RCA Victor
SERVICE NOTES
for
1929 — 1930

RCA Radiolas

RCA Loudspeakers

Victor Radio Receivers

Victor Radio-Electrolas

Miscellaneous Service Information

Service Division

RCA Victor Company, Inc.

Camden, N. J., U. S. A.

RCA Victor

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INTRODUCTION

The Service Notes and Data Sheets contained herein are for the radio receivers and phonograph combination instruments sold by the Radio Corporation of America, the Victor Talking Machine Company and the RCA Victor Company during the years 1929 and 1930. These booklets have been compiled for RCA Victor Distributors and Dealers for use by their personnel in conjunction with the servicing of the instruments listed.

Proper operation of any radio instrument is dependent upon correct service methods and replacement of defective parts. We earnestly recommend that you follow the instructions given, use the equipment recommended and replace defective parts with Genuine RCA Victor Factory Tested Replacement Parts. Your Distributors will be glad to obtain for you any part or service equipment described in this book and give you any possible assistance in the performance of your work.

CONTENTS

The booklets and data sheets listed are contained in this volume in the order indicated

RCA RADIOLAS AND LOUDSPEAKERS

VICTOR RECEIVERS

SUCCESS IN RADIO SERVICE WORK

The most valuable asset of any business is GOOD WILL. And Good Will is nothing more or less than public confidence in you and your business; confidence to the point that your customers are willing and glad to recommend you and your services to acquaintances and friends.

That kind of Good Will does more to build business than all other forces combined. Three factors are involved in building Good Will for a radio service business, in gaining the confidence of your customers to the point that they will do a selling job for you. These three essentials of success are:

Which one would you do business with?

Technical Ability • • •

Business Methods • • •

Parts and Test Instruments •

Technical Ability. Your technical ability is reflected in the test instruments you employ, by the appearance of your shop and work bench, and by the "kit" that you carry into customers' homes. Like the successful members of any of the professions, the radio service engineer must continually study to keep up with the times.

Business Methods. Insofar as your customers are concerned there are just two indices to your business methods: The way you handle yourself on the job and the quality of the Parts and the Test Instruments you use.

Contrast the picture of the two Service Men shown on this page. Each is about to make a call. Each is a good service man, so far as ability goes. But there the likeness ends. One has *business* written all over him. One has built his success on the foundation of fair prices for good work and highest quality parts. The other wonders why his business is slow even though he offers "cut prices" as a result of the bargain replacement parts he uses.

Parts and Test Instruments. The most tangible of the three factors essential to success in service work are the Parts and Test Instruments used. By these you are judged immediately and permanently, as the job holds up or fails to stand up.

Parts and Test Instruments may be made in either one of two ways. They may be built *up* to a *standard* or *down* to a *price.* No single Part or Test Instrument can be built both ways. It must be done either one way or the other.

And in the long run Parts and Test Instruments built *down* to a *price* cost you more than those built *up* to a *standard*—cost you more in disgruntled customers, prestige and loss of *GOOD WILL.*

Quality pays. Hundreds of leading radio service engineers attribute their success to their adherence to the following pledge:

The RCA Oscillator TMV-97-B, ideal for all service work

An output indicator that does not burn out, RCA Type TMV-121-A

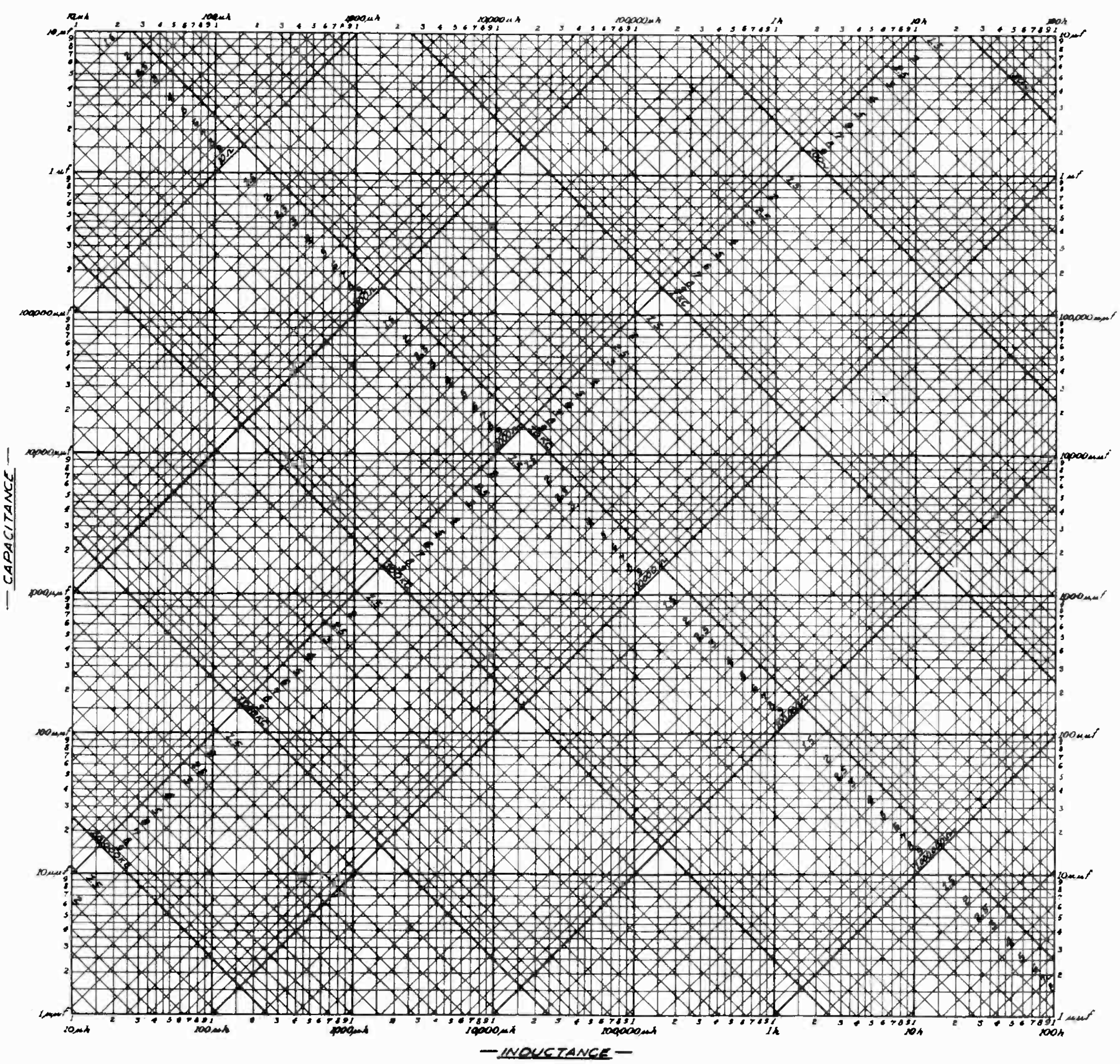
In our service work we pledge—

1. To use the highest quality materials.
2. To be thorough in all our work.
3. To handle your property with care.
4. To make reasonable promises and keep them.
5. To charge a fair price for our services.

BE ON THE SAFE SIDE • • • USE GENUINE FACTORY-TESTED RCA PARTS AND TEST INSTRUMENTS • • •

Chart of Frequency or Impedance vs. Inductance and Capacity

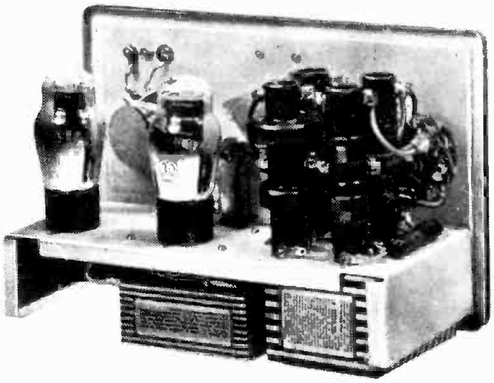
The Chart shown below provides a quick method of determining several unknown factors when one or more are known. The Chart covers a very wide range, namely, from 10 micro-henries to 100 henries inductance, 10 cycles to 50,000 kilocycles, 1 ohm to 10 megohms and 1 micro-microfarad to 10 microfarads. If, for example, one wishes to know the capacitance to use with a 10 henry inductor to have it resonate at 50 cycles, it can be readily seen that it would be a 1 mfd. capacitor. This is determined by finding the intersection of the vertical line representing 10 henries and the oblique line representing 50 cycles. The intersection occurs at the horizontal line representing 1 mfd. The other oblique line at this intersection represents the impedance at this frequency. This is approximately 3000 ohms.



RCA Full Range Test Oscillator

Type TMV-97-B

Front View



Rear View of Chassis

The RCA Full Range Type TMV-97-B Test Oscillator is a modulated R. F. oscillator which supersedes the Type TMV-97-A. New features are a wider frequency range, an improved calibrated tuning dial (reading in frequency) and a direct-reading range switch. All older features such as small compact size, light weight, self-contained batteries, etc., of the Type TMV-97-A are retained.

The frequency range extends continuously from 90 K. C. to 25,000 K. C. (3300–12 meters) and is divided into eight bands. This covers all intermediate, broadcast, police and short-wave frequency line-up points of all makes of receivers. An eight-position range switch provides for the selection of any desired band. An attenuator (output control) gives a means of adjusting the output to any level. This is very important in modern receivers, due to the increasing practice of combining the automatic volume control with other tubes.

Of special interest to amateurs and experimenters is the simplicity with which the modulation may be eliminated. This may be done by the use of a special adapter in the modulator socket. The oscillator then may be used as a heterodyne oscillator for short-wave superheterodyne receivers or for heterodyning the I. F. frequency of all-wave receivers to permit reception of pure CW signals.

SPECIFICATIONS

Circuit—A tuned-grid, plate-modulated circuit is used, which gives good stability over a wide range of voltage and climatic conditions. The output is modulated 50% at 400 cycles.

Radiotrons—Two Radiotrons RCA-30 are used, one as an R. F. oscillator and one as an A. F. modulator.

Batteries Required—One 22½ volt "B" battery and one 4½ volt "C" battery are used. The "C" battery provides filament power for the Radiotrons, the filaments of which are connected in series.

Size—Height 8½ inches (including raised handle), case alone 6½ inches, width 9¾ inches, depth 4½ inches.

Weight — 3½ lbs., including batteries.

Switch—A toggle-type operating switch for turning the oscillator "on" and "off" is mounted on the front panel.

Frequency Range—90 K. C.–25,000 K. C. by eight bands. The Range Switch is located on the front panel and marked directly in frequency.

Output—Two binding posts on the front panel, together with an attenuator, give an easy means of connecting and adjusting the output.

Dial—Variable vernier dial adjustable from 6:1 to 20:1 speed reduction. The dial glass has been made thicker so that the indicator line is very close to the dial, thus avoiding a possible parallax.

Calibration—The dial is calibrated directly in frequency to an accuracy of ±3%. Complete individual calibration may be obtained at an additional cost of $5.00.

Case—The entire oscillator is enclosed in a black wrinkle-finished aluminum case provided with a leather handle.

Net Price $29.50

(WITH RADIOTRONS—LESS BATTERIES)

Order Stock No. 9050

RCA Tools and Accessories

The following tools and accessories are useful for servicing Radio Receivers, Combinations and Short-Wave Instruments of all types and manufacture.

Alignment Tool

Stock No. 4160 **Net Price $0.60**

The Stock No. 4160 Alignment Tool is a bakelite shaft combination screwdriver and socket wrench. The matal screwdriver bit is so shaped that the increase in capacity caused by its touching a trimmer screw is offset by the reduction in inductance caused by its shape. This is very important when making adjustments on all-wave receivers where the screwdriver must be inserted through the end of the coil. The socket end fits the main tuning capacitor trimmer adjustment screws used on numerous RCA Victor Receivers. The bakelite shaft is 7/32" diameter, which gives entrance to 1/4" holes, used on older model Radiola receivers.

Alignment Wrench

Stock No. 7065 **Net Price $0.50**

The Stock No. 7065 Alignment Wrench is a combination screwdriver and alligator jaw end wrench. The metal screwdriver bit is shaped so that it will have a minimum effect on the alignment of the set when it touches a trimmer screw. The end wrench is suitable for adjusting trimmer screws that are accessible only from the side. The shaft is of bakelite, 7/32" diameter and the overall length is 5½".

Riveting Punch

Stock No. 10987 **Net Price $0.50**

The Stock No. 10987 Riveting Punch is a special metal punch for use with a riveting anvil. The punch may be used with the rivets usually used on radio receivers and permits the service man to make a factory type repair, instead of using machine screws to replace rivets. The punch is 5/16" in diameter and 5½" long.

Riveting Anvil

Stock No. 10988 **Net Price $0.70**

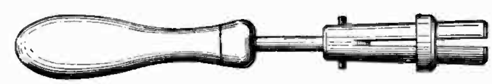
The Stock No. 10988 Off-Set Riveting Anvil is a special anvil that permits riveting in places ordinarily inaccessible. It is to be used in conjunction with a riveting punch such as Stock No. 10987. The Anvil is 5/16" in diameter and 3½" long.

Tuning Wand

Stock No. 6679 **Net Price $1.10**

The Stock No. 6679 Tuning Wand is a special alignment tool which makes possible the checking of alignment in all-wave receivers without disturbing the adjustment of the trimmer capacitors. The tool consists of a bakelite rod having a brass cylinder at one end and a special finely divided iron core at the other end. Inserting the brass cylinder into a coil lowers its inductance, while inserting the iron increases the inductance. From this it is evident that before adjusting trimmers, the adjustment may be checked by inserting each end of the wand into the coil. Proper adjustment is evidenced by a reduction in output with either end of the wand inserted into the coil.

Knurled Nut Wrench



Stock No. 10982 **Net Price $1.20**

The Stock No. 10982 Knurled Nut Wrench is a special wrench designed for tightening or removing the knurled nuts such as are used with toggle type switches. These nuts are ordinarily impossible to remove or tighten without marring. The wrench will hold a nut from 5/8" to ½" diameter. The overall length is 8½".

Off-Set Screwdrivers

Stock No. 3064
Net Price $0.50

Stock No. 2930
Net Price $0.50

The Stock Nos. 3064 and 2930 Off-Set Screwdrivers are useful for making adjustments to remote control units and other small screws that are inaccessible with an ordinary screwdriver. The No. 3064 screwdriver is 2½" long while No. 2930 has an overall length of 4 3/8".

Socket Wrench

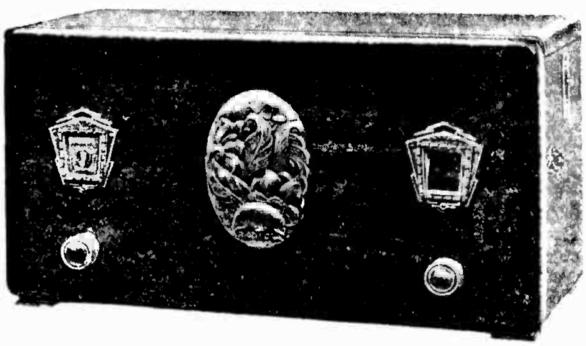
Stock No. 10983 **Net Price $1.80**

The Stock No. 10983 Socket Wrench is a special flexible end socket wrench designed for adjusting the alignment screws of the 1929 and 1930 Victor Receivers, Models R-32, R-35, etc. The overall length is 8¾".

RCA

Radiolas 21 and 22

SERVICE NOTES



RCA Radiola 21

First Edition—30M

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ATLANTA, GA.
150 Peters St.

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 Department 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 Department 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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

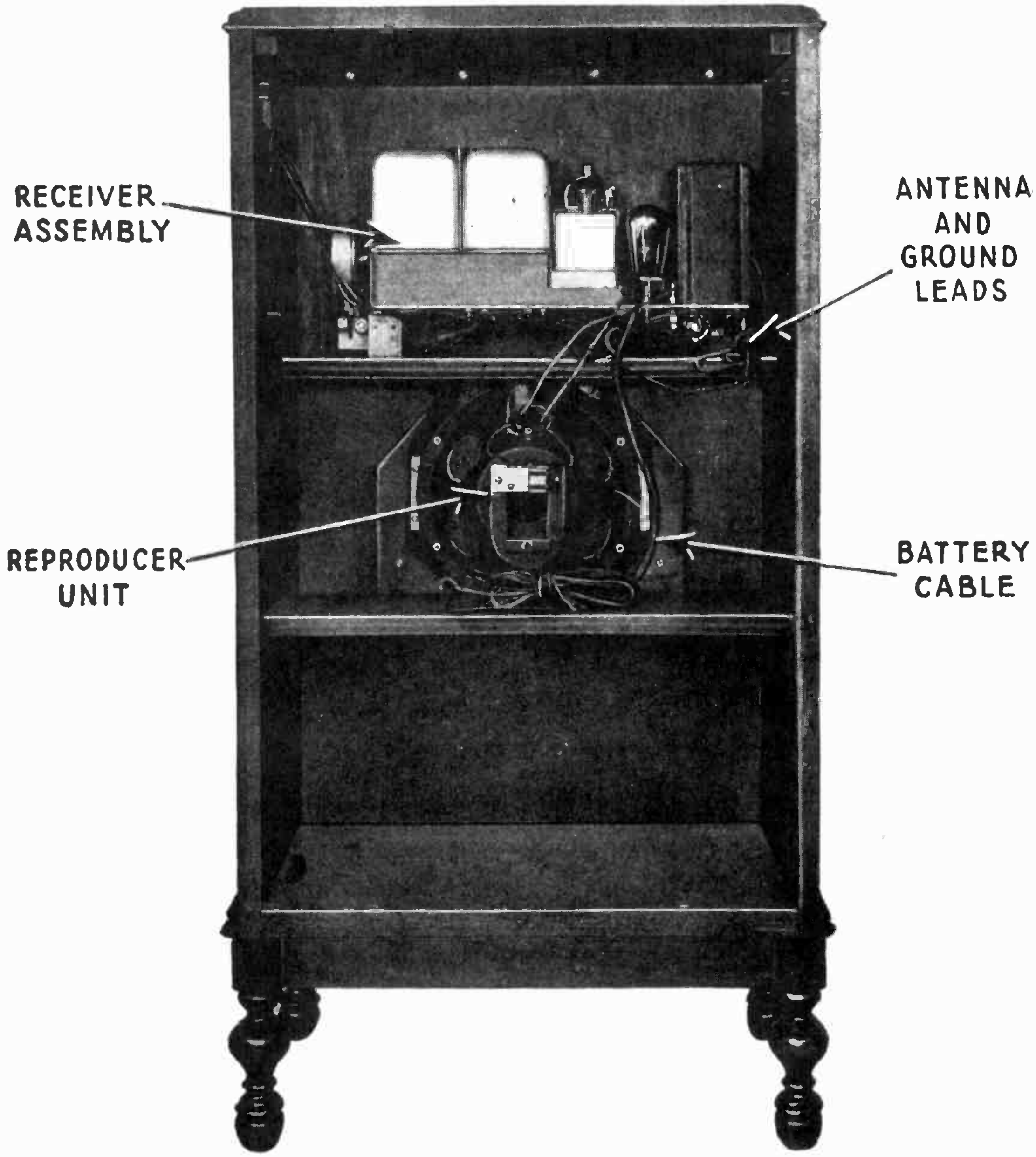


Figure 1—Rear interior cabinet view of Radiola 22

RCA RADIOLAS 21 and 22

SERVICE NOTES

Prepared by RCA Service Department

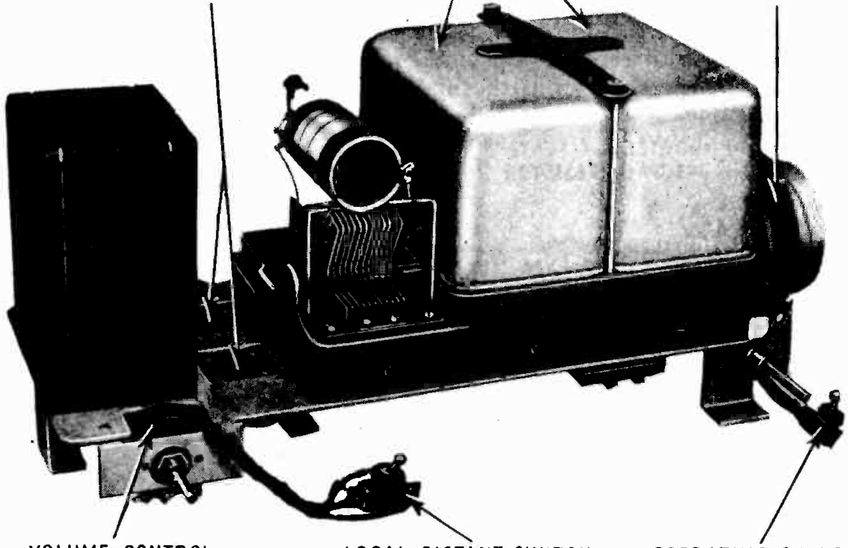


Figure 2—Top view of receiver chassis showing location of some parts

ELECTRICAL AND PHYSICAL SPECIFICATIONS

Type of Receiver—Screen Grid Tuned R.F. Battery.
Recommended Antenna Length—25—60 feet.
Type of Filament Power—Storage Battery or Eliminator.
Type of Plate and Grid Power—"B" and "C" Batteries or Eliminator.
Number and Type of Tubes—Two UX-222, 2 UX-112A, 1 UX-112A or UX-171A—Total 5.
Number of R.F. Stages—Two.
Type of Detector—Grid condenser and leak.
Number of A.F. Stages—Two.
Type of Loudspeaker (R22 only)—Magnetic.

	R21	R22
Height	10.5 inches	40.5 inches
Depth	10.0 "	22.0 "
Width	20.5 "	21.5 "
Weight, alone	27 lbs.	44 lbs.
Weight, packed	40 lbs.	105 lbs.

INTRODUCTION

RCA Radiolas 21 and 22 are battery operated screen grid radio receiving sets. Radiola 21 is a table model and Radiola 22 is a console model employing the same receiver chassis and the mechanism of RCA Loudspeaker 100B. RCA Screen Grid Radiotrons UX-222 are employed as radio frequency amplifiers, Radiotrons UX-112A as the detector and first audio and UX-112A or UX-171A as the power stage. The choice of the power tube is left to the customer, as different tubes may be desirable for different output requirements. The different battery requirements may also have a bearing on the choice, as the UX-171A requires more plate and bias batteries to obtain advantage of its greater output.

The sensitivity and selectivity of these Radiolas is sufficient for excellent reception. The fidelity is very good. Figure 1 illustrates a rear interior cabinet view of Radiola 22, Figure 2 top view of receiver chassis, Figure 3 sub-chassis view of receiver, and Figure 4 a view of the receiver with shields removed.

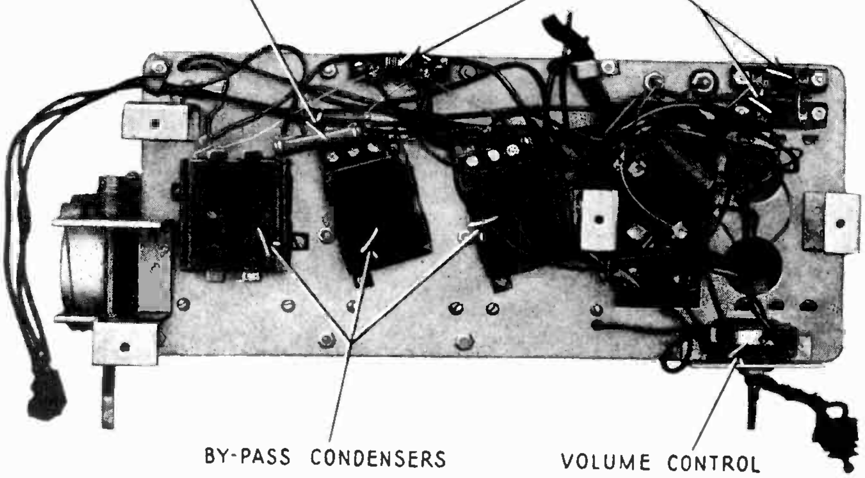


Figure 3—Sub-chassis view of receiver

Circuit features, see Figure 6, of these Radiolas are:

(a) Screen grid battery receiver giving sensitivity and selectivity comparable to that obtained with A.C. type screen grid receivers.

