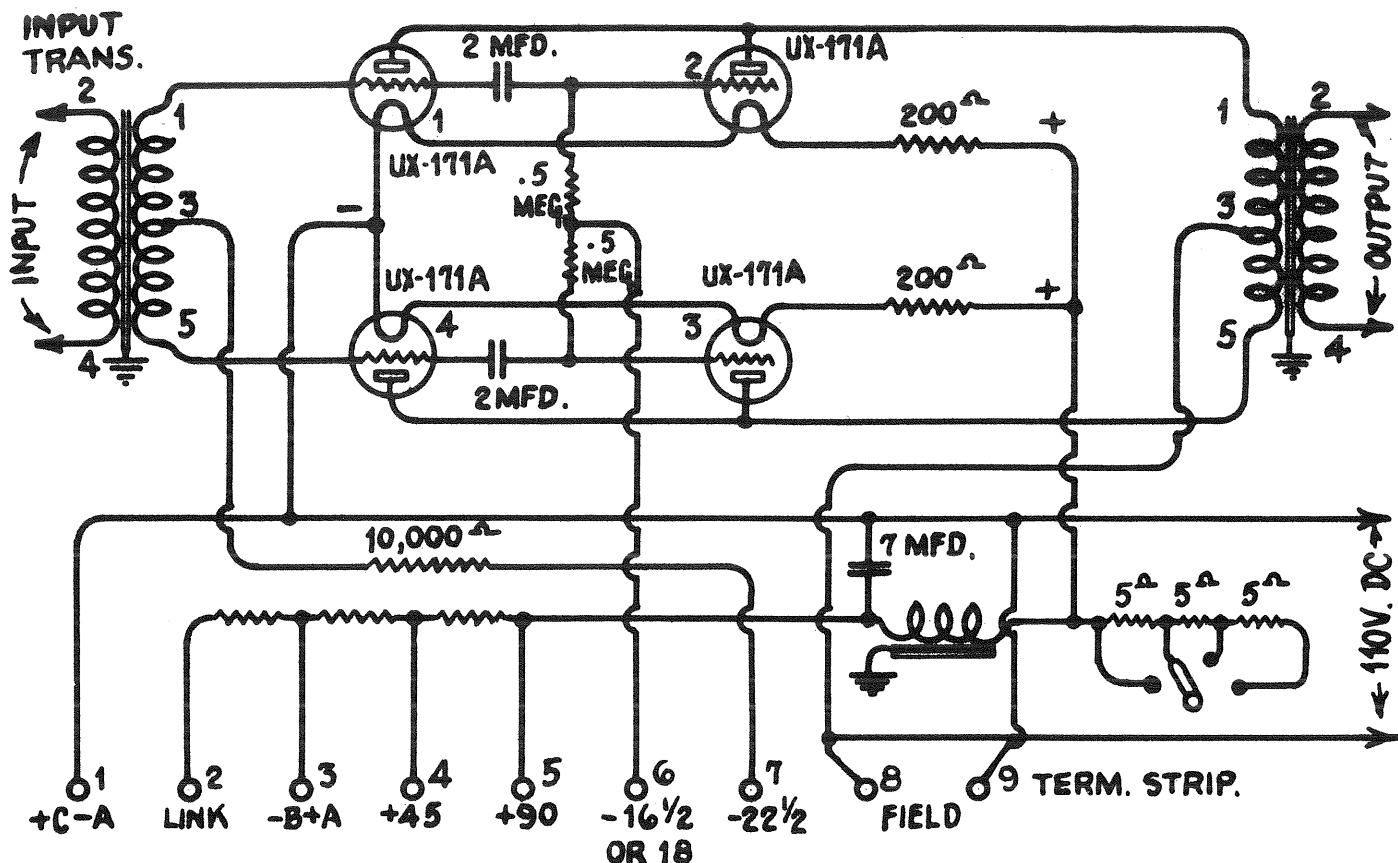


Figure 4 -- RCA Loudspeaker 104 D.C. socket power unit schematic circuit with terminal connections and "A", "B" and "C" Voltages.

from left to right when viewed from rear of Loudspeaker. Before running this test remove all connections from the terminal board at the rear of the S.P.U. and also the input plug, Radiotrons and link. A pair of headphones with at least 4 1/2 volts in series, or a voltmeter with voltage sufficient to give full scale deflection when connected directly across the terminals, should be used in making this test. Discharge the filter condenser by short-circuiting its terminals with a screw driver before starting test.

CONTINUITY TESTS FOR SOCKET POWER UNIT

Terminals	:Correct :Effect	: Incorrect Effect Caused by :
Across input terminals	: Closed	: Open primary of input transformer
Across output terminals	: Closed	: Open secondary of output transformer
G1 to G4	: Closed	: Open secondary of input transformer
G		
G1 to G2	: Open	: Shorted 2 Mfd. condenser
G3 to G4	: Open	: Shorted 2 Mfd. condenser
P1 to P4	: Closed	: Open primary of output transformer
1 to - 22 1/2	: Closed	: Open 1/2 secondary of input transformer
G4 to 7	: Closed	: Open 1/2 secondary of input transformer or grid resistance unit
G2 to 6	: Closed : (Weak)	: Open or defective grid resistor : If loud, shorted grid resistor
G3 to 6	: Closed : (Weak)	: Open or defective grid resistor : If loud, shorted grid resistor
↓ F2 to ↓ of input plug	: Closed	: Open filament resistor or tapped resistor
↓ F3 to ↓ of input plug	: Closed	: Open filament resistor or tapped resistor
5 to ↓ input plug	: Closed	: Open filter reactor or tapped resistance unit
2 to 5	: Closed	: Open resistance unit