(b) Circuit consists of two tuned R.F. stages, tuned grid leak type detector, first audio stage and second audio stage employing a choice of power tubes.

(c) Local-distant switch provides best reception on both loud and weak signals. At the local position a .00023 mfd. condenser is connected from the antenna connection to ground. This condenser or when the switch is at "distant," the antenna to ground capacity, causes the circuit to resonate in the broadcast band at about 700 K.C. and thereby brings up the sensitivity of the low frequency end. The result is that the receiver has about equal sensitivity throughout the tuning range.

(d) The use of screen grid tubes together with proper shielding, eliminates the necessity of neutralizing or other methods of stabilizing.

(e) The volume control varies the voltage on the screen grid of the two R.F. tubes. This provides a smooth means of control which, together with the local-distant switch, provides a positive cut-off even on loud local stations.

(f) The operating switch disconnects the filament battery and the "B" voltage to the volume control. This prevents unnecessary "B" battery consumption when the receiver is not in use.

(g) A fixed regenerative detector gives added sensitivity to that circuit with a resulting gain in over-all sensitivity. This does not require any adjustment during operation.

PART I—INSTALLATION

Information on the various points dealing with installation as listed below can be obtained by referring to the Service Notes or Instruction Books mentioned. This information has been repeatedly published in past issues of Service Notes, and the average service man is probably so familiar with it, that further details are unnecessary.

The Radiola 22 has two red wood screws to hold the reproducer unit during shipment. Be sure that these are removed as otherwise acoustic howling may result.

Antenna (Indoor or outdoor).—See R-44 and 46 Service Notes.

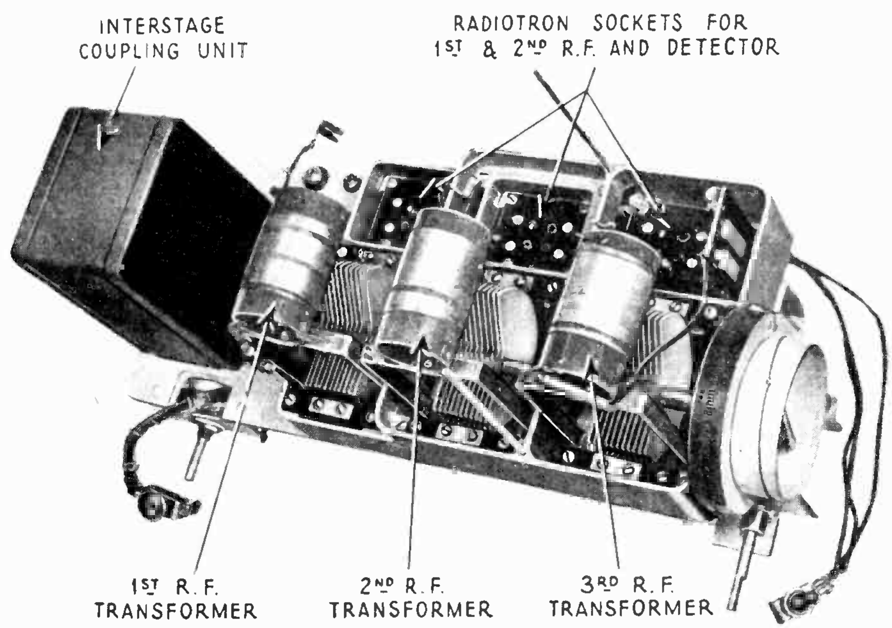


Figure 4—View of receiver with shields removed

Ground.—See R-44 and 46 Service Notes.
Shields.—See R-44 and 46 Service Notes.
Batteries and Connections.—See R-21 or 22 Instruction Book.

PART II—SERVICE DATA

Service data on the following subjects can be obtained from the Service Notes mentioned below:
Antenna system failures.—See R-44 and 46 Service Notes.
Radiotron sockets and prongs.—See R-44 and 46 Service Notes.
Broken condenser drive cord.—See R-44 and 46 Service Notes.
Adjusting R.F. line-up condensers.—See R-44 and 46 Service Notes.
Service data on reproducer unit.—See R-100A or R-100B Service Notes.

SERVICE DATA CHART

The following service data chart indicates various troubles by their symptoms and gives the specific remedy necessary.

Indication	*Cause*	*Remedy*
No Reproduction	Defective Radiotrons	Replace defective Radiotrons
	Defective Operating Switch	Replace defective operating switch
	Defective Volume Control	Replace defective volume control
	Wrong battery connections	Connect battery correctly. Complete instructions are given in R-21 or 22 Instruction Book
	Run-down batteries	Replace "B" and "C" batteries if low. Charge storage battery if necessary.
	Defective local-distant switch	Replace defective local-distant switch.
	Defective parts in receiver	Check by means of continuity tests and make any replacement necessary
	Defective loudspeaker	Repair any defect in loudspeaker
Low Volume	Defective Radiotrons	Test and replace any defective Radiotrons
	Poor antenna system	Install antenna as suggested in Part I
	Run-down batteries	Check voltage of all batteries including any eliminator if used. Unless the voltages are within the limits given in Part III, Section 2, batteries should be replaced. If it is the storage battery it should be charged until gassing lasts for 1 hour. If a trickle charger is being used possibly the rate is not sufficiently high for the service the receiver is giving. The remedy is to increase the charging rate
	Line-up condensers out of adjustment	Adjust line-up condensers as described in R-44 and 46 Service Notes
	Defective parts in receiver	Check by means of continuity test and make any replacement necessary
	Defective loudspeaker	Check by using another loudspeaker known to be in good operating condition and make any replacement necessary
Distorted Reproduction	Defective Radiotrons	Test and replace any defective Radiotron
	Defective interstage A.F. transformer, output choke, output condenser or other parts	Check parts by means of continuity test and make any replacement necessary
	Receiver oscillation	Should the Radiolas oscillate, all signals will be weak, distorted and accompanied by a whistle. See section on "Oscillation" for remedies

SERVICE DATA CHART—Continued

Indication	*Cause*	*Remedy*
Distorted Reproduction	Defective batteries	Check battery voltages and discard any with readings not in the limits given in Part III, Section 2, Charge storage battery if necessary
	Defective loudspeaker	Check with a loudspeaker known to be in good operating condition. Make any repairs necessary
Acoustic Howl	Radiotron selection	Interchange Radiotrons, especially the detector
	Loudspeaker mounting	Check mounting of loudspeaker of Radiola 22 and make sure it is properly supported
	Loudspeaker position	Do not place loudspeaker too close to Radiola 21. Increase its distance to the receiver or change the relative angle between the loudspeaker and the receiver
Audio Howl	An audio grunt or howl may be caused in Radiola 22 by reversed output leads to the loudspeaker	Connect loudspeaker leads as shown in Figure 7
	Oscillation	Receiver oscillation will cause a whistle when the receiver is tuned through a broadcasting station carrier wave. See section on "Oscillation" for remedies
	By-pass condenser	An open in any of the by-pass condensers may cause an audio howl
	Radiotrons	Vibrating elements in Radiotrons will cause a gradually developing howl. See section under "Acoustic Howl"
	Audio system	A defective audio system may cause a howl
Oscillation	Shields not in place or not making good contact	Place the tube shield over sockets 1 and 2 and the stage shields over sockets 2 and 3. If oscillation does not stop clean points of contact between base and all shields
	Local-distant switch not grounded	Ground local-distant switch properly
	Shield contact clips not clamping condenser shaft properly	Bend shield contact clips so that a good, firm contact is made to the condenser rotor shaft
	Open by-pass condenser	An open by-pass condenser or one improperly connected may cause oscillation. Check and replace if necessary
	Defective Radiotrons	A defective Radiotron UX-222 may cause oscillation. Interchanging with one known to be in good condition will remedy the trouble

PART III—ELECTRICAL TESTS

(1) TESTING CONDENSERS

Most of the condensers in Radiolas 21 and 22 can be tested by the continuity tests given in Part III, Section 3. If further tests are desirable the large 1 mfd. condensers may be tested by charging them with the highest "B" voltage available and then shorting their terminals with a screw-driver. An O.K. condenser will give a good spark when such a short is made. A leaky condenser will give no spark and a shorted condenser will give a spark when an attempt is made to charge it.

Small condensers may be click tested for shorts or conveniently replaced by new ones to check on their operating condition.

(2) VOLTAGE READINGS

The following voltages taken at the sockets are correct for batteries when new. A 25 per cent drop is permissible before renewal is necessary. Individual batteries may be tested by disconnecting entirely and reading with a voltmeter. The "B" batteries should be discarded when their voltage is less than 34 volts per block. The "C" batteries should be renewed with the "B" batteries. A storage "A" battery requires charging when the voltage is below 5.4 for a battery or 1.8 per cell *under load.*

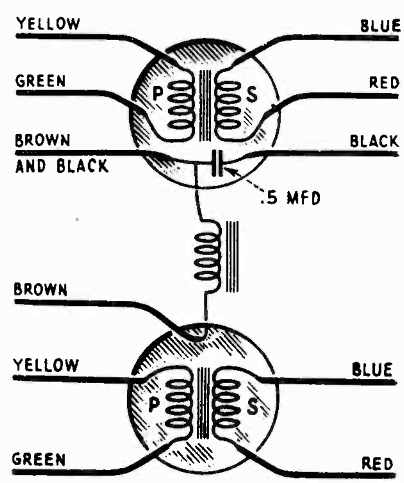


Figure 5—Internal connections of A.F. coupling unit

SOCKET VOLTAGES RADIOLA 21 OR 22

Radiotron UX-171A used in last stage with 135 volts plate supply. For other power tubes or plate voltage the change will be in last socket only, all other voltages remaining the same.

VOLUME CONTROL AT MINIMUM

Socket No.	*Filament Volts*	*Filament to Control Grid Volts*	*Filament to Screen Grid Volts*	*Filament to Plate—Volts*	*Plate Current Milliamperes*
1	3.2	1.6	0	135	0
2	3.2	1.6	0	135	0
3	5.0	—	—	45	3.5
4	5.0	9	—	125	6.5
5	5.0	27	—	130	15

VOLUME CONTROL AT MAXIMUM

Socket No.	*Filament Volts*	*Filament to Control Grid Volts*	*Filament to Screen Grid Volts*	*Filament to Plate—Volts*	*Plate Current Milliamperes*
1	3.2	1.6	67	135	5.0
2	3.2	1.6	67	135	5.0
3	5.0	—	—	45	3.5
4	5.0	9	—	125	6.5
5	5.0	27	—	130	15

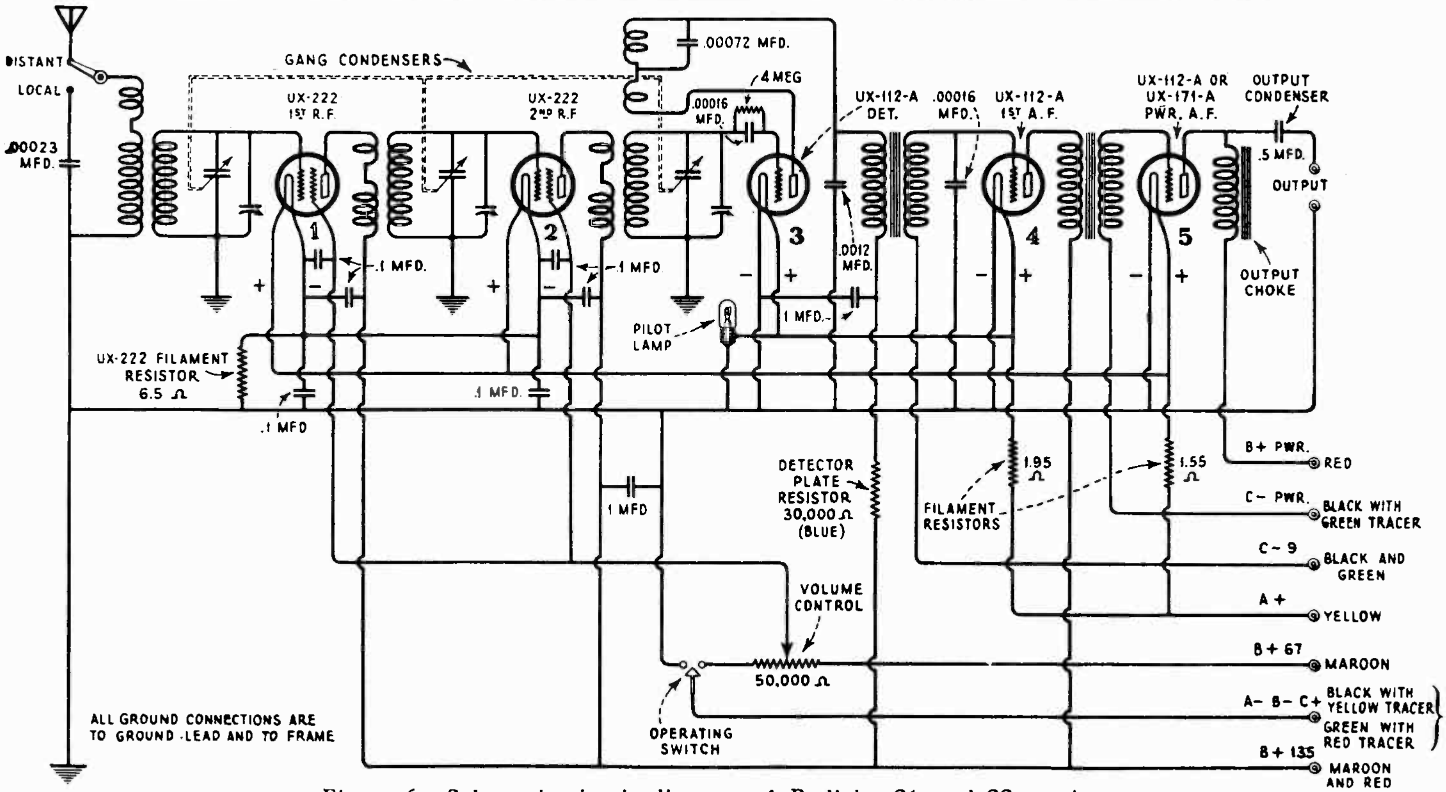


Figure 6—Schematic circuit diagram of Radiolas 21 and 22 receivers

(3) RADIOLA 21 OR 22 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly of Radiolas 21 and 22. Disconnect the antenna and ground leads, the cable connections to all batteries, and unscrew the pilot lamp.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient battery to give a good deflection when connected across the battery terminals should be used in making these tests.

The resistance of the various circuits are also shown in the column titled, "Correct Effect." Checking the resistance of the circuits adds an additional check on their correct functioning. This may be done by means of a direct reading "Ohmmeter," a resistance bridge, or any of the methods shown in previous issues of RCA Service Notes.

The Radiotron contacts and socket numbers, the cable connections and color scheme are shown in Figures 7 and 8, and should be referred to when making these tests. Figure 5 illustrates the internal connections of the A.F. coupling unit.

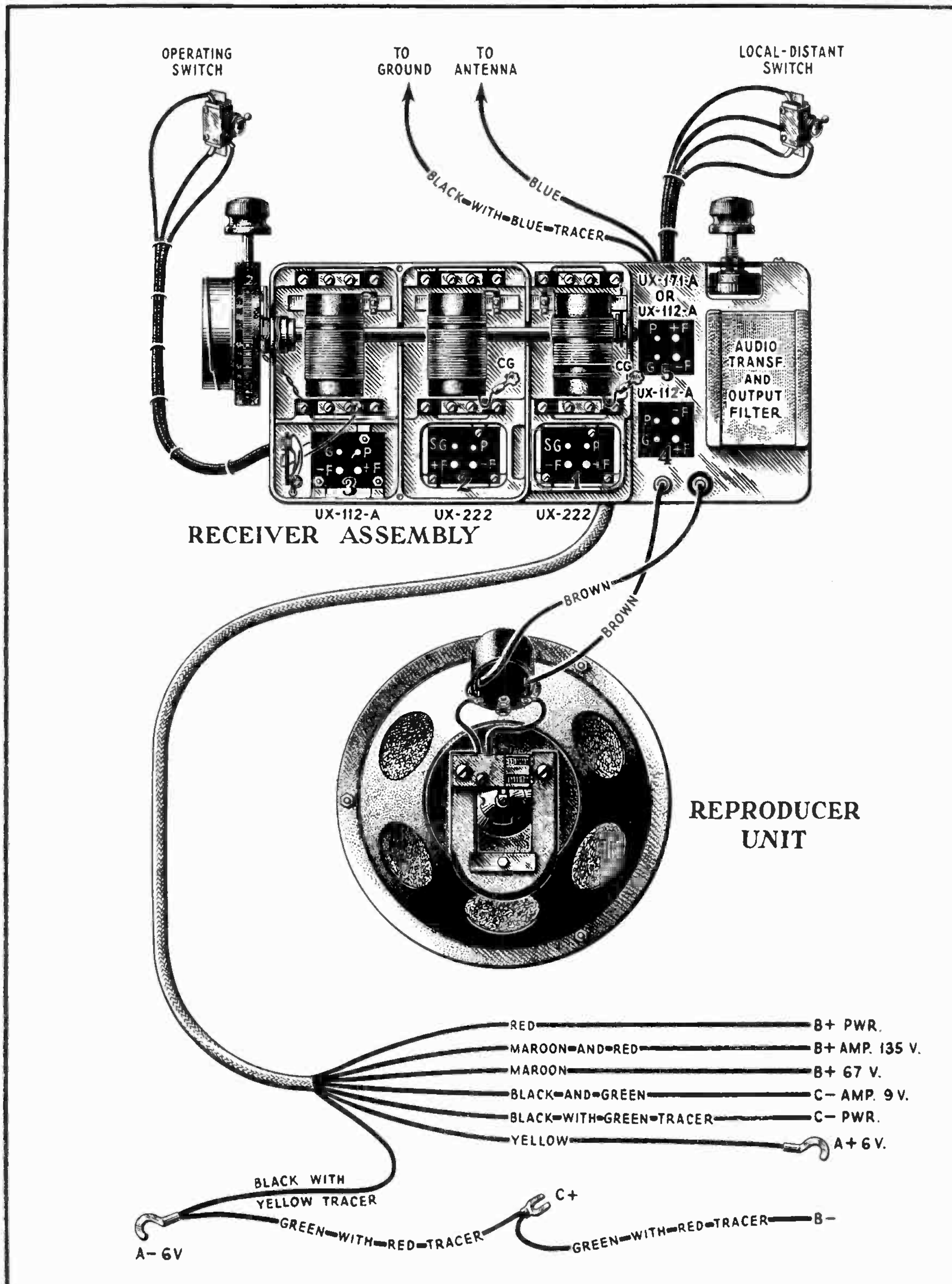


Figure 7—Radiola 22 battery cable and external connections of receiver assembly and reproducer unit

CONTINUITY TEST CHART

Unscrew Pilot Lamp Before Making Test

Circuit	Test Terminals	Correct Effect	Incorrect Effect: Indication	Incorrect Effect: Caused by
Grid	CG1 to Ground	Closed (3 Ohms)	Open Short	Open secondary of 1st R.F. transformer Shorted tuning or trimming condenser
	SG1 or SG2 to B+67 (Maroon) Vol. Cont. at minimum	Closed (50,000 Ohms)	Open	Open volume control or connection
	SG1 or SG2 to B+67 (Maroon) Vol. Cont. at maximum	Closed (Short)	Open	Open connection or volume control arm
	CG2 to Ground	Closed (3 Ohms)	Open Short	Open Secondary of 2nd R.F. transformer Shorted tuning or trimming condenser
	G3 to Ground	Closed (4 Megs)	Open 3 Ohms Short	Open grid leak or secondary of 3rd R.F. transformer Shorted grid condenser Shorted grid condenser and tuning or trimming condenser
	Stator tuning condenser No. 3 to Ground	Closed (3 Ohms)	Open Short	Open secondary of 3rd R.F. transformer Shorted tuning or trimming condenser
	G4 to C—9 (Black and Green)	Closed (5,500 Ohms)	Open	Open secondary of 1st A.F. transformer
	G5 to C—Pwr (Black with Green tracer)	Closed (5,500 Ohms)	Open	Open secondary of 2nd A.F. transformer
Plate	P1 to B+135 (Maroon and Red)	Closed (60 Ohms)	Open	Open primary of 2nd R.F. transformer
	P2 to B+135 (Maroon and Red)	Closed (60 Ohms)	Open	Open primary of 3rd R.F. transformer
	P3 to B+135 (Maroon and Red)	Closed (31,100 Ohms)	Open 1,100 Ohms	Open regenerative coil, primary of 1st A.F. transformer or 30,000 ohm resistor Shorted 30,000 ohm resistor
	P4 to B+135 (Maroon and Red)	Closed (1,000 Ohms)	Open	Open primary of 2nd A.F. transformer
	P5 to B+Pwr (Red)	Closed (550 Ohms)	Open	Open output choke
	P5 to output jack with insulating bushing	Open	Closed	Shorted .5 mfd. output condenser

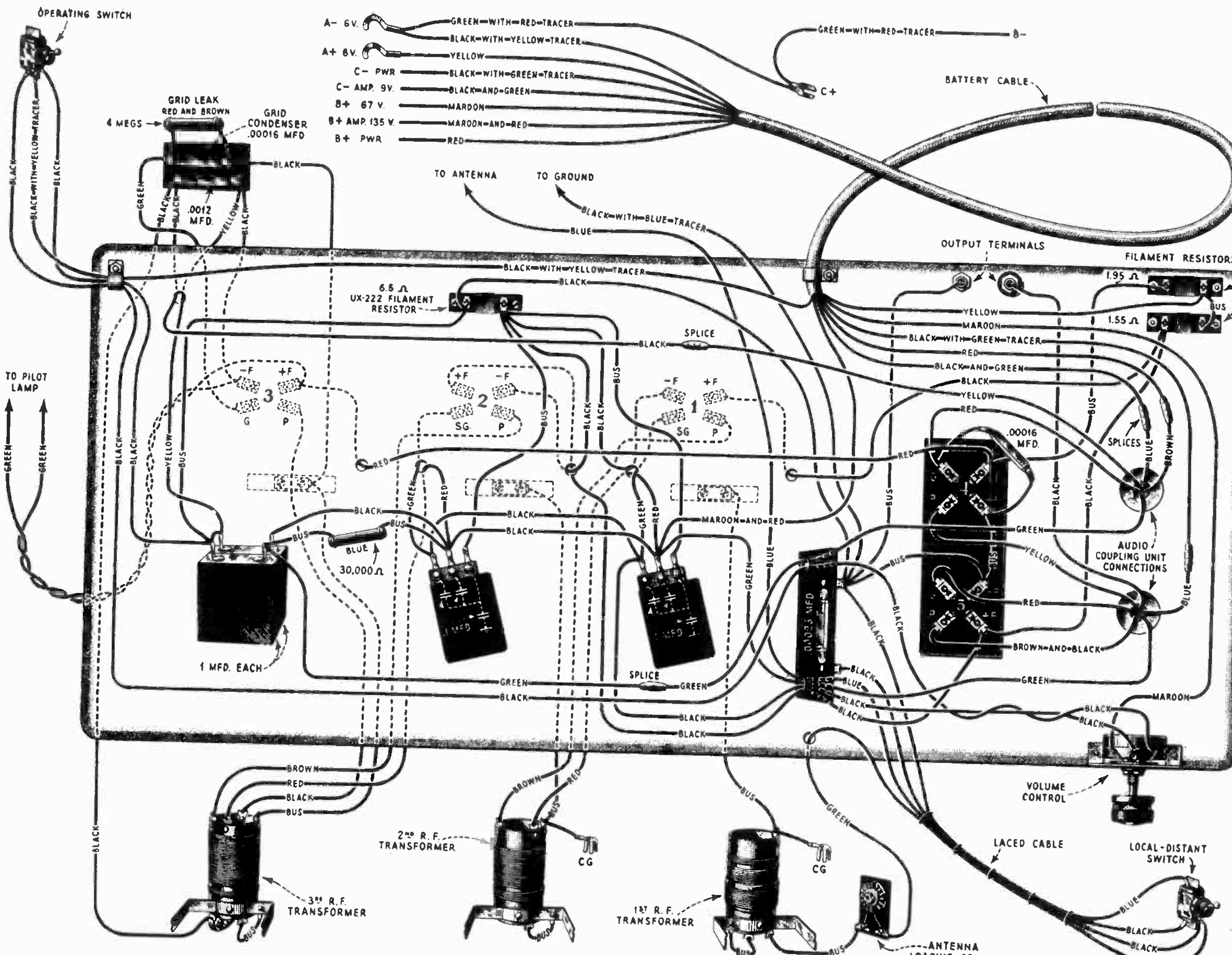


Figure 8—Wiring diagram showing color code and connections

CONTINUITY TEST CHART—Continued

Unscrew Pilot Lamp Before Making Test

Circuit	*Test Terminals*	*Correct Effect*	*Incorrect Effect*	
			Indication	*Caused By*
Filament	—F1 to Ground	Closed (6.5 Ohms)	Open Short	Open UX-222 filament resistor or connection Shorted .1 mfd. condenser
	—F2 to Ground	Closed (6.5 Ohms)	Open Short	Open UX-222 filament resistor or connection Shorted .1 mfd. condenser
	—F3 to Ground	Closed (Short)	Open	Open connection
	—F4 to Ground	Closed (Short)	Open	Open connection
	—F5 to Ground	Closed (Short)	Open	Open connection
	+F1 to +A (Yellow)	Closed (1.55 Ohms)	Open	Open 1.55 ohm resistor or connection
	+F2 to +A (Yellow)	Closed (1.55 Ohms)	Open	Open 1.55 ohm resistor or connection
	+F3 to +A (Yellow)	Closed (1.95 Ohms)	Oven	Open 1.95 ohm resistor or connection
	+F4 to +A (Yellow)	Closed (1.95 Ohms)	Open	Open 1.95 ohm resistor or connection
	+F5 to +A (Yellow)	Closed (1.55 Ohms)	Open	Open 1.55 ohm resistor or connection
Misc.	Antenna to ground (Switch at "distant" position)	Closed (30 Ohms)	Open	Open connection, antenna loading coil, or primary of first R.F. transformer
	B+67 (Maroon) to A—(Black with Yellow tracer) (Close op. sw.).	Closed (50,000 Ohms)	Open	Open volume control
	—F1 to B+135 (Maroon and Red)	Open	Closed	Shorted .1 mfd. condenser
	—F2 to B+ 135 (Maroon and Red)	Open	Closed	Shorted .1 mfd. condenser
	B+135 (Maroon and Red) to ground	Open	Closed	Shorted 1 mfd. condenser
	P3 to —F3	Open	Closed	Shorted 1 mfd. condenser or .0012 mfd. condenser
	G4 to —F4	Open	Closed	Shorted .00016 mfd. condenser
	SG1 to —F1 SG2 to —F2	Open Open	Closed Closed	Shorted 0.1 mfd. condenser Shorted 0.1 mfd. condenser

PART IV—MAKING REPLACEMENTS

The various assemblies and parts of Radiolas 21 and 22 are readily accessible and replacements can be easily made. Figure 2 illustrates the receiver chassis and Figure 1 the rear interior cabinet view of Radiola 22. The following procedure gives the correct method for removing the various assemblies from their cabinets.

(1) REMOVING CHASSIS FROM CABINET OF RADIOLA 21

To remove the receiver chassis from the cabinet of the Radiola 21, proceed as follows:

(a) Release the local-distant switch and the operating switch from their respective escutcheon plates. This is best done by removing the wood screws that hold the escutcheon and then releasing the switch from the escutcheon by twisting its mechanism with the hand. This eliminates the possibility of marring the collar of the switches with pliers or other tools.
(b) Remove the four machine screws at the bottom of the cabinet that holds the chassis in place.
(c) Remove the volume control and station selector knobs from their respective shafts by merely pulling them off.
(d) The chassis may now be lifted clear of the cabinet and placed in a position convenient for work.

(2) REMOVING R-22 RECEIVER ASSEMBLY

To remove the receiver assembly of Radiola 22 proceed as follows:

(a) Release the operating switch and local distant switch by removing their escutcheons and releasing the switch collar. Replace the escutcheons temporarily.
(b) Remove the station selector and volume control knobs.
(c) Release the antenna and ground leads and the battery cable. Remove the loudspeaker connections from the pin jacks on the receiver assembly.
(d) Remove the four machine screws that hold the chassis to the shelf. It may now be lifted clear and placed in a position convenient for work. After the completion of all repairing replace it in the reverse manner of that used to remove it.

(3) REMOVING R-22 REPRODUCER UNIT

To remove the R-22 reproducer unit proceed as follows:

(a) Release the two loudspeaker leads from the receiver chassis at the output pin jacks.
(b) Remove the eight screws that hold the reproducer unit mounting felt to the baffle board. The unit together with its felt mounting may be lifted clear and placed in a position convenient for work. After all work is completed it should be replaced in the reverse manner of that used to remove it.

(4) REPLACING R.F. LINE-UP CONDENSERS

The correct procedure for replacing the R.F. line-up condensers is given in the Radiola 44 and 46 Service Notes and should be followed when making a replacement of this kind.

Changes Necessary

for

Adapting Radiolas 21 *or* 22

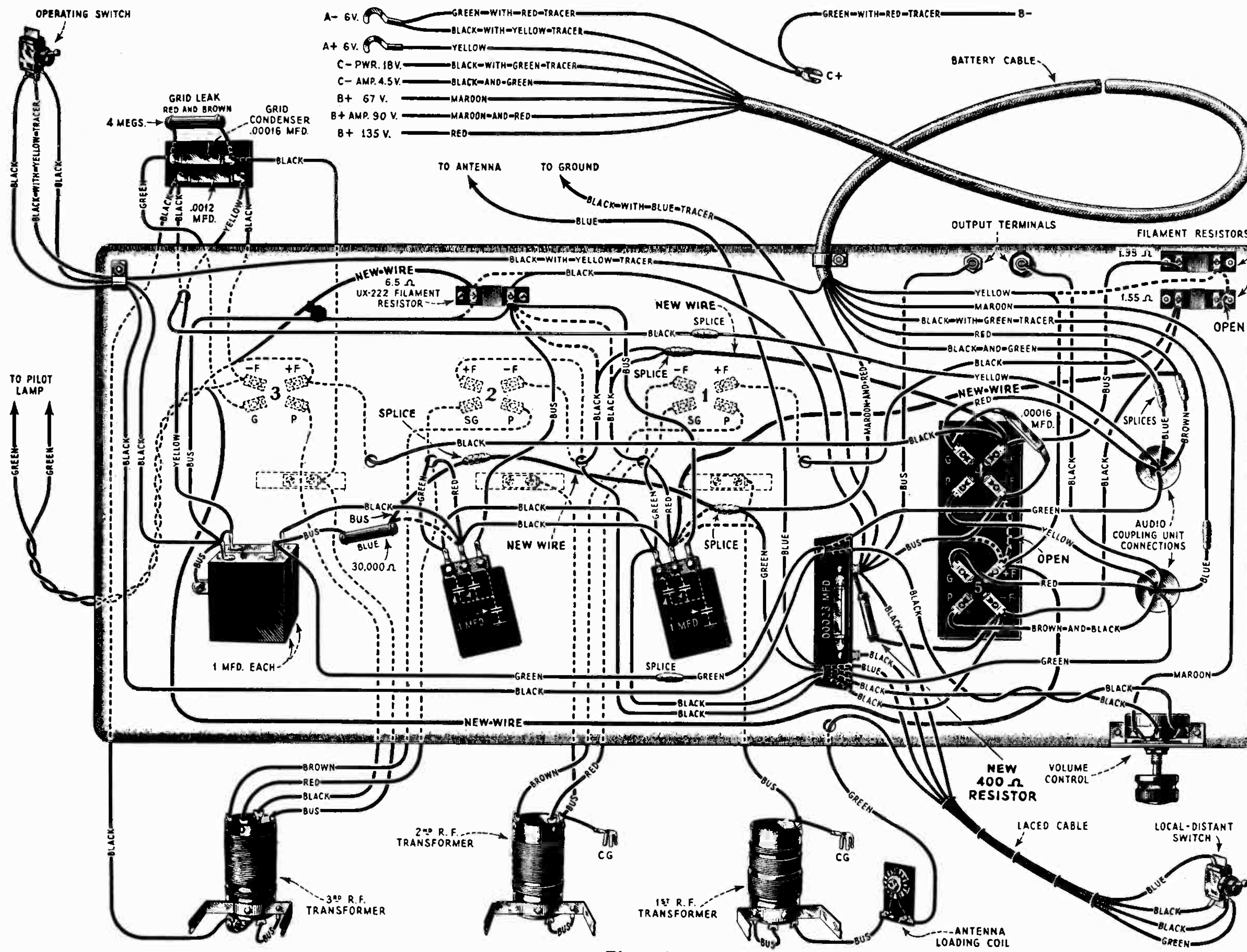
for use with

Radiotrons RCA-230 RCA-231 *and* RCA-232

Radiola Division

RCA Victor Company, Inc.

Camden, N. J., U. S. A.



OPERATING SWITCH
A− 6V.
A+ 6V.
C− PWR. 18V.
C− AMP. 4.5V.
B+ 67 V.
B+ AMP. 90 V.
B+ 135 V.
GREEN-WITH-RED-TRACER
BLACK-WITH-YELLOW-TRACER
YELLOW
BLACK-WITH-GREEN-TRACER
BLACK-AND-GREEN
MAROON
MAROON-AND-RED
RED
B−
C+
BATTERY CABLE
GRID LEAK
RED AND BROWN
4 MEGS.
GRID CONDENSER .00016 MFD.
.0012 MFD.
TO ANTENNA
TO GROUND
BLACK-WITH-BLUE-TRACER
BLUE
OUTPUT TERMINALS
FILAMENT RESISTORS
1.95 Ω
1.55 Ω
OPEN
NEW WIRE
6.5 Ω
UX-222 FILAMENT RESISTOR
SPLICE
SPLICES
TO PILOT LAMP
GREEN
BLACK
BUS
30,000 Ω
1 MFD.
1 MFD. EACH
.00016 MFD.
.00023 MFD
AUDIO COUPLING UNIT CONNECTIONS
BROWN-AND-BLACK
BROWN
NEW 400 Ω RESISTOR
VOLUME CONTROL
LACED CABLE
LOCAL-DISTANT SWITCH
ANTENNA LOADING COIL
1ST R.F. TRANSFORMER
2ND R.F. TRANSFORMER
3RD R.F. TRANSFORMER
CG

Figure 1

Changes Necessary for Adapting Radiolas 21 or 22 for use with Radiotrons RCA-230, RCA-231 and RCA-232

1. Remove receiver assembly from cabinet, place in a position convenient for work and turn upside down. Make the following changes. Figure 1 shows the wiring after the changes have been made, the dotted heavy lines indicating the old connections. Figure 2 shows the schematic diagram of the Radiola after changes have been made.

2. Remove bus from —F4 to +F5.

3. Shift bus bar connected to +F5 from +F5 to —F4. The other end of this bus connects to the .00023 mfd. condenser.

4. Solder yellow cable lead formerly connected to 1.95 ohm resistor to +F5.

5. Shift the two black leads connected from —F1 and —F2 to the 6.5 ohm resistor from the 6.5 ohm resistor to +F4. It will be necessary to splice and tape a wire to these leads in order to make this change.

6. Clip the bus between the 1.95 and the 1.55 ohm resistor.

7. Shift all connections to the 6.5 ohm resistor to one terminal. This should be the terminal closest to socket No. 1.

8. Unsolder both connections to the pilot lamp. Clip these off at socket No. 3 and tape up the exposed ends. Solder two new thin leads to the pilot lamp connecting one to the terminal on the 6.5 ohm resistor to which no connections are present. Connect the other to +F5. It is best to run these leads through the hole in the bottom of the chassis into the detector stage and thence out of the side of the casting to the pilot lamp.

9. Remove the maroon and red cable lead from the center terminal of the third (closest to socket No. 1) by-pass condenser block. Also remove the green A. F. transformer lead from the same point. Unsolder the 30,000 ohm resistor from the center connection of the second by-pass condenser block, solder on about a three-inch length of wire, and then solder the other end of this wire to the maroon and red cable lead and the green transformer lead already exposed. Tape both joints carefully.

10. Connect about a three-inch length of wire to the center connection of the third by-pass condenser block. (Where the maroon and red cable lead was formerly connected.) The other end of this wire is connected to the splice between the red cable lead and the brown output choke lead. Tape carefully after soldering.

11. Solder a 400 ohm, 1 watt resistor from —F5 to the ground side of the .00023 mfd. condenser.

12. Substitute new cable tag supplied for old one.

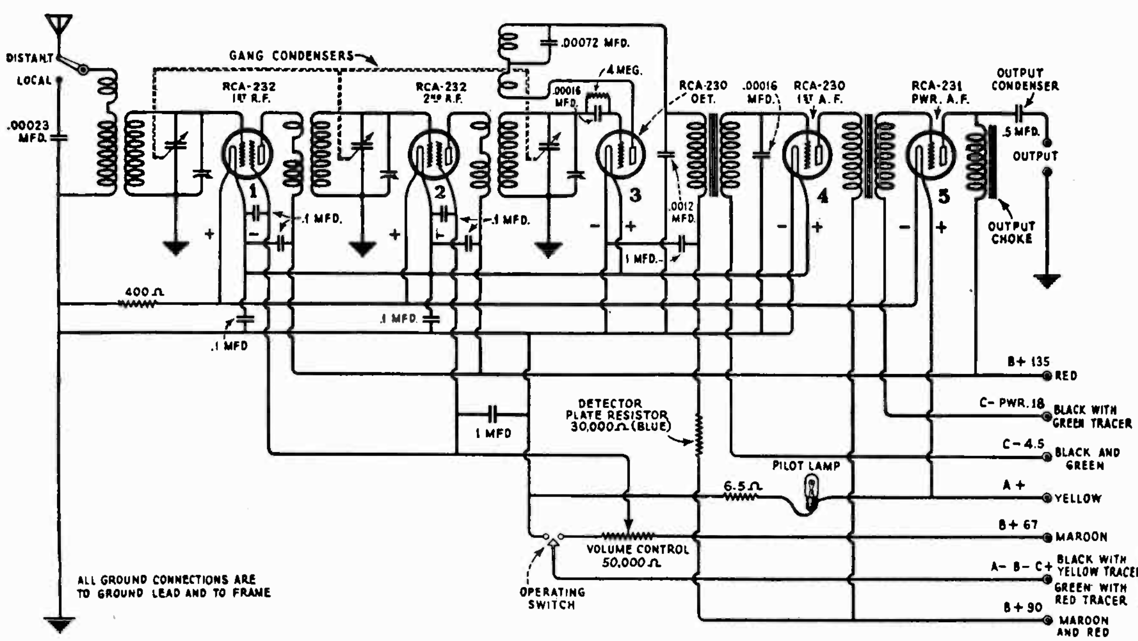


Figure 2

13. Paste new license notice over old one in cabinet.

14. Remove instruction book and guarantee card in envelope and substitute new card furnished. Destroy guarantee card as guarantee is printed on license label.

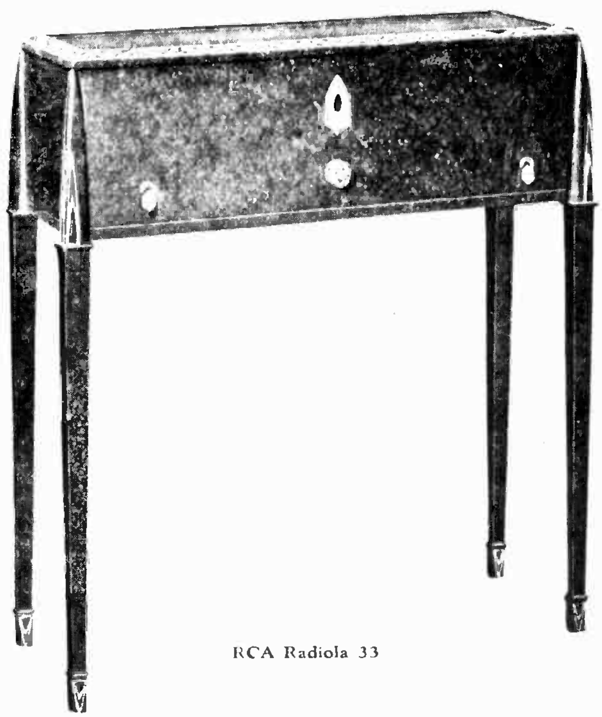
15. Place new Radiotrons in sockets as indicated on new instruction card, connect batteries in accordance with new battery tag and test Radiola.

16. Return chassis to cabinet in reverse manner of that used to remove it and return to shipping carton.

RCA

RCA Radiola 33

SERVICE NOTES



RCA Radiola 33

Second Edition—2M
March, 1931

RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

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

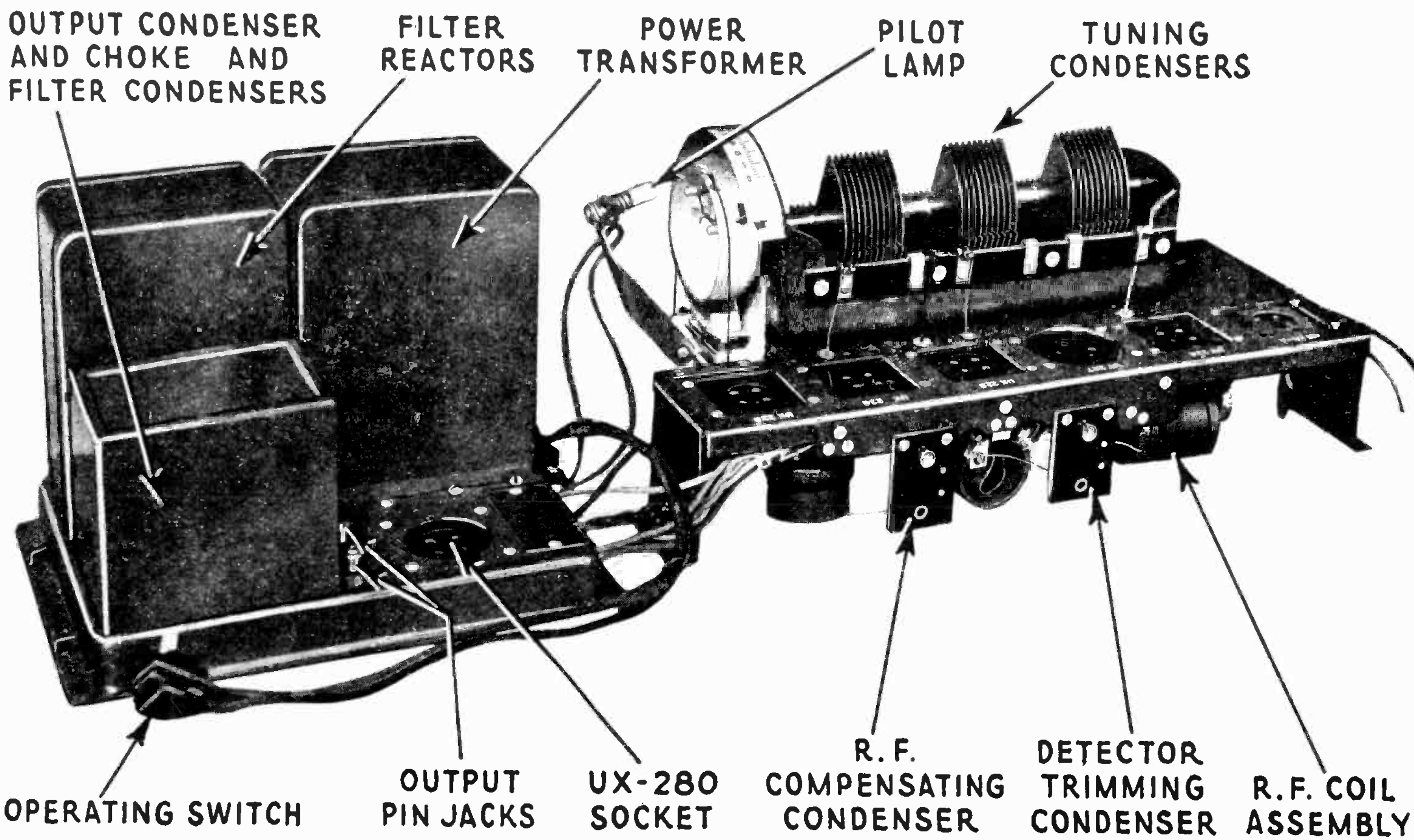
PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS



Figures 2 and 3—Top view of receiver assembly and socket power unit showing location of parts

RCA RADIOLA 33

(105-125 Volts, 50-60 Cycle A. C.)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 33 is a socket powered six-tube, tuned radio frequency receiver utilizing RCA Radiotrons UX-226, UY-227, UX-171A and the full wave rectifier Radiotron UX-280 in the Socket Power Unit. It operates on 105-125 volts, 50 to 60 cycle A.C. lines. Radiola 33 is also supplied in models designed for 105-125 volts, 25-40 cycle A.C. lines. The difference between this model and the 50-60 cycle is the power transformer. The service Notes apply to both models. Figure 1 illustrates a front view of the cabinet and Figures 2, 3, 4 and 5 a top and bottom view of the various units in the Receiver Assembly and the Socket Power Unit.

The following principles are incorporated in the circuit design—See Figure 6.

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

(b) An aperiodic antenna or first R.F. circuit, eliminates the necessity for a separate antenna tuning control.

(c) The volume control regulates the input grid voltage to the first R.F. amplifier stage. This is the most practical method of volume control for use with A.C. Radiotrons and gives a smooth control of volume without distortion.

(d) Raw A.C. of the correct voltage is used for filament heating of all Radiotrons.

(e) The three R.F. stages and the first audio stage receive a plate voltage of 135 volts in conjunction with a negative grid bias of 9 volts. The detector receives 30 volts plate supply. The last audio stage receives a plate voltage sufficient to provide ample loudspeaker output. The plate and grid voltages are supplied by means of a built-in "B" and "C" power supply unit using Radiotron UX-280 as the rectifying device.

Figure 7 illustrates the sequence of the Radiotrons in the receiver, omitting Radiotron UX-280 in the socket power unit. From right to left, when facing the front of the Radiola, 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.

Radiotrons Nos. 5 and 6 are respectively, the first and second stages of audio frequency amplification. The last stage, Radiotron No. 6, employs power amplifier Radiotron UX-171A. An ouput filter protects the loudspeaker windings from any D.C.

The following notes are published for the guidance of those called upon to locate and remedy any trouble that may occur. The text is divided into four parts, Part I—Installation; Part II—Service Data; Part III—Electrical Tests, and Part IV—Making Replacements.

PART I—INSTALLATION

(1) ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiola 33 the antenna length need only be approximately 25 to 50 feet. 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. Bring the lead-in wire through a porcelain tube insulator to the inside of the house for connection to the receiver.

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.

(2) 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.

(3) GROUND

A good ground is quite as important as the antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

(4) RADIOTRONS

Four Radiotrons UX-226, one UY-227, one UX-171A and one UX-280 are used. The locations of these Radiotrons are plainly designated on each socket. Be careful not to insert a Radiotron UX-226 in the UX-171A socket, as immediate filament burn-out will result when the current is turned "ON."

Connect the loudspeaker to the output pin terminals and insert the A.C. input plug into a socket outlet of correct voltage and frequency. Turn "ON" the operating switch. After about 30 seconds the Radiotron UY-227 will glow dimly, indicating that the receiver is in operating condition. If no signals are heard when tuning to a station known to be broadcasting, examine the Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more known to be in operating condition will isolate the damaged one.

If there is an excessive hum present during operation:

(a) Reverse the A.C. input plug at the socket outlet.

(b) Interchange the Radiotrons UX-226 in the R.F. stages with the one in the first A.F. stage, and use the combination that gives least hum. Then interchange the three in the R.F. stages for the best results while tuned to a broadcast station.

(5) ADJUSTMENT FOR LOW LINE VOLTAGES

A lead is provided on the side of the S.P.U. for use when Radiola 33 is connected to lines, the voltage of which never exceeds 115 volts. A good plan is to allow the lead to remain as connected in manufacture unless unsatisfactory operation is experienced. Should such adjustment be necessary, however, proceed as follows:

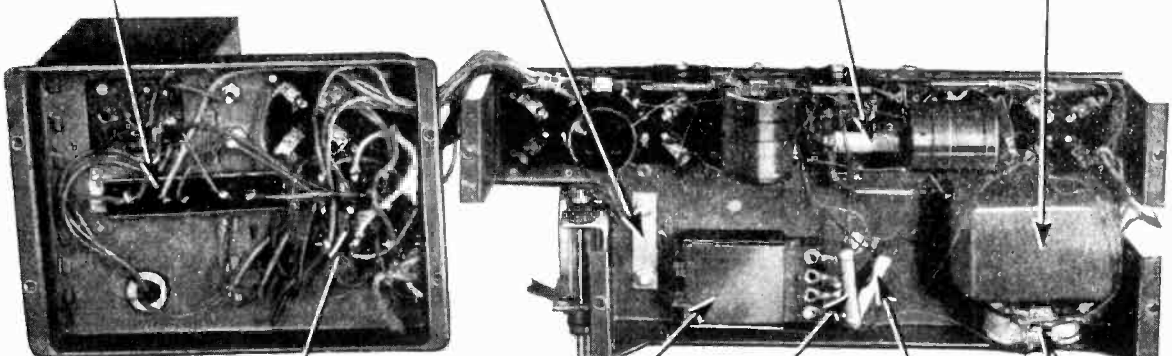
(a) Remove top from metal cabinet.

(b) Connected to the operating switch will be found two taped connections, one of which has a transformer lead (black with red tracer) connected to a black switch lead. Untape and unsolder this connection and then tape up the black with red tracer lead so that it will not ground or short to other parts.
(c) A black and red lead will be found taped up and not used. Untape this lead and clean the end for splicing.
(d) Splice this lead just untaped to the black lead from the switch that has been released. Solder and tape securely.

The 110-volt tap of the transformer is now properly connected and the Radiola may be used on 105-115 volt lines with maximum efficiency. Figure 15 illustrates these changes to be made.

(6) ATTACHING LEGS TO RADIOLA 33

Four legs are provided with Radiola 33 that must be attached by the dealer or the purchaser of the Radiola.



Figures 4 and 5—Sub-chassis view of receiver and socket power unit showing location of parts

The following step-by-step procedure may be used:
(a) Place Radiola 33 upside down on a soft blanket or rug in a place convenient for work, Figure 8.
(b) Mount a leg (all legs are alike and interchangeable) at one corner so that the designs on the cabinet and leg match and the leg is square against the wooden cabinet base.
(c) Place one of the wood screws in the hole closest to the leg and screw it tightly in place, making sure while starting the screw that the leg is not displaced from its setting.
(d) Place the two other screws in their holes and screw in tightly.
(e) Repeat this procedure on all legs. After all of the legs are tightly in place, carefully lift the Radiola and place on its feet.

(7) REFINISHING MARRED SURFACES

Should the surfaec of the Radiola 33 cabinet become scratched or marred either when installing or after use, it may be easily refinished in the same manner that wood is refinished. In other words, it may be stained, lacquered, varnished and polished.

(8) KNOBS

Radiola 33 uses an improved type of push knob on the station selector similar to that used on the Radiola 60 and two pendant type push knobs on the operating switch and volume control. These knobs may be removed by simply pulling them from their shafts and replaced by pushing them on. Care should be taken when replacing the knobs to make sure the small dielecto spacing washers are placed over the shaft before the knob is put on so the knob will not bind against the cabinet.

(9) 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 existing at that point.

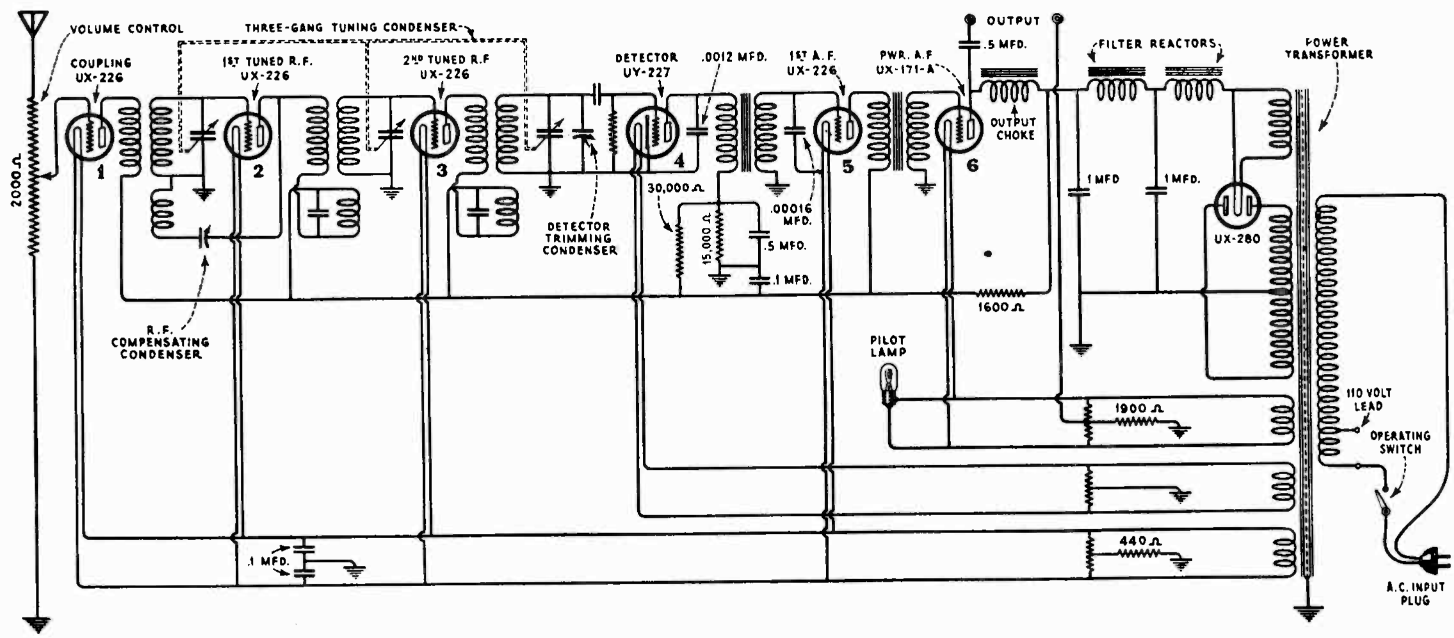


Figure 6—Schematic circuit diagram of receiver and socket power unit—all grounds are connected to frame and metal cabinet

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

The function of the wave trap is to absorb a large portion of the energy of the powerful local signal picked up by the Radiola 33 antenna, thereby reducing the effect of the powerful local 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 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.

It is intended that the Radiola 33 Wave Trap shall be located on the top of the chassis frame at the extreme left end viewing the set from the front. Installation can be made in five or ten minutes without removing the chassis from the cabinet. Complete installation and adjustment instructions accompany each unit.

PART II—SERVICE DATA

(1) ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

(2) RADIOTRON SOCKETS

The sockets in Radiola 33 are the standard gang UX and UY type. Care must be exercised when inserting Radiotrons in their sockets. A socket contact may not be in its correct position and forced insertion of a tube will bend or break it. If care is exercised and the Radiotron inserted gently, little trouble will be experienced with socket contacts. A bent one will be noticeable on inspection and may be corrected by inserting a narrow instrument in the socket hole and pushing the contact into its correct position. A badly bent or broken socket contact should be replaced.

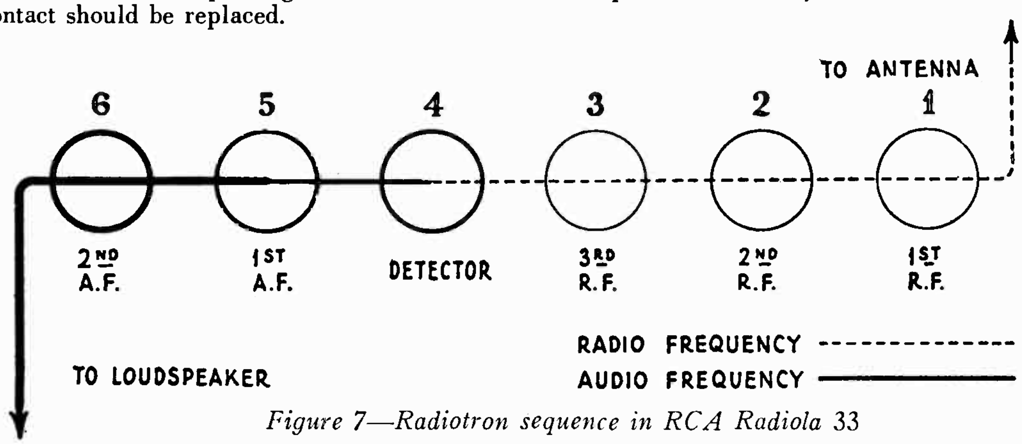


Figure 7—Radiotron sequence in RCA Radiola 33

The bakelite Radiotron guide shields used in Radiola 33 will prevent any possible shock from contact with high voltages in the socket when inserting the Radiotrons.

The prongs of the tubes fit into this shield opening very snugly and require only a twist until the prongs find the correct holes into which they fit.

(3) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuit sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact.

The use of emery cloth or steel wool is not recommended. Before reinserting Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

Care should be exercised to see that the two large pins and two small pins of the Radiotrons match the socket holes. The UY-227 Radiotron has five prongs, all of the same size, and will fit in the socket only one way. If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

(4) LOOSE VOLUME CONTROL AND LOW VOLUME

A loose volume control contact arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the receiver assembly and S.P.U. from the cabinet as described in Part IV, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame.

Low volume even on local stations may be due to one of the following causes:

(a) Defective antenna and ground system. A poor antenna and ground system or one in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2 and 3 should be followed if trouble of this kind is experienced.

(b) R.F. compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 10.

(c) Defective R.F. transformers. Should the R.F. transformers become damaged so that they do not properly match, weak signals may be the result.

(d) Defective A.F. transformer. An open or short in the A.F. transformers may cause weak signals and distorted reproduction.

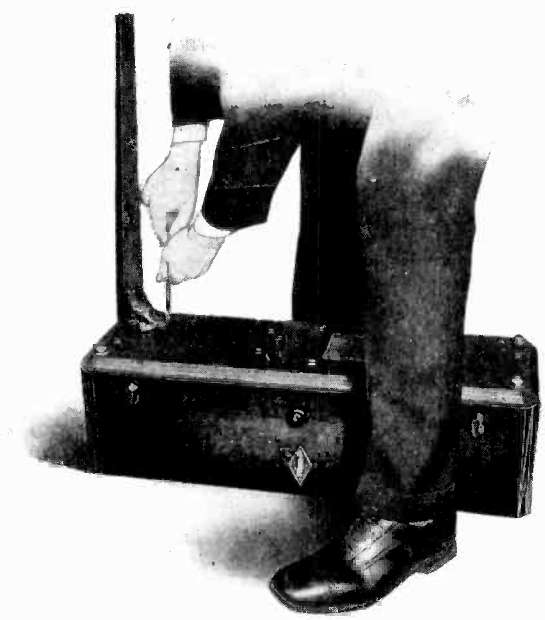


Figure 8—Placing legs on cabinet

(5) 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 9.

(b) Remove the receiver assembly and S.P.U. from the cabinet as described in Part IV, Section 1, 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 condenser 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 rotor 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 small trimming condenser for aligning this circuit. Instead of bending the plate of the condenser adjustment should be first attempted at the trimming condenser. 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.

(6) HUM

Part I, Section 4 describes the method to eliminate ordinary hum in Radiola 33 when making an installation. If a pronounced hum develops during operation check the following:

(a) Low emission Radiotron UX-280. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(b) Shorted filament condenser. There are two .1 mfd. condensers hooked in series across the UX-226 filaments with the center tap grounded. A short of either of these condensers will cause loud hum and imperfect operation of the Radiola.

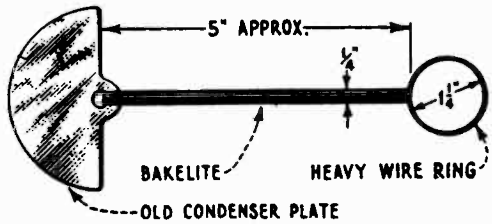


Figure 9—Tool for testing electrical alignment of gang tuning condensers

(c) Defective center tapped resistance. A short or open in any of the center tapped resistances connected across the various filament supplies will cause a loud hum.

(d) Any open of the several grounding connections in the Radiola or defective voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part III, Section 3.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part IV, Section 10, and heating it in a slow oven. The open end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

(7) LOUDSPEAKER POLARITY

The use of an output filter in Radiola 33 makes unnecessary any adjustment for polarity of the output current. Any type of loudspeaker (either horn, magnetic type cone or dynamic type cone) can be connected in the manner that gives the most pleasing reproduction.

(8) AUDIO HOWL

Audio howl may be caused by:

(a) 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.

(b) Open by-pass condensers. An open .5 mfd. by-pass condenser connected across the detector plate resistor connection may cause a howl.
(c) Vibrating elements in 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 the loudspeaker and the Radiola. In extreme cases it will be necessary to increase the distance between the Radiola and the loudspeaker.

(9) UNCONTROLLED OSCILLATION

Uncontrolled oscillations in any part of the tuning range may be caused by:
(a) Poor ground. Install ground system as indicated in Part I, Section 3.

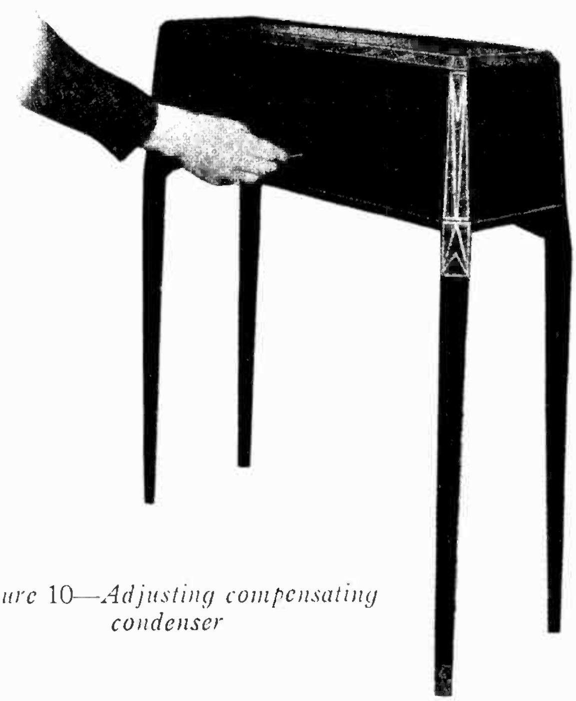


Figure 10—Adjusting compensating condenser

(b) An open connection in any of the several ground leads in the Radiola.
(c) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause oscillation.
(d) A defect in the R.F. coil system. A short in any of the concentrated primary coils or the condenser shunted around them may cause the receiver to oscillate.
(e) Incorrect adjustment of compensating condenser. The correct procedure for adjusting the compensating condenser is given in Part II, Section 10.

(10) ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The R.F. compensating condenser in Radiola 33 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) 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 10.)

(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.

(d) 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.

(e) When the adjusting screw has been turned to the right as far as possible without oscillation occurring at any wavelength, the correct adjustment has been found for best sensitivity.

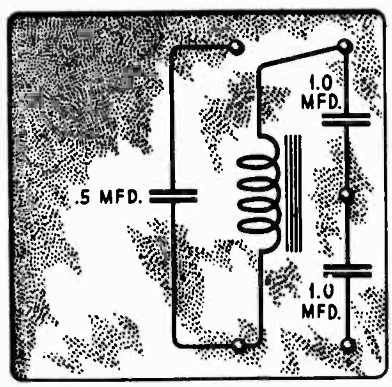


Figure 11—Internal connections of output condenser and choke and filter condensers

(11) DISTORTED REPRODUCTION

Under normal conditions Radiola 33 will deliver a strong signal of good quality to the loudspeaker. The high sensitivity of Radiola 33 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 and 2nd audio stages and the rectifier tube.

(b) High or low plate and grid voltages from the Socket Power Unit. The cause may be a defective Radiotron UX-280 or resistance unit. Replace the Radiotron UX-280 with one of known quality and check the various resistances for a possible short or open.

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 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. The volume control should be examined for poor contact between the contact arm and the resistor strip.

(12) PILOT LAMP

Radiola 33 is equipped with a small pilot lamp operating from the UX-171A filament winding. Its purpose is to illuminate the tuning dial and act as a current supply indicator. The latter use is quite important because the time required for Radiotron UY-227 to develop normal operation, which is approximately 30 seconds, can be checked.

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.

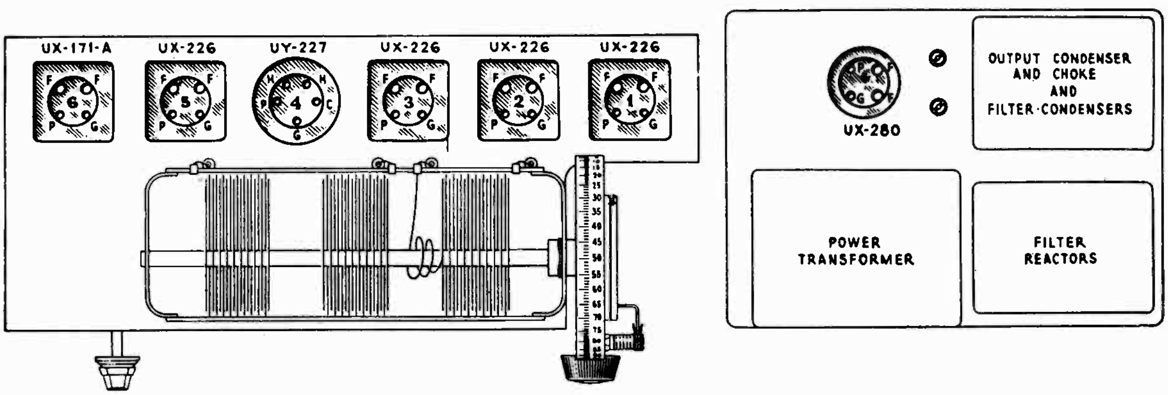


Figure 12—Diagram showing location of Radiotron socket contacts

(13) FILTER CONDENSER, AND OUTPUT CONDENSER AND CHOKE

The output choke and condenser and the two filtering condensers are located in one container in the S.P.U. Figure 11 shows the internal connections. The procedure for testing this unit is to "click test" the choke for an open, and charge and discharge the condensers individually by shorting their terminals with a screwdriver. A condenser that will not retain its charge is defective. Approximately 200 volts D.C. should be used when making this test.

An open output condenser or an open or shorted choke will cause weak and distorted reproduction. A defective filter condenser is indicated by excessively hot plates, possibly showing color, in Radiotron UX-280.

PART III—ELECTRICAL TESTS

(1) VOLTAGE READINGS

Voltage readings of Radiola 33 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 when connected to a 120-volt A.C. line. There is no voltage between the detector heater and cathode in Radiola 33.

Tube No.	Filament to Grid Volts	Filament or Cathode to Plate Volts	Plate Current Milliamperes	Filament Voltage
1	9	130	4.5	1.5
2	9	130	4.5	1.5
3	9	130	4.5	1.5
4	—	30	2.0	2.5
5	9	130	4.5	1.5
6	30	135	17.0	5.0

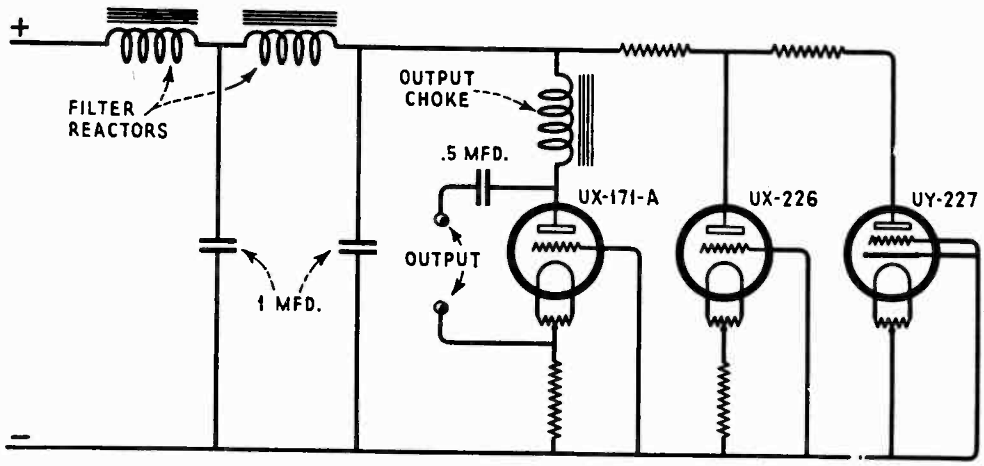


Figure 13—*Schematic circuit diagram of voltage supply system*

(2) VOLTAGE SUPPLY SYSTEM

It is well to understand the various voltage supply systems incorporated in Radiola 33 as they differ somewhat from the systems normally used. Generally speaking, Radiola 33 uses what is known as the series resistance method of obtaining its various voltages. This series arrangement makes it possible to use small filter condensers. Figure 13 shows the schematic circuit. The grid bias voltages are obtained by using the drop across a resistance connected in the plate return lead.

With this arrangement the correct grid or plate voltage is dependent on the Radiotrons being in good condition. A low emission tube will cause the voltage to rise on all tubes. It is important to note that when interchanging Radiotrons all tubes should be in their respective sockets before turning "on" the current supply.

(3) RADIOLA 33 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly (Figure 14) and the Socket Power Unit (Figure 15). Disconnect the antenna and ground leads and the A.C. supply cord at its outlet.

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. The receiver sockets, numbers and lugs used in these tests are shown in Figure 12. The S.P.U. terminals are shown in Figure 15.

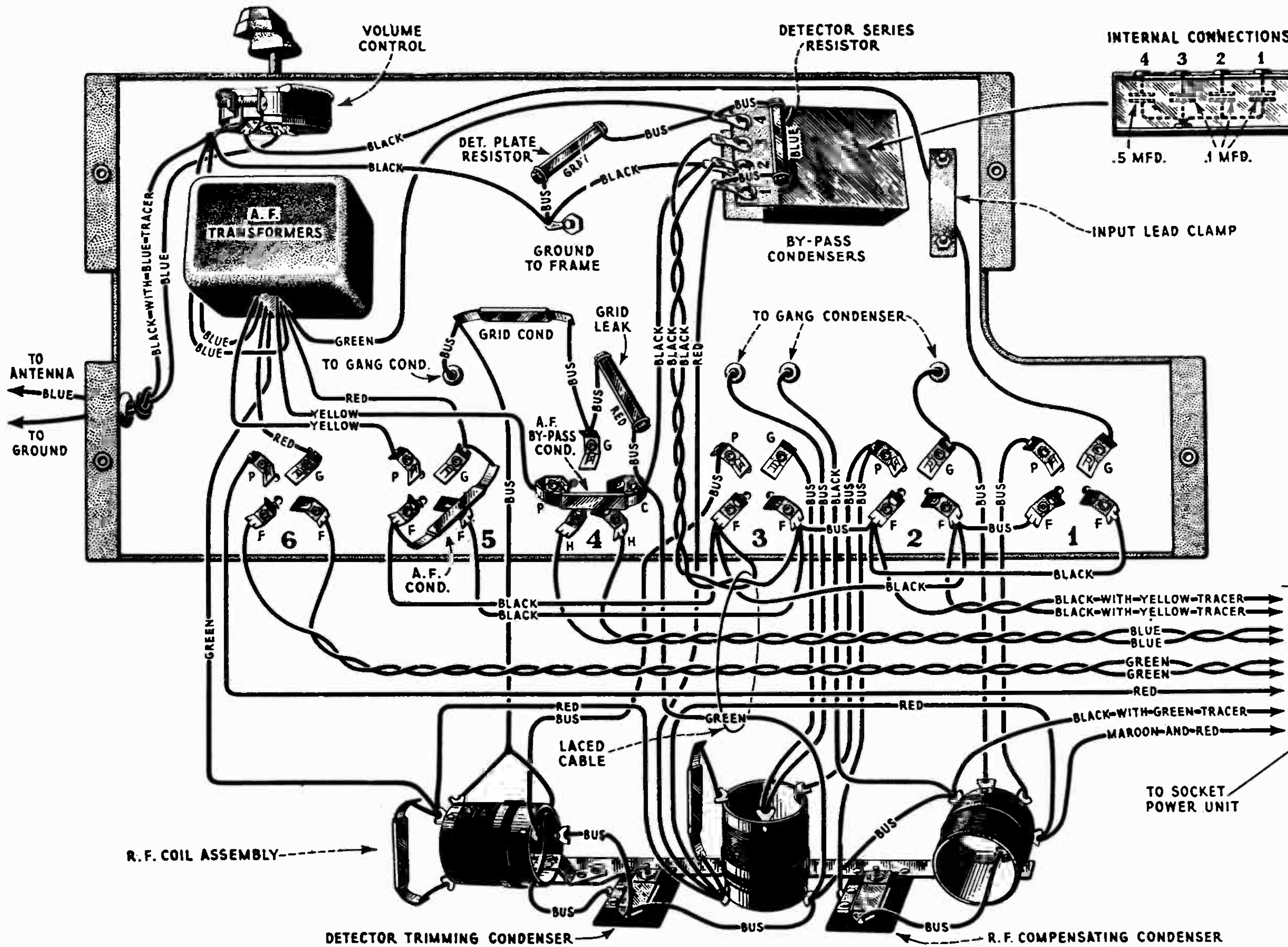


Figure 14—Wiring diagram of receiver assembly—grid leak in some models is connected from grid of socket No. 4 to ground connection of frame instead of as shown

RECEIVER ASSEMBLY AND S. P. U. CONTINUITY TESTS

Remove All Radiotrons and Disconnect A. C. Input Plug

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna to ground	Closed	Open volume control
	Antenna to G1	Closed	Open volume control or contact arm
	G2 to Gnd.	Closed	Open secondary of 1st R.F. transformer
	G3 to Gnd.	Closed	Open secondary of 2d R.F. transformer
	Stator condenser No. 3 to Gnd.	Closed	Open secondary of 3d R.F. transformer
	G4 to Gnd.	Closed (Very Weak)	Open grid leak or if loud, shorted grid condenser
	G5 to Gnd.	Closed	Open secondary of 1st A.F. transformer
	G6 to Gnd.	Closed	Open secondary of 2d A.F. transformer
Plate	P1 to P6	Closed	Open primary of 1st R.F. transformer, 1,600 ohm resistor or output choke
	P2 to P6	Closed	Open primary of 2d R.F. transformer, concentrated primary coil, 1,600 ohm resistor or output choke
	P3 to P6	Closed	Open primary of 3d R.F. concentrated primary coil, 1,600 ohm resistor or output choke
	P4 to P6	Closed	Open primary of 1st A.F. transformer, 30,000 ohms resistor or output choke
	P4 to Ground	Closed	Open primary of 1st A.F. transformer or 15,000 ohm plate resistor
	P5 to P6	Closed	Open primary of 2d A.F. transformer, 1,600 ohm resistor or output choke
	P6 to either UX-280 filament contact	Closed	Open output choke, filter reactor UX-280 filament winding
Filament	Across filament contacts of sockets Nos. 1, 2, 3 and 5*	Closed	Open UX-226 filament winding of power transformer and center tapped resistor or wiring
	Across heater contacts of socket No. 4*	Closed	Open UY-227 heater winding of power transformer and center tapped resistor or wiring
	Across filament contacts of socket No. 6*	Closed	Open UX-171A filament winding of power transformer and center tapped resistor or wiring

* In making these tests if the filaments light, the center tapped resistances should be checked by releasing all connections to them. An open center tapped resistor is generally indicated by excessive hum.

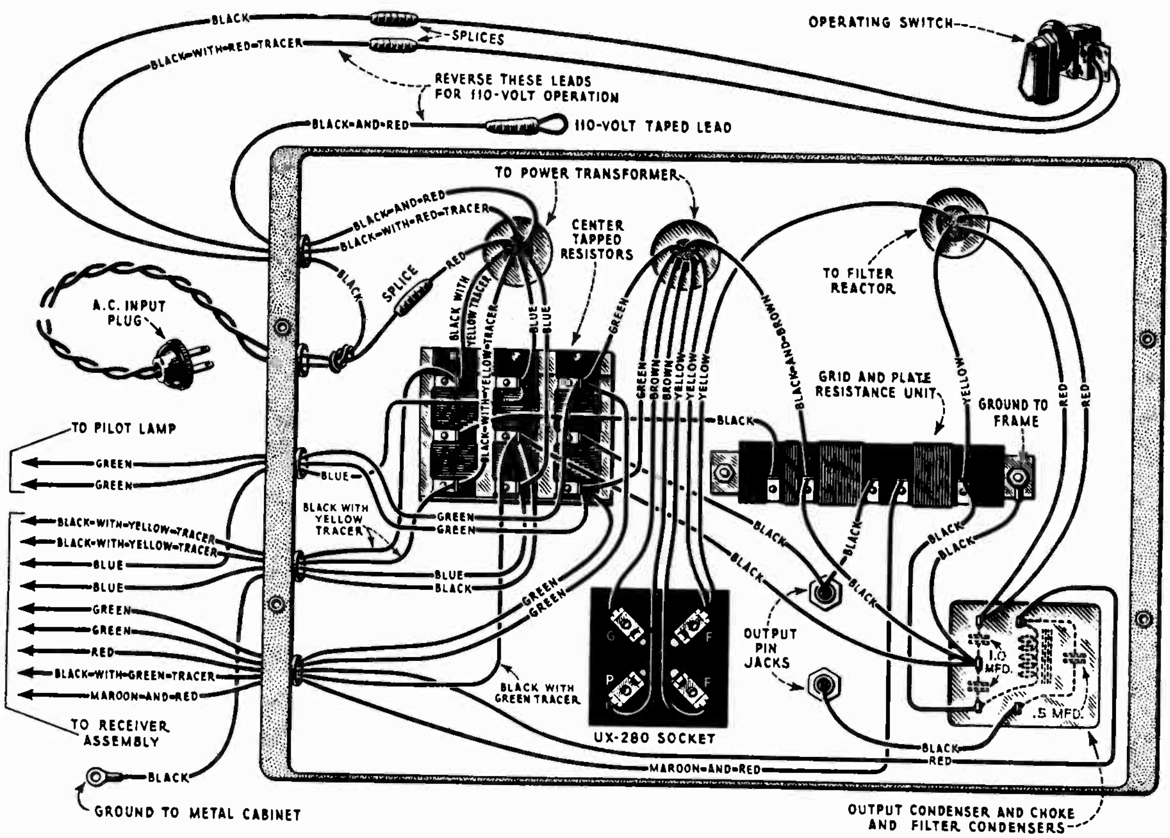


Figure 15—*Wiring diagram of socket power unit*

RECEIVER ASSEMBLY AND S.P.U. CONTINUITY TESTS—Cont'd

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
	Across UX-280 filament contacts	Closed	Open UX-280 filament winding
	Across A.C. input plug with operating switch "On"	Closed	Open primary of power transformer
S.P.U.	G. to P of UX-280 socket	Closed	Open high voltage winding of power transformer
	Either F5 to Ground	Closed	Open 440-ohm bias resistance
	Either F6 to Ground	Closed	Open 1900-ohm bias resistance
	P6 to one output pin terminal (next to rear of cabinet)	Open	Shorted .5 mfd. output condenser

PART IV—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 33 are easy of access and replacements can be made quickly.

(1) REPLACING VOLUME CONTROL

The following procedure should be used when replacing the volume control.

(a) Remove the left front leg and remove the screw under it that holds the receiver assembly. Then replace the leg temporarily.

(b) Remove the seven other screws that hold the receiver assembly and S.P.U. to the bottom of the cabinet.

(c) Remove the metal lid and release the screw holding the ground lead to the back of the cabinet.

(d) Remove the three control knobs. All the knobs are of the push type and can be removed by simply pulling off.

(e) Remove the collar that holds the switch to the front of the cabinet. The switch should now be pulled clear of the cabinet.

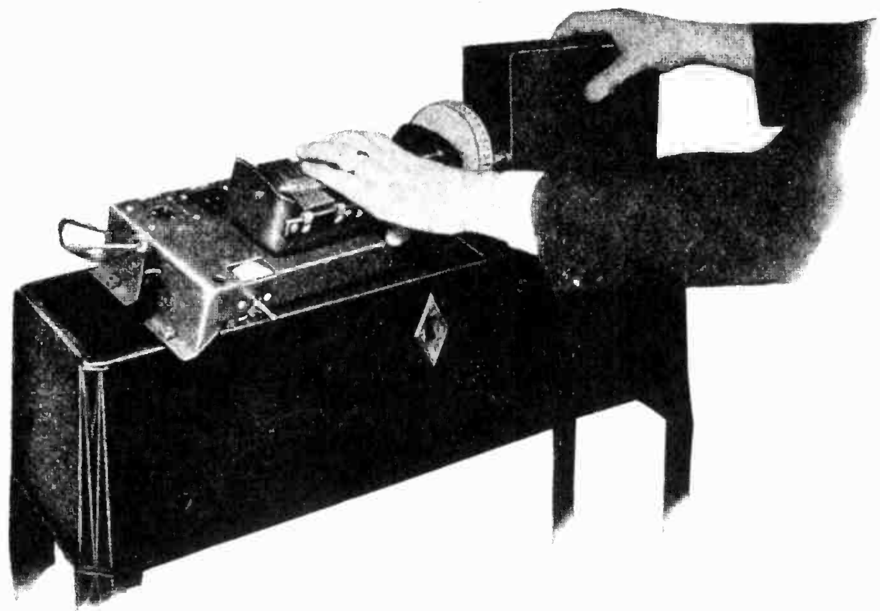


Figure 16—Removing receiver chassis and socket power unit from cabinet in one operation

(f) Pull the input A.C. cord through the lagre hole in the bottom of the cabinet and let it hang over the cabinet side so that it will be clear when the receiver assembly and S.P.U. are removed. Pull the antenna and ground leads clear.

(g) Grasping the receiver assembly by the tuning condenser assembly and the S.P.U. by the power transformer or filter reactor, lift the two assemblies clear of the cabinet—See Figure 16. The S.P.U. can be lifted straight up, but the receiver assembly must first be pulled back slightly so the volume control and tuning control clear the front of the cabinet. Place the two assemblies on a suitable support for work.

(h) Unsolder the leads to the volume control.

(i) Remove the two screws that hold the volume control to the metal chassis. It may now be removed and the new one fastened in place. The connections should be soldered to the new volume control. These connections are shown in Figure 14.

(j) The Radiola is now reassembled in the reverse manner of that already given.

(2) REPLACING RADIO FREQUENCY COILS

The three radio frequency transformers together with small fixed condensers across the concentrated primary coils and R.F. compensating and detector trimming condensers are mounted on one strip and must be replaced as a unit. The following procedure is used:

(a) Remove the chassis assembly from the cabinet as described in Part IV, Section 1.
(b) Unsolder all connections to the three transformers.
(c) Remove the three screws that hold the mounting strip to the metal chassis. The entire assembly can now be removed. The new assembly is placed in the position occupied by the old one.
(d) Replace the screws that hold the mounting strip to the metal chassis.
(e) Replace and resolder all leads to the three transformers. These connections are shown in Figure 14. When making this replacement be careful not to disturb the

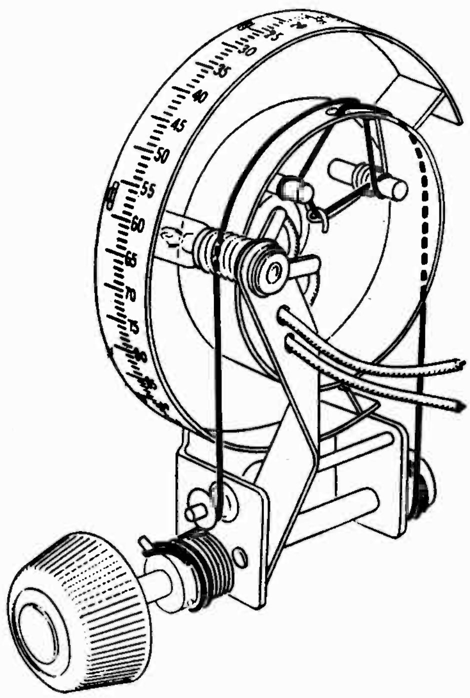


Figure 17—Gang tuning condenser drive mechanism and cable

two condensers connected across the concentrated coils. Placing these condensers closer to the coils than their normal position will affect the inductance of the coil with a resulting decrease of sensitivity.
(f) Return chassis assembly to cabinet and replace all screws and knobs. Adjust the compensating condenser to the correct position as indicated in Part II, Section 10. Also adjust the detector trimming condenser as described in Part II, Section 5.

(3) REPLACING RADIOTRON GANG SOCKETS

The Radiotron sockets of Radiola 33 are of the gang variety, using one detector socket; two A.F. socket strips, and one three-gang socket strip for the radio frequency amplifying tubes. There is a small Bakelite shield placed over all sockets. This shield is supplied separately and does not come with the socket. The sockets are riveted to the metal chassis. To replace them, drill out the old rivets and use screws, nuts and lock washers for securing the new sockets. A step by step procedure follows:

(a) Remove chassis assembly from cabinet as described in Part IV, Section 1.
(b) Remove all leads to the terminals of the sockets.
(c) Drill out the rivets holding the sockets to the metal chassis frame. In some cases it may be necessary to loosen the R.F. transformer assembly in order to slip the socket strips out.
(d) The socket assembly is now removed and the new one placed in the position occupied by the old one.
(e) Fasten new socket in place by using small round head machine screws, nuts and lock washers in place of the rivets previously removed.
(f) Replace connections as indicated in Figure 14 for the correct socket connections.
(g) Return chassis to cabinet.

(4) REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and the driving mechanism are replaced as one complete unit. The step by step procedure follows:

(a) Remove chassis assembly from housing as described in Part IV, Section 1.
(b) Unsolder four connections to condensers.
(c) Remove three screws, nuts, lock washers and insulating strip on under side of chassis that holds the assembly to the frame.
(d) The assembly may now be removed and the new assembly placed in the position occupied by the old one. Be sure and connect the ground wire previously connected under the nut and washer to one screw.
(e) Replace the three screws, nuts and lock washers and resolder the leads.
(f) Replace chassis assembly in cabinet.

(5) REPLACING BY-PASS CONDENSER

This condenser, located on the under side of the chassis frame is held in place by four metal tabs that are a part of the condenser case and are bent over on the upper side of the metal chassis. A step by step procedure for making this replacement follows:

(a) Remove chassis from cabinet as described in Part IV, Section 1.
(b) Remove tuning condenser assembly from chassis as described in Part IV, Section 4.
(c) Unsolder the leads and resistor connected to the defective condenser.
(d) The four tabs holding the condenser to the chassis may now be bent up with a screw-driver and the old condenser replaced by the new one. Insert the tabs in the holes and bend them over on the upper side of the chassis assembly. Resolder the leads and resistors to their correct terminals. The connections are shown in Figure 14.
(e) Replace the tuning condenser assembly as described in Part IV, Section 4.
(f) Return chassis assembly to cabinet in reverse order of that used to remove it.

(6) REPLACING AUDIO FREQUENCY TRANSFORMERS

The audio transformers of Radiola 33 are built together in one unit. In making a replacement the following procedure should be used:

(a) Remove chassis from cabinet as described in Part IV, Section 1.
(b) Unsolder all leads to the audio transformers.
(c) Use a screw-driver to turn up the tabs that hold the transformer assembly to the chassis frame and remove it.
(d) Place the new transformer in the position occupied by the old one, bend over the tabs and resolder all connections. The correct connections are shown in Figure 14.
(e) Replace chassis in cabinet in the reverse order of that used to remove it.

(7) REPLACING CONDENSER DRIVE CABLE

The condenser drive cable of Radiola 33 is of rugged fishline and should give good service. If replacement becomes necessary proceed as follows:

(a) Remove the chassis from the cabinet as described in Part IV, Section 1. Place chassis on table with controls to the front.

(b) Remove the old cable from large drum and grooved drums completely.

(c) By referring to Figure 17 the new cable may be placed in the position occupied by the old one.

(d) Re-assemble the Radiola in the reverse manner of that used to disassemble it.

(8) REPLACING TUNING DIAL

After considerable use a tuning dial may become dirty or illegible and a new scale desired. A step by step procedure for making replacement follows:

(a) Open lid of cabinet of Radiola.

(b) Turn dial so that the small clamp that holds the dial in place is on top.

(c) Remove the clamp and pull the dial clear.

(d) Replace old dial with new one and clamp in place.

(e) Close lid of cabinet.

(9) REPLACING FILTER CONDENSER, OUTPUT CHOKE AND CONDENSER ASSEMBLY

The filter condensers, together with the output choke and condenser, are all contained in one metal container and must be replaced as a unit. The replacement procedure follows:

(a) Remove the receiver assembly and S.P.U. as described in Part IV, Section 1.

(b) Unsolder the connections to the filter condenser unit.

(c) Turn up the tabs that hold this unit to the S.P.U. base with a screw-driver. The entire assembly may now be removed and the new one placed in the position occupied by the old one.

(d) Clamp the assembly in place by turning the tabs over on the under side of the base. Solder the connections as indicated in Figure 15.

(e) Return the S.P.U. to the cabinet and re-assemble in the reverse order of that used to remove it.

(10) REPLACING EITHER POWER TRANSFORMER OR FILTER REACTOR

The power transformer and the filter reactor are each encased in a metal container. Either unit may be replaced in the following manner:

(a) Remove receiver assembly and S.P.U. from cabinet as described in Part IV, Section 1.

(b) Unsolder the leads of the unit being replaced.

(c) Bend up the tabs holding the unit to the base. It may be necessary to remove the resistance unit in order to bend all the tabs. The particular assembly being replaced may now be removed and the new assembly placed in the position occupied by the old one.

(d) The tabs on the new assembly should be bent so as to properly fasten the unit to the S.P.U. base.

(e) Connect all the leads from the assembly to the points of connection as in Figure 15 which should be followed exactly when any S.P.U. parts are replaced.

(f) Return to cabinet in the reverse order, and connect to receiver assembly.

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 Loose volume control arm Defective R.F. transformer Defective A.F. transformer Defective By-pass condenser Defective socket power unit	Repair or replace switch Tighten volume control arm, P. II, S. 4 Replace R.F. transformer assembly, P. IV, S. 2 Replace A.F. transformer assembly, P. IV, S. 6 Replace By-pass condenser, P. IV, S. 5 Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. III, S. 3
Weak Signals	Compensating condenser out of adjustment Defective R.F. transformer Defective A.F. transformer Dirty prongs of Radiotrons Defective By-pass condenser Defective main tuning condensers Low voltages from socket power unit Defective socket power unit	Adjust compensating condenser correctly, P. II, S. 10 Replace R.F. transformer assembly, P. IV, S. 2 Replace A.F. transformer assembly, P. IV, S. 6 Clean prongs with fine sandpaper, P. II, S. 3 Replace defective By-pass condenser, P. IV, S. 5 Replace defective tuning condensers, P. IV, S. 4 Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. III, S. 1 Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. III, S. 3
Poor Quality	Defective A.F. transfomer Defective By-pass condenser Dirty prongs on Radiotrons Defective output condenser or choke	Replace A.F. transformer assembly, P. IV, S. 6 Replace defective By-pass condenser, P. IV, S. 5 Clean prongs with fine sandpaper, P. II, S. 3 Replace output condenser and choke, P. IV, S. 8
Howling	Compensating condenser out of adjustment Defect in audio system Open grid circuit in any stage Receiver in oscillation	Adjust compensating condenser correctly, P. II, S. 10 Check and repair any defect, P. II, S. 3 Check circuit and repair defect Correct cause of oscillation, P. II, S. 9
Excessive Hum	Defective center tapped resistance unit Socket plug position Line voltage low Defective filter condenser	Replace defective resistance unit Reverse socket plug, P. I, S. 4 Reconnect transformer for low line voltage, P. I, S. 5 Replace defective condenser
Radiotrons Fail to Light	Operating switch not "On" Defective operating switch Defective input A.C. cord Defective power transformer No A.C. line voltage	Turn operating switch "On" Replace operating switch Repair or replace A.C. input cord Replace power transformer, P. IV, S. 10 Turn A.C. line voltage "On"

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RCA

Radiola 33 (D.C.)

(110-VOLT)

SERVICE NOTES

RCA Radiola 33 (D. C.) 110-Volt

First Edition—5M

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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

PART I—GENERAL SERVICE DATA

PART II—ELECTRICAL TESTS

PART III—MAKING REPLACEMENTS

ILLUSTRATIONS

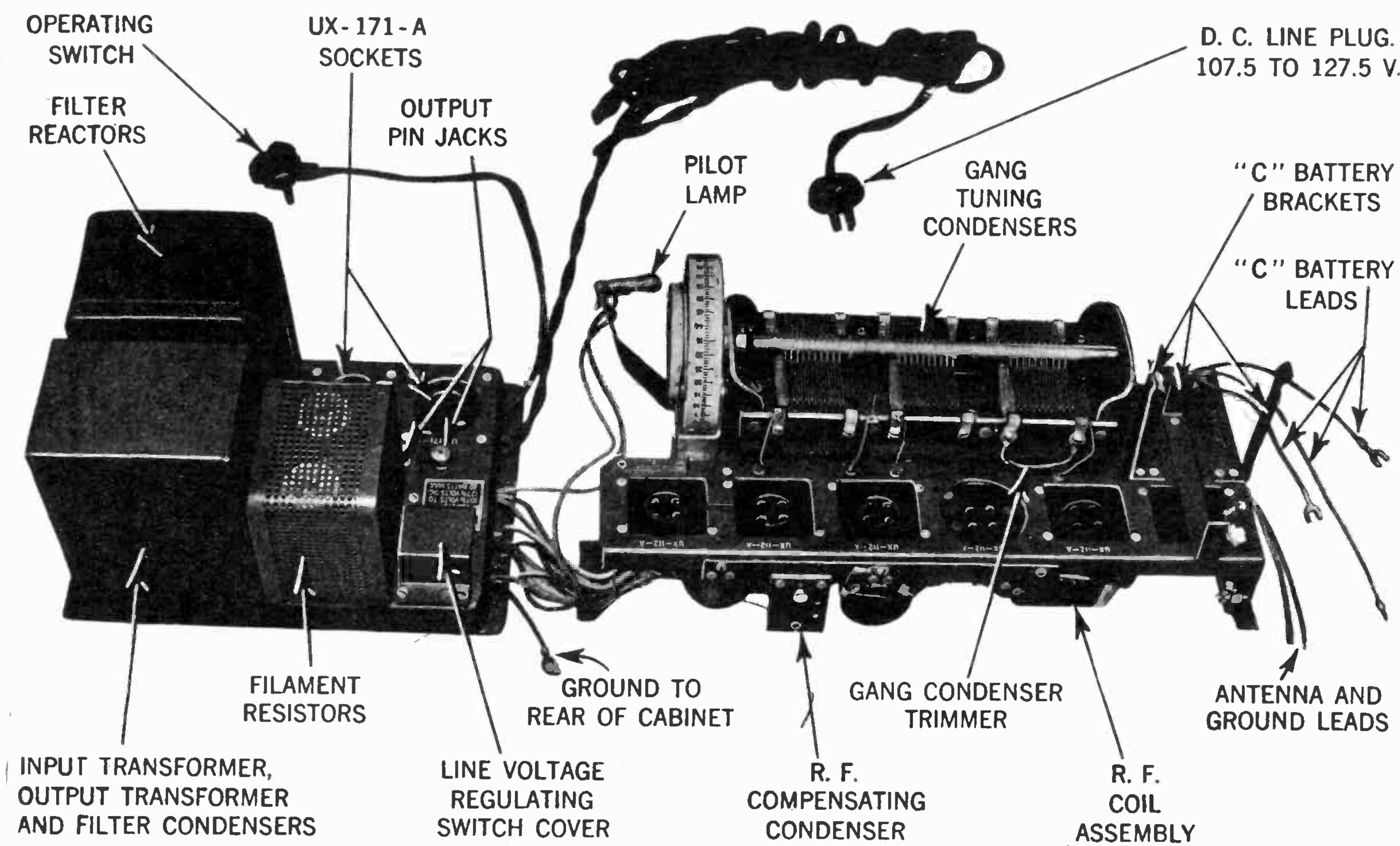


Figure 1—Top view of receiver chassis and socket power unit

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.

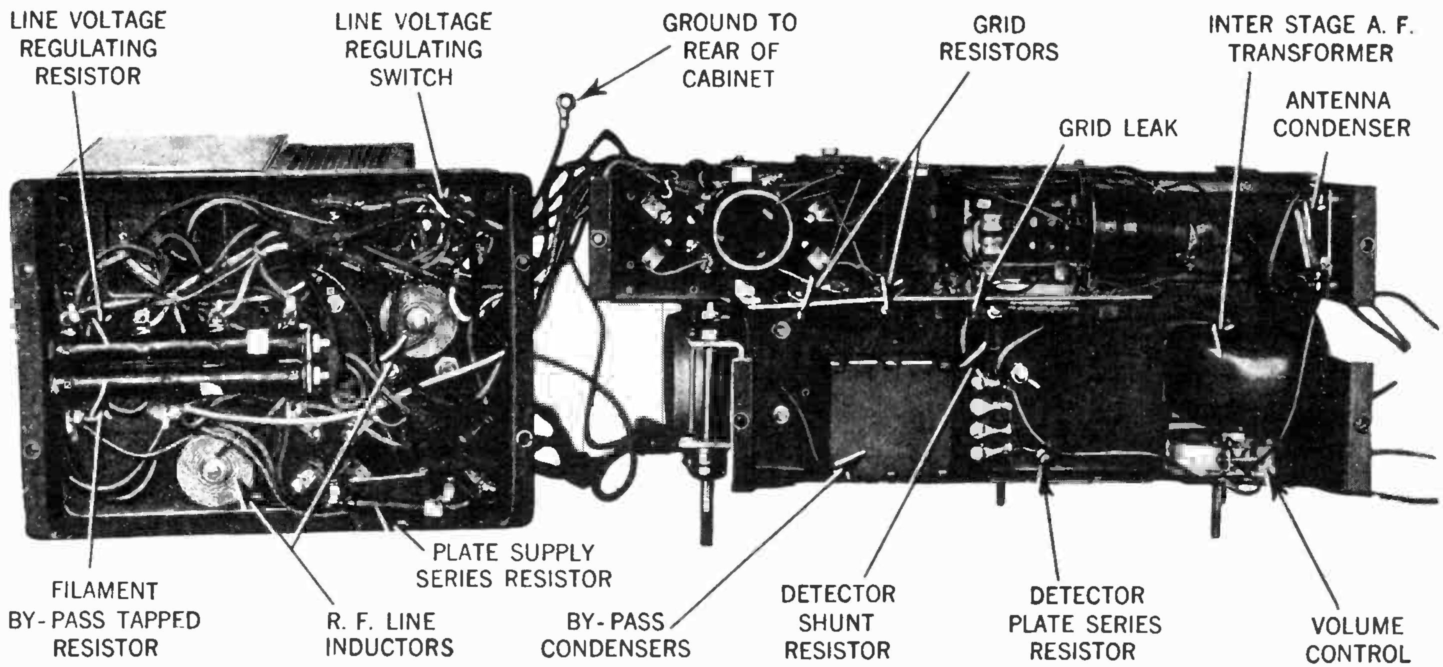


Figure 2—Sub-chassis view of receiver and socket power unit

[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.

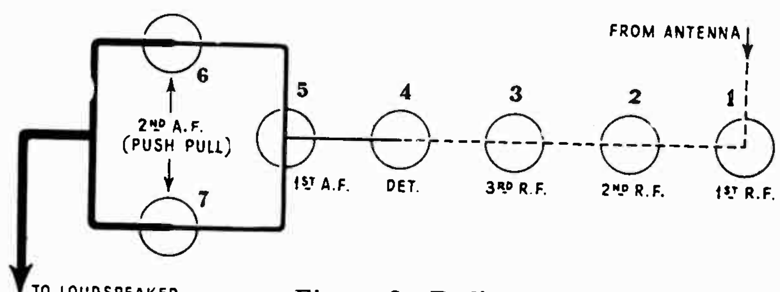


Figure 3—Radiotron sequence

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.

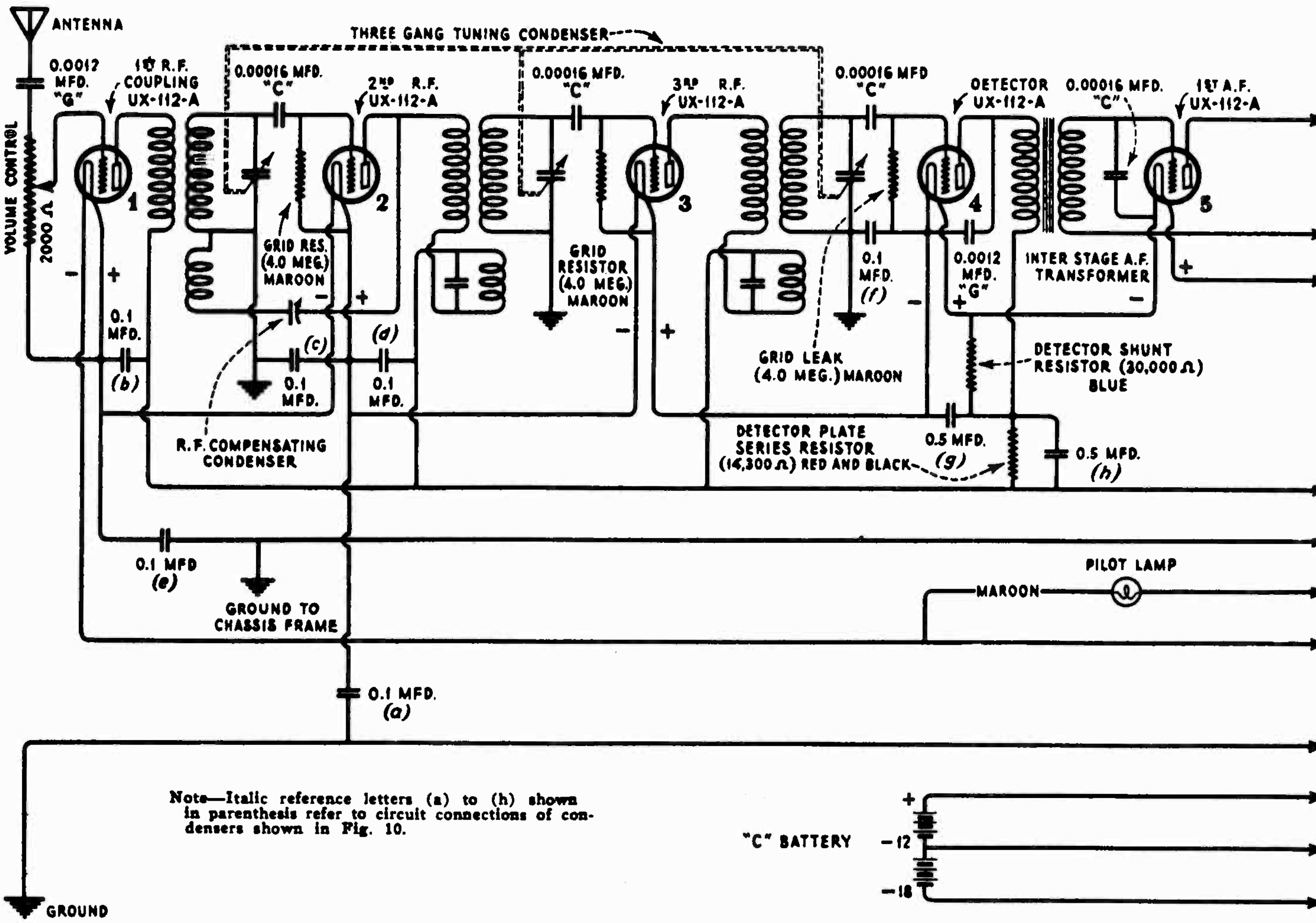


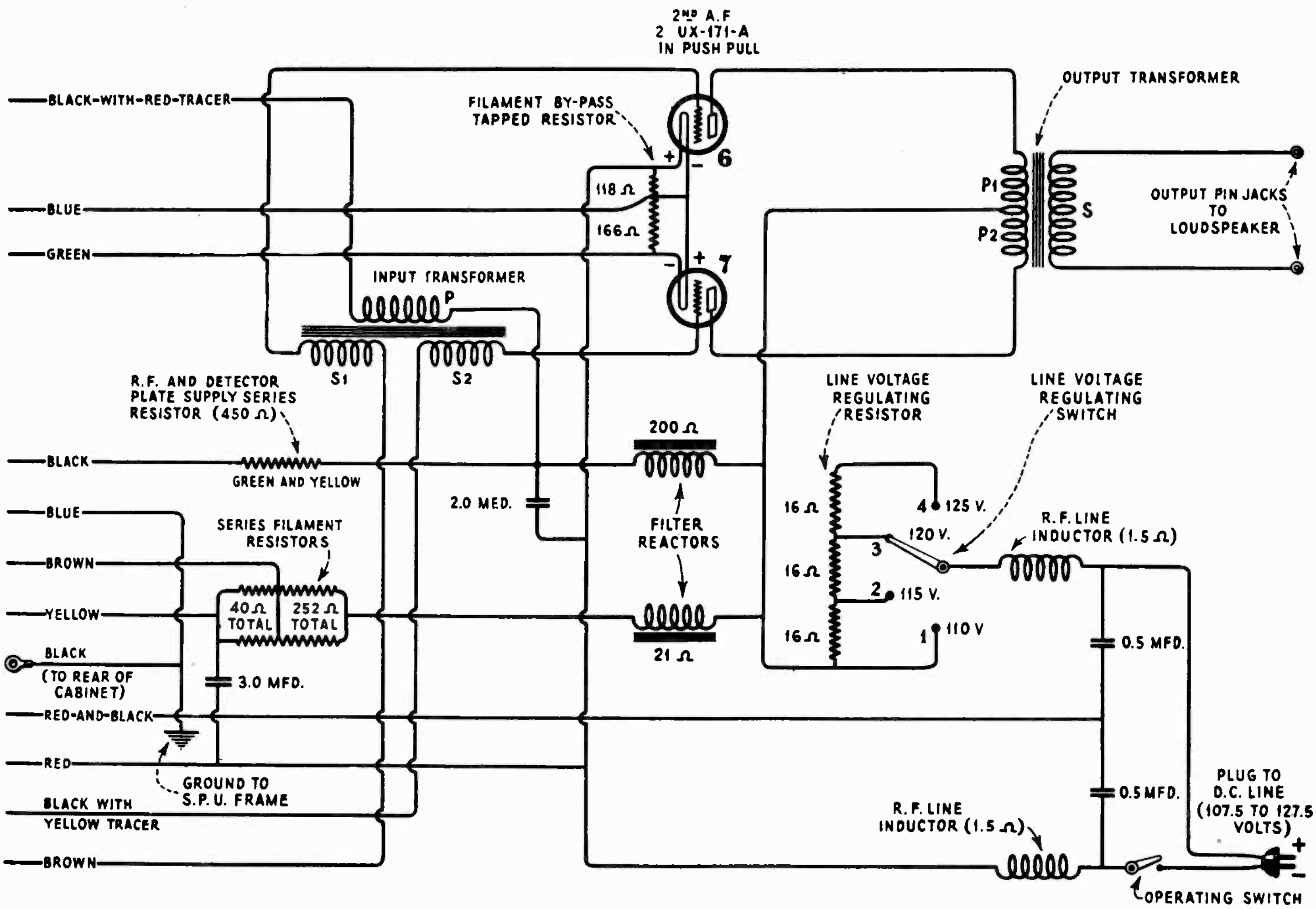
Figure 4—Schematic circuit diagram of

[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.



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.

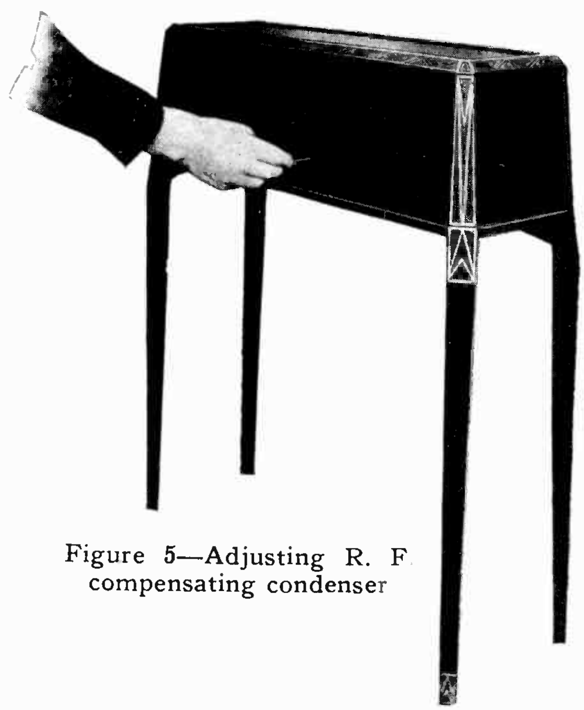


Figure 5—Adjusting R. F compensating condenser

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.

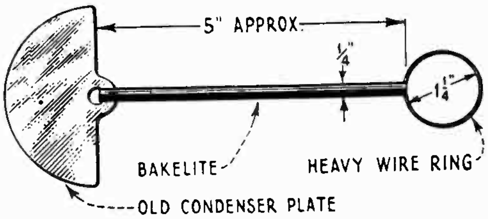


Figure 6—Aligning tool

[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.

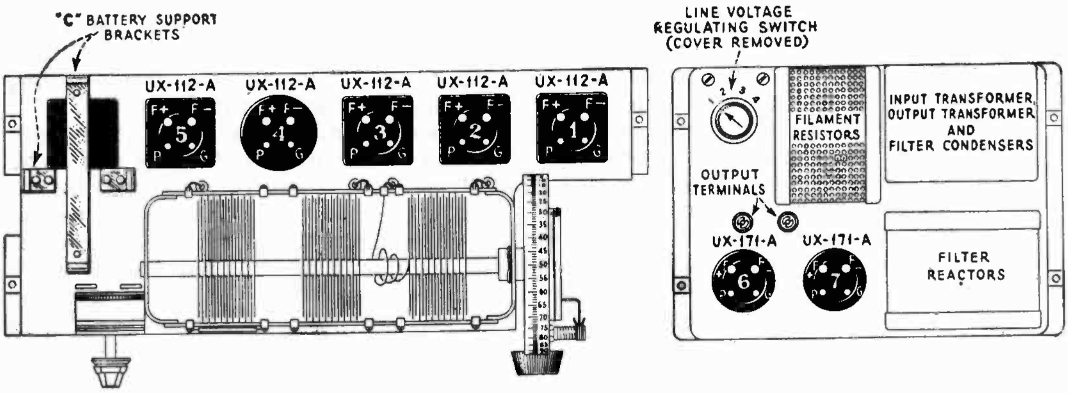


Figure 7—Radiotron socket layout showing filament, plate and grid terminals

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

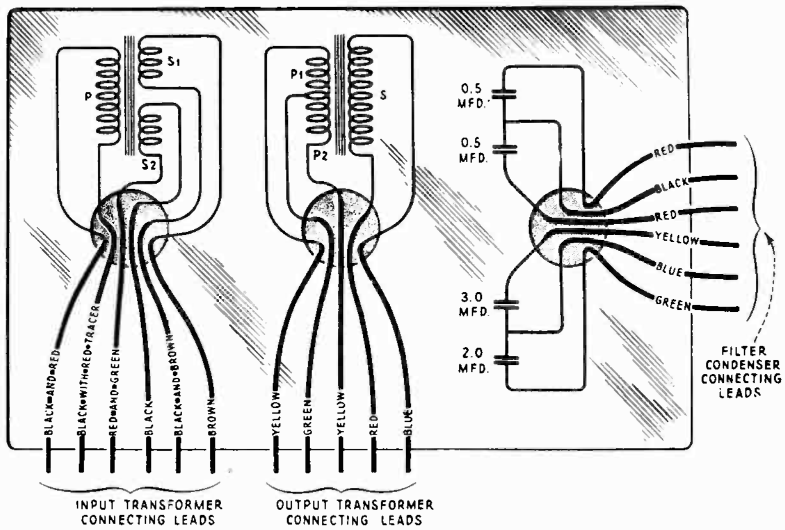


Figure 8—Internal connections of input transformer, output transformer and filter condenser

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-

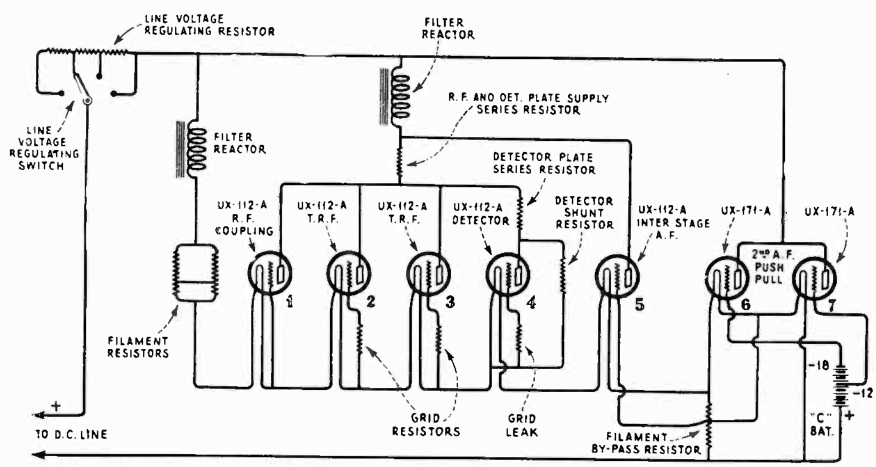


Figure 9—Schematic circuit diagram of voltage supply system

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.

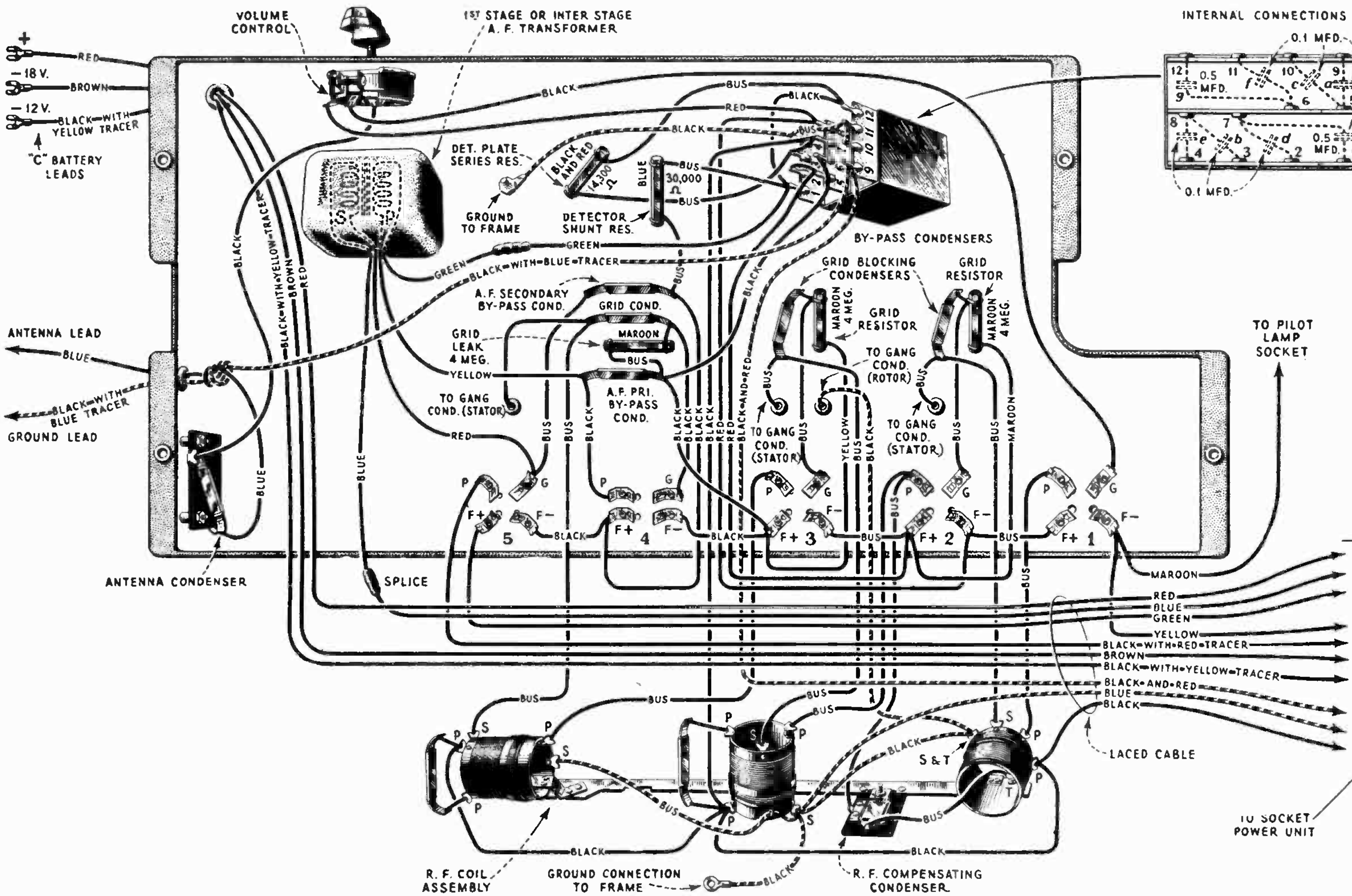


Figure 10—Continuity wiring diagram of receiver

[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 (Bla-k 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.
			(1070 Ohms)	Shorted 0.5 mfd. (g) cond.
	P2 to receiver chassis frame (ground.)	Open	Closed)	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.

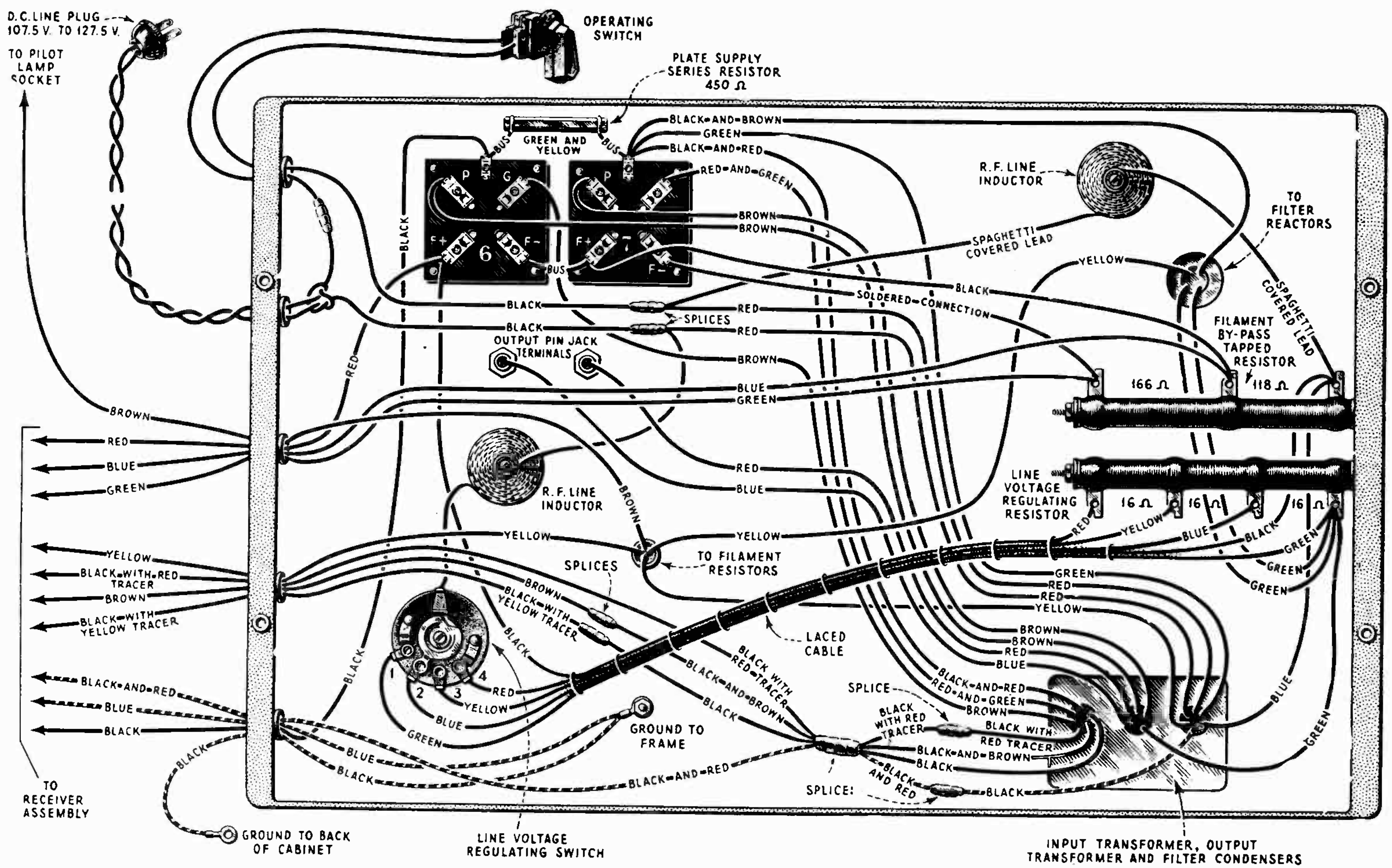


Figure 11—Continuity wiring diagram of socket power unit

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.

RCA
Radiola 33 (D. C.) 220 VOLTS

SERVICE NOTES

RCA Radiola 33 (D.C.) 220-Volt

First Edition—1M

RCA-VICTOR COMPANY, INC.
FOREIGN DEPARTMENT
233 BROADWAY, NEW YORK CITY

PREFACE

Service goes hand in hand with sales. The well-informed RCA-Victor 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-Victor 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-Victor Loudspeakers and Radiolas.

Such service organizations have been established by RCA-Victor Distributors, and 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-Victor Dealer.

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

This information has been compiled from experience with 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-Victor Service Department 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 Distributors in the performance of service work.

CONTENTS

PART I—GENERAL SERVICE DATA

PART II—ELECTRICAL TESTS

PART III—MAKING REPLACEMENTS

LIST OF ILLUSTRATIONS

RADIOLA 33 (D.C.) 220-VOLT

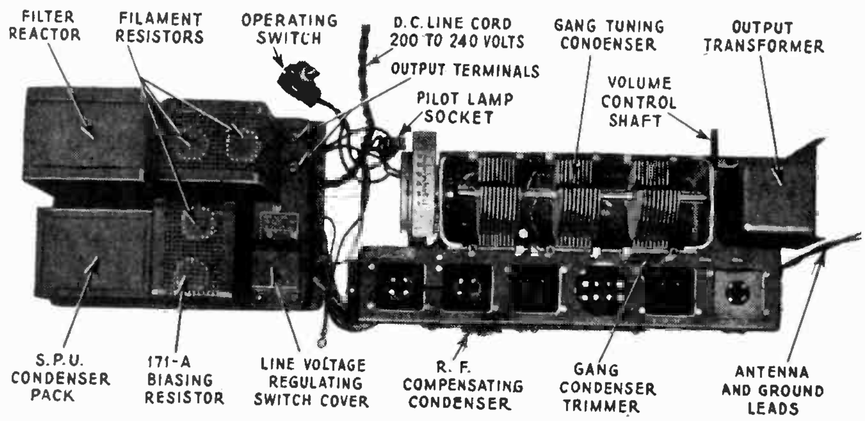


Figure 1—Top view of the receiver chassis and socket power unit

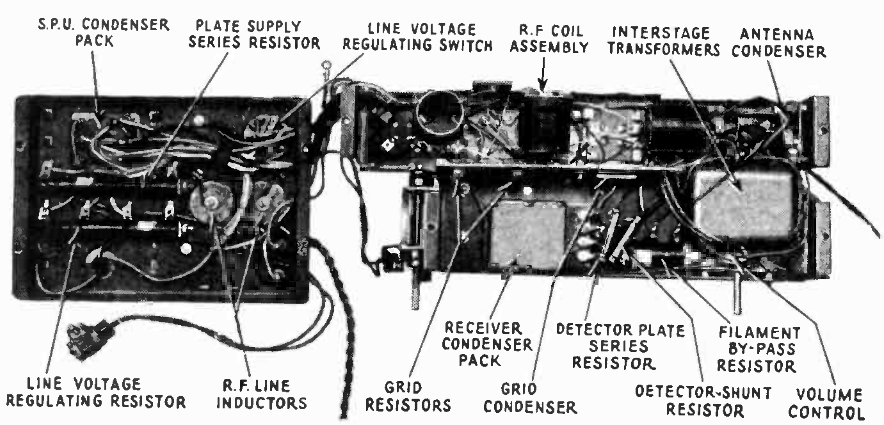


Figure 2—Sub-chassis view of receiver assembly and socket power unit

RADIOLA 33 (D.C.) 220 VOLTS

SERVICE NOTES

Prepared by RCA-Victor Service Department

ELECTRICAL SPECIFICATIONS

Direct Current Line Voltage	200-240 volts
Maximum Power Consumption	72 watts

PHYSICAL DIMENSIONS

Height	31 inches
Depth	8¾ inches
Width	27 inches
Weight (Receiver ready for operation)	42 lbs.
Weight (Packed for shipping without legs)	50 lbs.
Packing Case Dimensions	13½" x 14½" x 36½"

INTRODUCTION

RCA-Victor Radiola 33 is designed for 220-240-volt 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 and circuit arrangement, it is considerably different in the manner of supplying the necessary electric power to the circuits. 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 the 220-volt Radiola 33 (D.C.).

(a) It 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 the two radio frequency amplifiers and the detector.

(c) The volume control regulates the R.F. 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, resulting in a minimum input wattage.

(e) The D.C. house current in addition to supplying filament voltages for the Radiotrons, supplies all the plate and grid voltages.

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

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

Radiotron No. 2 is a stage of tuned radio frequency amplification, and is tuned by the 1st of the gang condensers.

Radiotron No. 3 is the second stage of tuned radio frequency amplification, and 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 audio frequency amplification.

Radiotron No. 6, the second stage of audio amplification, is the UX-171A power Radiotron which is capable of delivering a large undistorted output to the speaker. 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.

(2) ANTENNA (Outdoor and Indoor Types)

Due to the high sensitivity of the 220-volt Radiola 33 (D.C.) the length of an outdoor antenna need only be approximately 50 feet. However, due to the design of the input stage the length of antenna will have no effect on the tuning of the set. The best length of antenna for a particular installation will depend upon local conditions. For localities near high powered broadcast stations a short antenna is advisable, and in general the more remote the installation is from powerful stations the longer the

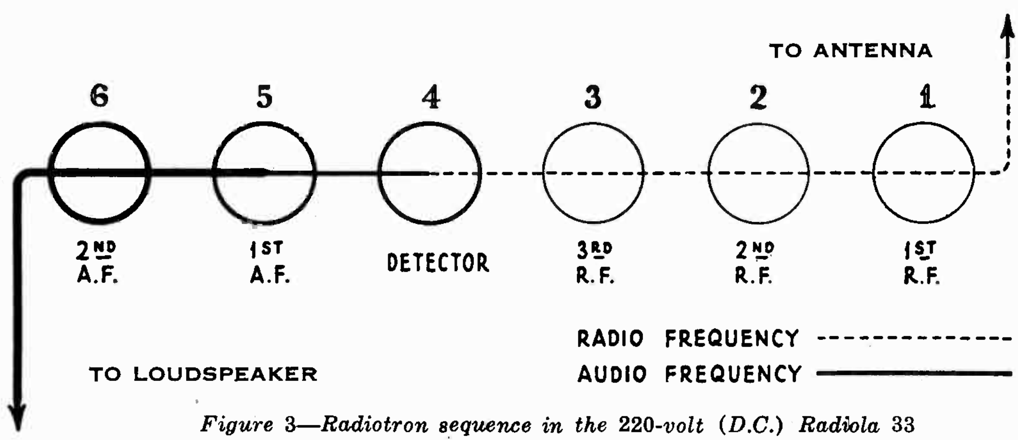


Figure 3—Radiotron sequence in the 220-volt (D.C.) Radiola 33

antenna can be without encountering interference difficulties. However, there is no point in using an antenna length in excess of that necessary to obtain an objectionable noise level with the volume control set for maximum sensitivity. The antenna should be as high as possible and 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 necessary to splice the lead-in to the antenna the joint must be carefully soldered to insure good electrical contact. Clean off all excess flux and tape the connection to protect it from oxidation effects of the atmosphere.

High grade glass or porcelain insulator supports are required, and at no point should the antenna or lead-in come in contact with any part of the building. Use a porcelain tube insulator where the lead-in 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, and as far as possible from, such lines or other antennas. Care should be taken not to run the antenna or lead-in near any apparatus that is liable to cause disturbance. Where it is necessary to run an antenna or lead-in near disturbing apparatus or power lines it is often advisable to use a long antenna so that the major part of the antenna can be kept clear of the disturbance. A small fixed condenser (approx. .00025 to .0005 mfd.) should then be put in series with the antenna at the receiver to cut down the strength of the signal. A shielded lead-in will often be found advisable. The advisability of grounding the shield should be determined by experiment. An outdoor antenna should be protected by means of an approved lightning arrester.

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna of about 20 or 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 obtainable with this type of antenna. Under such conditions various arrangements of the indoor antenna should be tried to secure satisfactory results.

(3) GROUND

A good ground is as important as a good antenna. A short lead to the nearest cold water pipe will usually be satisfactory. In some cases where it is necessary to go some distance to a cold water pipe, a lead run to a steel rod or pipe driven several feet into the ground will be more convenient and satisfactory. A soft, damp loam or clay is the best type of soil for this kind of ground connection. Sandy, rocky or dry soil should be avoided whenever possible.

(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 for best performance. The second R.F. stage is the most critical and the Radiotron selected for No. 2 socket should be the 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.

(5) VOLTAGE REGULATING SWITCH

A four-position switch is provided on the S.P.U. for adjusting the Radiola to various line voltages over a range of 200 to 240 volts. The line voltage should be measured with an accurate D.C. voltmeter, and the switch set at the correct position for the voltage.

Position	For Line Voltage of
1	200—210
2	210—220
3	220—230
4	230—240

The voltage regulating switch is accessible by removing the switch cover—see Figure 1.

(6) RADIOLA 33 WAVE TRAP

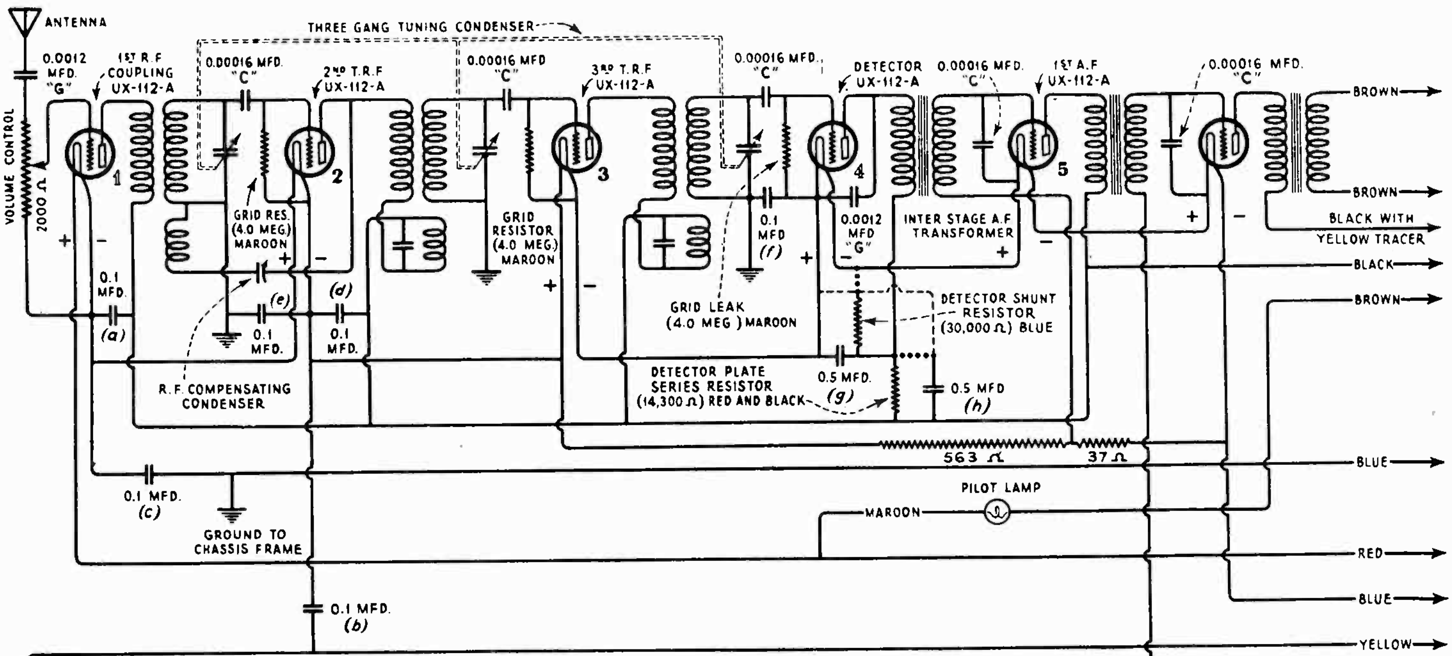
Due to the wide variation in broadcast receiving conditions the performance of any radio receiver will vary with the locality and its performance in any particular location will depend upon the local receiving conditions.

Receivers located in the vicinity of powerful broadcasting stations receive the signal from such stations with great intensity over several divisions of the tuning dial scale. 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, Wave Trap" has been designed and is carried in stock by RCA as an accessory.

The function of the wave trap is to absorb a large portion of the energy of the station it is tuned to, therefore it can be used to reduce the effect of the powerful local signal to a value comparable with that of more distant stations.

This wave trap may be adjusted to absorb a strong signal at any point on the Radiola 33 (D.C.) dial scale. After it has been adjusted to absorb a strong local signal causing interference it needs no further adjustment or attention.



NOTE: A SMALL PART OF THE PRODUCTION IS WIRED AS INDICATED BY THE DOTTED LINES
----- CONNECTIONS WHICH ARE ADDED TO THE REGULAR PRODUCTION
••••• CONNECTIONS REMOVED FROM REGULAR PRODUCTION.

Figure 4—Schematic circuit diagram of

Due to the location of the output transformer on the 220-volt 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

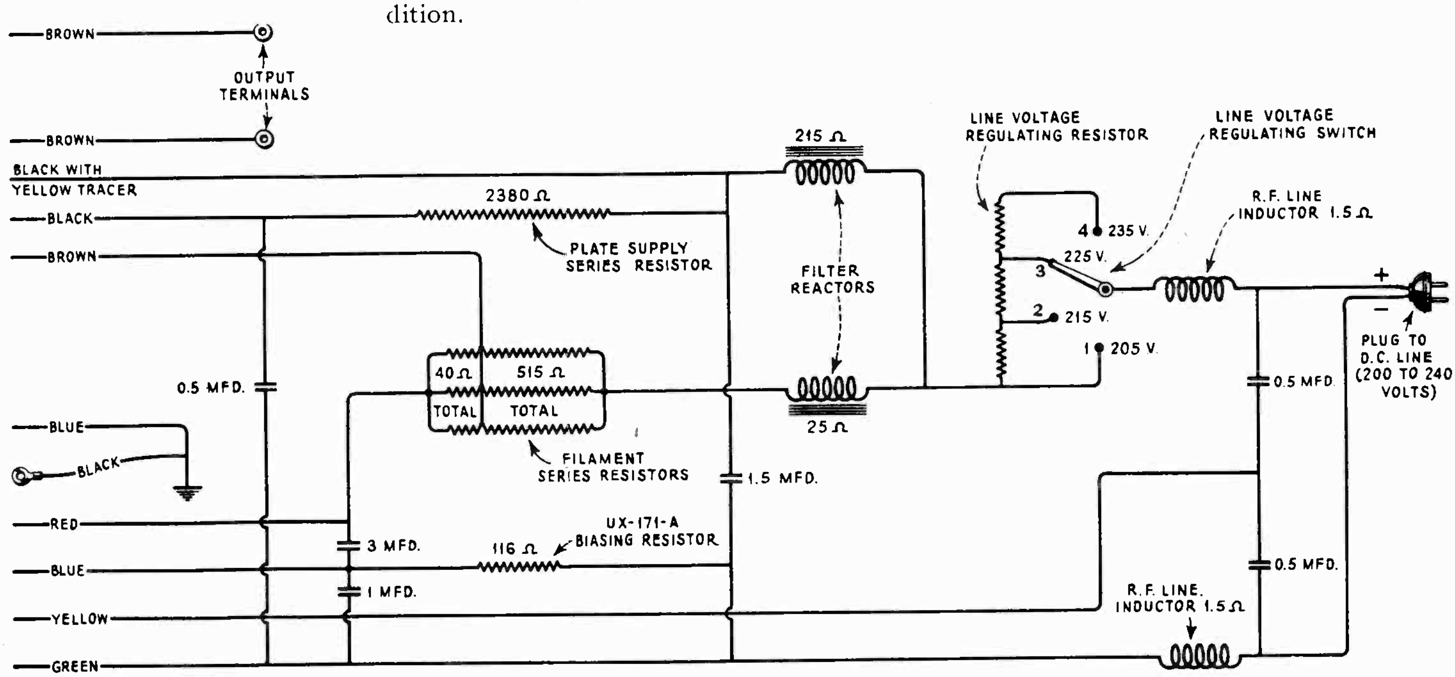
The R.F. compensating condenser in Radiola 33 (D.C.) is provided to allow adjustment of the receiver to compensate for variations in tube characteristics and thereby allow the receiver to function in its most sensitive condition. Before readjusting this condenser, the Radiotrons should be interchanged 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 give the loudest signal on a weak station. The test should be made on a station near each end of the dial to insure that the sensitivity is satisfactory over the entire dial. If satisfactory sensitivity cannot be secured by this means an adjustment of the compensating condenser may be made as follows:

(a) Put the receiver in operation in the usual manner using an antenna and ground and set the tuning condensers to a position corresponding to the lowest frequency obtainable.

(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 just goes into oscillation. Then turn the station selector to the high frequency end of the dial. The receiver should go into oscillation at this end of the dial also. If it does not, try interchanging Radiotrons, bearing in mind that the desirable condition is to have the receiver go into oscillation at both ends of the dial at a fixed compensating condenser setting. When this condition is obtained, back off the compensating condenser screw (turn to the left) just enough to prevent oscillation.

(d) Try various settings of the volume control for both extreme settings of the station selector, and make sure the receiver does not oscillate under any condition.



receiver and socket power unit.

(e) Should the receiver oscillate only when the volume control setting is decreased or should it not be possible to select a tube for No. 2 socket that will satisfy the conditions of (c) it is probable that the tuning condensers are out of alignment. (See Part I, Section 8.) If the compensating condenser is adjusted just below the point of oscillation for a low frequency dial setting the reproduction will sometimes be distorted. This should be checked by tuning the receiver to a broadcast station of low frequency and the compensating condenser adjusted to maximum sensitivity consistent with good quality.

(8) ALIGNMENT OF TUNING CONDENSERS

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 fairly weak signal, either broadcast or a modulated oscillator of about 1400 K.C. and adjust the volume control so that the signal is very weak, making sure that receiver is accurately tuned to the signal.

(c) With the condenser plate end of the tool touch the rotor of one of the gang condensers and gradually slide it along the rotor plates, bringing it closer to the stator plates. This increases the capacity of the condenser in question. If the signal increases that particular condenser is low in capacity. This can be corrected by bending the two end rotor plates toward their adjacent plates slightly until the test paddle gives a decrease rather than an increase in signal. The test should be continued until all three of the condensers show decrease in signal when their respective capacities are increased slightly. The gang condenser that tunes the detector circuit has a trimmer (See Figure 1). It may be used in adjusting that condenser by bending the bus toward the

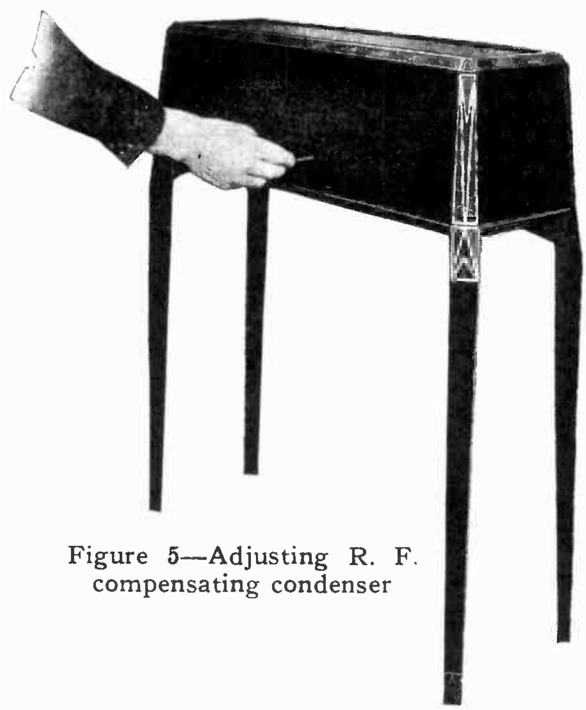


Figure 5—Adjusting R. F. compensating condenser

Figure 5—Adjusting compensating condenser.

frame to increase the capacity. But this trimmer should be used only when making the adjustment at a high frequency (1400 K.C., approximately).

(d) After adjusting at 1400 K.C. the set should be checked at 600 K.C., approximately. The same method of testing can be used as was used at 1400 K.C., but it is advisable to use the other end of the aligning tool, with the shorted turn, because the circuit is more sensitive to changes in inductance at low frequencies. The shorted turn brought up parallel to the coil windings reduces the inductance. If the circuits were properly aligned, bringing the shorted turn up close to the coil will cause a decrease in signal. Should the signal increase as the shorted turn is brought up toward the coil it would indicate that there was too much capacity in the circuit. The end plates of the rotor should then be bent away from their adjacent plates until the shorted turn causes a decrease in the signal when brought close to the coil.

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

NOTE: The tuning condensers are not often out of alignment at low frequencies sufficiently to impair the performance and it is usually only necessary to adjust at 1400 K. C. and, therefore, not necessary to remove the set from the cabinet.

(9) PILOT LAMP

Radiola 33 (D.C.), 220-volt, 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 the dial will not be sufficiently illuminated.

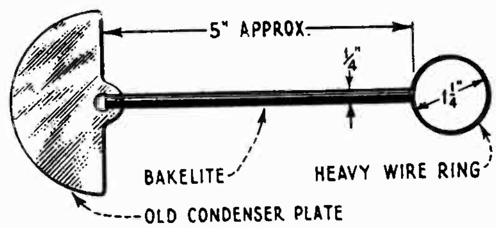


Figure 6—Aligning tool.

(10) INTERSTAGE TRANSFORMER, OUTPUT TRANSFORMER AND FILTER CONDENSERS

The two interstage transformers are alike and they are both in one container mounted on the underside of the receiver chassis frame. Their internal connections are shown in Figure 9. Their primary resistances are approximately 1000 ohms and their secondary resistance is approximately 5000 ohms. The output transformer is mounted on the top of the chassis at the end of the gang condensers. The internal connections are shown in Figure 9. The primary resistance is approximately 580 ohms and the secondary resistance is approximately 770 ohms. Shorted turns in audio transformers can appreciably decrease their efficiency without changing the resistance of the winding beyond limits allowed in O.K. transformers. Replacing the transformer of questionable performance is a reliable means of testing for such a defect. An O.K. transformer can be connected in the circuit temporarily to check any transformer in question, without physically replacing the unit.

The filter condensers are mounted in a single container mounted on the S.P.U. chassis. The diagram of internal connections is shown in the "Continuity Wiring Diagram of the S.P.U.," Figure 10.

SERVICE DATA CHART

When experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, a poor antenna or ground system. If convenient it is advisable to check the socket voltages. Should any of the voltages be appreciably different from those given in Part II, Section 1, check the circuits by means of continuity and to ground. If imperfect operation is not due to any of these causes the "Service Data Chart" below should be consulted for further detailed causes.

SERVICE DATA CHART—Continued

Indication	Observation	Cause	Remedy
No Signal	Radiotrons fail to light	Operating switch not "On"	Turn operating switch "On"
		Defective operating switch	Replace operating switch
		Defective D.C. input cord	Replace or repair input cord
		No D.C. line voltage	Obtain proper D.C. line voltage
		Defective part or connection	Check by means of continuity test and make any repairs necessary
	Radiotrons light	Socket plug in reverse position	Reverse socket plug
		Loose volume control arm	Tighten volume control arm
		Defective part or connection	Check by means of continuity test and make any repairs or replacements necessary
Weak Signals	Signals normal on local stations but weak on distant station	Compensating condenser out of adjustment	Adjust compensating condenser correctly Part I, Sec. 7
		Defective alignment of main tuning condenser	Re-align main tuning condensers (See Part I, Sec. 8)
		Defective R.F. transformer	Replace R.F. transformer assembly
		Low line voltage	Adjust "Line Voltage Regulating Switch," (See Part I, Sec. 5)
	Signals weak on local stations, distant stations received though weak	Defective part or connection	Check by means of continuity test and make any repairs or replacements necessary
		Defective audio transformer not shown by continuity test	Replace audio transformer (See Part I, Sec. 10)
Poor Quality	Volume normal	Compensating condenser out of adjustment	Adjust compensating condenser correctly (See Part I, Sec. 7)
	Volume below normal	Defective part or connection	Check by means of continuity test and make any repairs or replacements necessary
		Defective audio transformer or output transformer	Replace defective transformer (See Part I, Sec. 10)
	Howling or high pitched squeal	Compensating condenser out of adjustment	Adjust compensating condenser correctly (See Part I, Sec. 7)
		Open in any of the small fixed condensers connected between plate and filament, on grid and filament in the audio stages	Check and repair
		Open in 0.5 mfd. condenser connected between one side of 30,000-ohm resistor and filament of socket No. 4	Check and repair

SERVICE DATA CHART—Continued

Indication	Observation	Cause	Remedy
Noisy Operation	Noise eliminated when antenna is disconnected	External disturbance picked up by antenna	Locate disturbing apparatus and eliminate disturbance by use of line filters or use a long antenna with a .00025 to .0005 mfd. condenser in series Relocate the antenna and lead-in
	Noise not eliminated when antenna is disconnected	Noise due to commutator ripple of generator or picked up by the power lines Defective filter condensers or chokes	Use filter in power supply. Use additional capacity across Radiotron filaments Check for open or shorted filter condensers and shorted filter reactors
Uncontrolled Oscillation	Howling or squeal noticed only at high volume level	Overloading the detector Radiotron	Replace UY-227 Radiotron. Back off on volume control
	Howling affected by volume control setting	Receiver wiring not suited to particular D.C. line condition	Change wiring to conform with standard production (See Figures 4 and 9)
	Oscillation controllable by use of compensating condenser	Radiotrons not arranged for best results Improper setting of compensating condenser	Rearrange Radiotrons in R.F. stages Adjust compensating condenser (See Part I, Sec. 7)
	Oscillates too readily over the high frequency range of the tuning condensers, causing the receiver to be insensitive over low frequency range	Poor receiver ground Condenser connected across the primary R.F. coil too high in capacity	Use better means of grounding the receiver Replace condenser with one of lower capacity
	Oscillates too readily over the low frequency range of the tuning condensers, causing the receiver to be insensitive over high frequency range	Tuning condensers out of alignment over the high frequency range of the tuning condensers Condenser connected across concentrated primary of R.F. coil too low in capacity	Align the tuning condensers (See Part I, Sec. 8) Replace condenser with one of higher capacity
	Oscillation not appreciably affected by changing the setting of the compensating condenser	A defective ground or a defective by-pass condenser	Check for grounds and open or shorted by-pass condensers
Play in Station Selector	Knob tight on shaft	Slack caused by defective tension spring	Replace defective spring

PART II—ELECTRICAL TESTS

(1) VOLTAGE READINGS

Voltage readings of the Radiola 33 (D.C.) 220-volts may best be checked at the 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 when connected to a 240-volt D.C. line with the line voltage regulating switch at Position No. 4.

When using a standard set checker for testing see that the proper Radiotron is inserted in the instrument's socket before the set is turned "On," otherwise the filament voltmeter will probably burn out, as approximately full line voltage is impressed across the filament voltmeter under this condition.

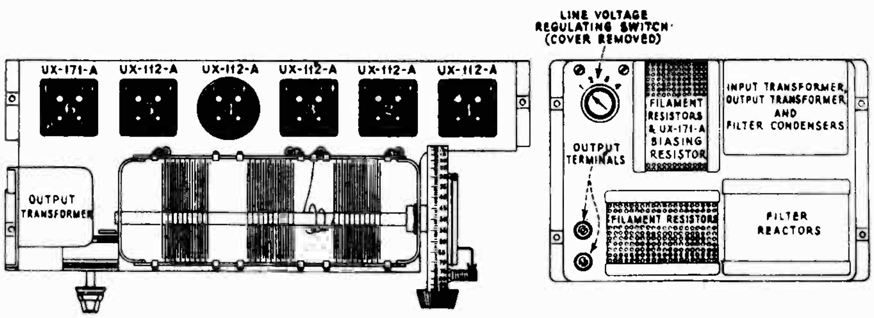


Figure 7—Radiotron socket contacts

VOLTAGES AT RADIOTRON SOCKETS

Tube No.	Filament to Grid (Volts)	Filament to Plate (Volts)	Plate Current Milliamperes	Filament Voltage
1	3.5	63	4.0	4.9
2	*2.0	68	4.5	4.8
3	*2.0	73	4.0	4.7
4	*2.0	30	1.8	4.7
5	8	78	5	5.1
6	33	150	16	5.1

*Will vary with type of Tester used.

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

(2) VOLTAGE SUPPLY SYSTEM

Figure 8 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 last three Radiotrons to by-pass accumulated plate current from the UX-112A's as well as by a tapped connection to supply correct grid bias to the first interstage audio amplifier. The voltage drop in a resistor in series with the filaments, supplies the grid bias for the UX-171A tube. The grid bias for the R.F. amplifiers is supplied by connecting the grid to the negative side of the filament. For the second and third Radiotron this connection is made through a 2 to 4-megohm resistor. This resistor is in no sense a grid leak as employed, because the grid does not take current. The detector is of the grid leak and condenser type. The grid is connected to the positive side of the filament through a 2 to 4-megohm resistor.

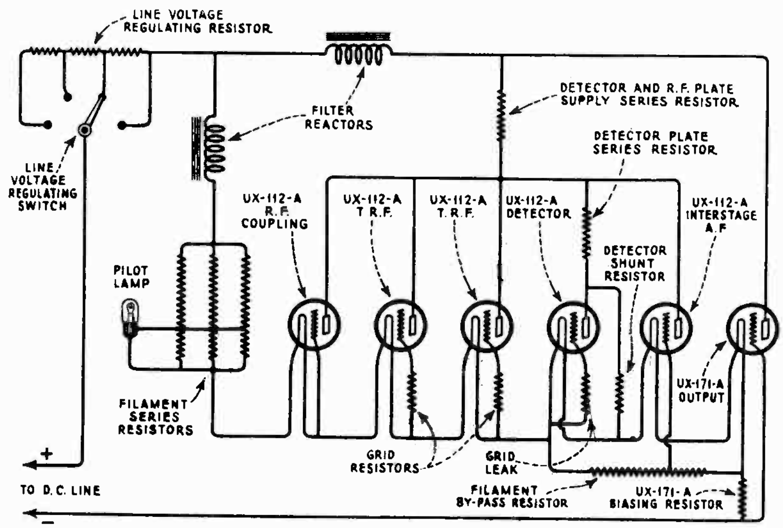


Figure 8—Schematic circuit diagram of voltage supply system

(3) RADIOLA 33 (D. C.) 220-VOLT CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly (Figure 9), and socket power unit (Figure 10).

A pair of head phones with at least 4½ volts in series, or a voltmeter with sufficient voltage to give full scale deflection when connected directly across the battery terminals can be used in making these tests. But a more complete test can be made if the actual resistances are measured. This can readily be done with any of the various resistance meters now on the market, or by employing a voltmeter in series with a battery as mentioned above and calculating the resistance. (See Part II, Section 5.)

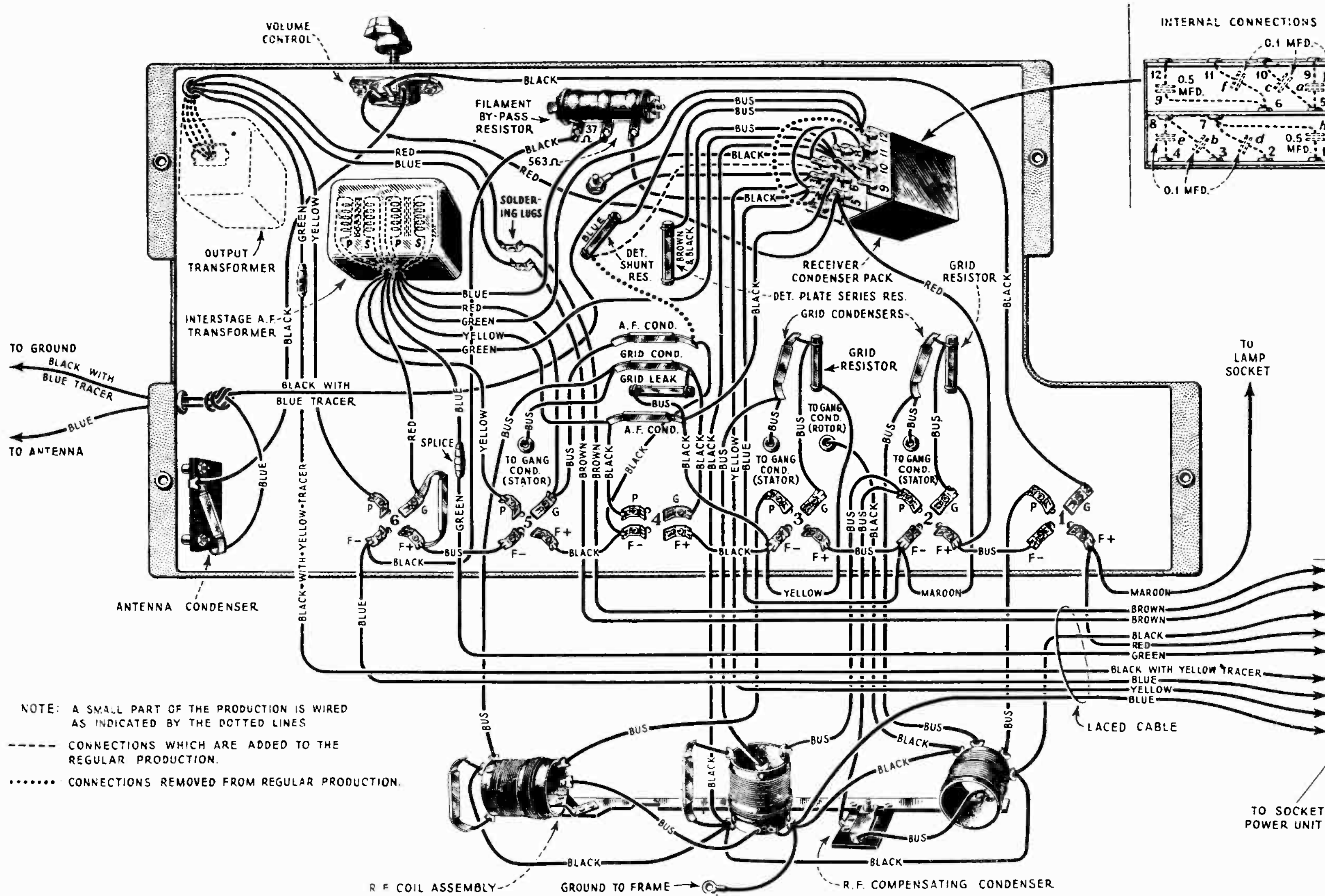
The following nomenclature is used in the continuity table.

In the "Correct Effect" column "Open" is used to indicate that the circuit will not pass direct current. "Closed" is used where the resistance is greater than one ohm and may be as high as 4 meghoms, and the correct resistance is given beneath the word "Closed." These values as given are approximate, being subject to manufacturing tolerances. "Shorted" is used to indicate a resistance of less than one ohm.

In the "Indication" column "Open" is used in the same sense as when used in the "Correct Effect" column, but a measured resistance appreciably greater than the correct value should be investigated.

Where a value of resistance is given in this column the probable cause of the incorrect reading is given in the column headed "Caused by."

Before proceeding with the continuity test disconnect the antenna and ground leads. Remove all Radiotrons and pilot lamp. Disconnect D.C. input plug. Reference letters in last column refer to Figure 9.



NOTE: A SMALL PART OF THE PRODUCTION IS WIRED AS INDICATED BY THE DOTTED LINES

----- CONNECTIONS WHICH ARE ADDED TO THE REGULAR PRODUCTION.

••••••• CONNECTIONS REMOVED FROM REGULAR PRODUCTION.

Figure 9—Continuity wiring diagram of receiver assembly.

RADIOLA 33 (D. C.) 220-VOLT CONTINUITY TEST CHART

Circuit	Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused By
Antenna	Antenna lead to G1	Open	Closed	Shorted antenna condenser
Receiver Ground	Ground lead to —F2	Open	Closed 716 ohms	Shorted 0.1 mfd. condenser (b) in receiver condenser pack Shorted 0.5 mfd. condenser in S. P. U. condenser pack
	Ground lead to + prong of line plug (line switch closed)	Open	Closed	Shorted 0.5 mfd. condenser in S. P. U. condenser pack
Grid	G1 to —F1 with volume control in extreme clockwise position	Closed 2000 ohms	Open Shorted	Open volume control or open volume control arm contact Shorted volume control or reversed connection to volume control
	G2 to receiver frame	Open	Closed	Shorted or grounded grid condenser
	G2 to —F2	Closed 2-4 meg.	Open	Open grid resistor or connection
	G3 to receiver frame	Open	Closed	Shorted or grounded grid condenser
	G3 to —F3	Closed 2-4 meg.	Open	Open grid resistor or connection
	G4 to receiver frame	Open	Closed	Shorted or grounded grid condenser
	G4 to +F4	Closed 2-4 meg.	Open	Open grid leak or connection
	G5 to —F6	Closed 5000 ohms	Open	Open secondary of 1st interstage A.F. transformer or open 37 ohm section of 600 ohm filament by-pass resistor, or open connection
	G5 to +F5	Open	Closed	Shorted 160 mmfd. condenser between G5 and + F5
	G6 to +F6	Open	Closed	Shorted 160 mmfd. condenser between G6 and + F6
	G6 to —F6	Closed 5200 ohms	Open	Open secondary of 2nd interstage A.F. transformer or open 116-ohm UX-171A biasing resistor or open connection
Plate	P1 to + prong of line plug (Line switch closed) voltage regulator switch at position No. 4	Closed 2600 ohms	Open	Open primary of 1st R.F. transformer, or open 2380-ohm plate resistor, or open filter choke, or open voltage tap resistor or open R.F. line filter or open line switch or open connection to any of the above There should be a difference of 33 ohms in the measured resistance between consecutive positions of the voltage regulator switch

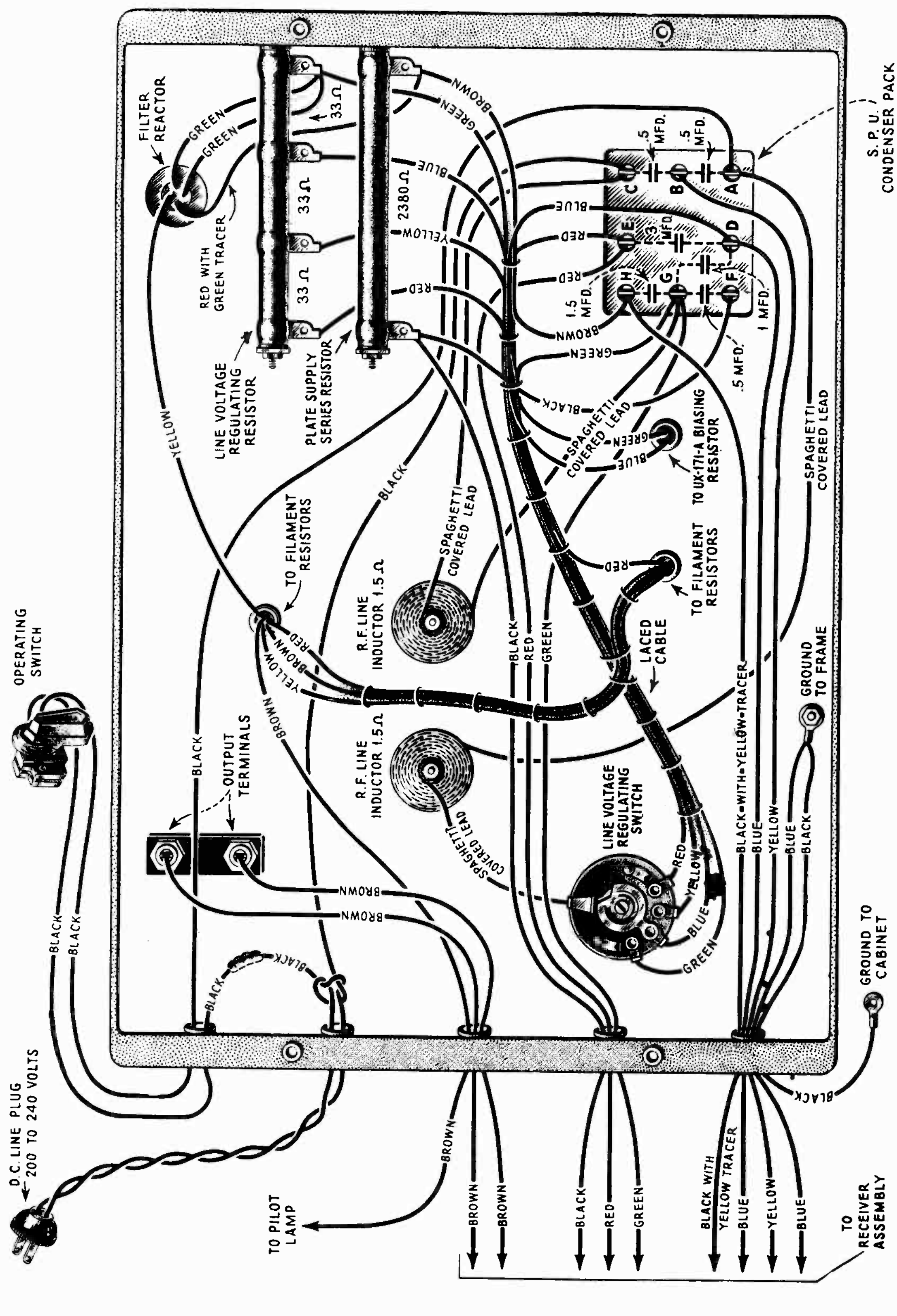


Figure 10—Continuity wiring diagram of socket power unit.

CONTINUITY TEST CHART—Continued

Circuit	Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused By
Plate	P1 to — prong of line plug	Open	Closed 2500 ohms	Shorted 0.5 mfd. condenser in S.P.U. condenser pack Shorted 1.5 mfd. condenser in S.P.U. condenser pack
	P1 to —F1	Open	Closed	Shorted 0.1 mfd. condenser (a) in receiver condenser pack
	P2 to P1	Closed 28 ohms	Open	Open primary of 2nd R.F. transformer
	P2 to —F2	Open	Closed	Shorted 0.1 mfd. condenser (d) in receiver condenser pack
	P2 to receiver frame	Open	Closed	Shorted R.F. compensating condenser
	P3 to P2	Closed 52 ohms	Open	Open primary of 3rd R.F. transformer or open connection
	P4 to P3	Closed 15,500 ohms	Open 1200 ohms	Open primary of 1st interstage AF transformer, or open 14300-ohm carbon resistor or open connection Shorted 0.5 mfd. condenser (h) in receiver condenser pack
	P4 to +F4	Open	Closed 31,000 ohms	Shorted 0.5 mfd. condenser (g) or shorted 1200 mfd. condenser from P4 to + F4 Of slightly different production check by referring to test from P4 to —F4 immediately following
	P4 to —F4	Closed 31,000 ohms	Open	Open primary or 1st interstage A.F. transformer or open 30,000-ohm carbon resistor or open connection or of slightly different production. Check by referring to test from P4 to + F4
	P5 to P3	Closed 920 ohms	Open	Open primary of 2nd interstage A. F. transformer, or open connection
	P6 to + prong of line plug	Closed 840 ohms	Open	Open primary of output transformer or open line switch, or open connection
Filament	+F1 to + prong of line plug, voltage regulator switch at position No. 1	Closed 580 ohms	Open 850 ohms 1680 ohms	Open filament resistor or open filter choke or open line voltage tapped resistor or open connection to any of above Open in one section of filament resistors Open in two sections of filament resistor
	+F1 to —F6	Open	Closed	Shorted 3.0 mfd. condenser in S.P. U. condenser pack
	—F6 to — prong of line plug	Closed 120 ohms	Open Shorted	Open 116-ohm UX-171A biasing resistor Shorted 1.0 mfd. condenser across the 116 ohm resistor
	—F1 to receiver frame	Open	Closed	Shorted 0.1 mfd. condenser (c) in receiver condenser pack

CONTINUITY TEST CHART—Continued

Circuit	Terminals	Correct Effect	Incorrect Effect Indication	Incorrect Effect Caused By
Filament	—F1 to +F2	Closed Short	Open	Open connection
	—F2 to receiver frame	Open	Closed	Shorted 0.1 mfd. condenser (e) in receiver condenser pack
	—F2 to +F3	Closed Short	Open	Open connection
	—F2 to — prong of line plug	Closed 740 ohms	Open	Open 600-ohm filament by-pass resistor, or open 116-ohm UX-171A biasing resistor or open R. F. line reactor or open connection to any of above parts
	+F3 to —F4	Closed Short	Open	Open connection
	+F4 to —F5	Closed Short	Open	Open connection
	+F4 to receiver frame	Open	Closed	Shorted 0.1 mfd. condenser (f) in receiver condenser pack
	+F5 to —F6	Closed	Open	Open connection
	Receiver frame S.P.U. frame	Closed Short	Open	Open connection
	One audio output terminal to other output terminal	Closed 756 ohms	Open	Secondary of output transformer open
Secondaries of R.F. Transformer	Stator 1st gang condenser to receiver frame	Closed 5 ohms	Open Shorted	Open secondary of 1st R. F. transformer Shorted 1st gang condenser or grounded secondary of 1st R. F. transformer
	Stator 2nd gang condenser to receiver frame	Closed 5 ohms	Open Shorted	Open secondary of 2nd R. F. transformer Shorted 2nd gang condenser or grounded secondary of 2nd R. F. transformer
	Stator 3rd gang condenser to receiver frame	Closed 5 ohms	Open Shorted	Open secondary of 3rd R. F. transformer Shorted 3rd gang condenser or grounded secondary of 3rd R. F. transformer

(4) TESTING CONDENSERS AND TESTING FOR DEFECTIVELY GROUNDED PARTS

The large by-pass condensers (from 0.1 mfd. up) and filter condensers may be checked by connecting them across the terminal of a high resistance D.C. voltmeter and suitable battery, connected in series. When contact is made with the terminals of the condenser the meter should give a slight kick upwards and then return to its zero position. Should the needle not "kick" as stated the indication is that the condenser is open. Should a continuous reading be shown the indication is a leaky or shorted condenser. (Note: In testing condensers it is advisable to use a fairly high voltage, about 150 volts, as a shorted condenser may show O. K. at a potential below operating voltage.)

In order to avoid false tests on condensers or parts in the chassis assembly due to one side being normally grounded it is recommended that the three ground connections to the frame shown in Figure 9 and Figure 10 be disconnected when testing for ground. This isolates all parts from ground. If a defective ground is causing trouble a test from the suspected part to ground should uncover the defect.

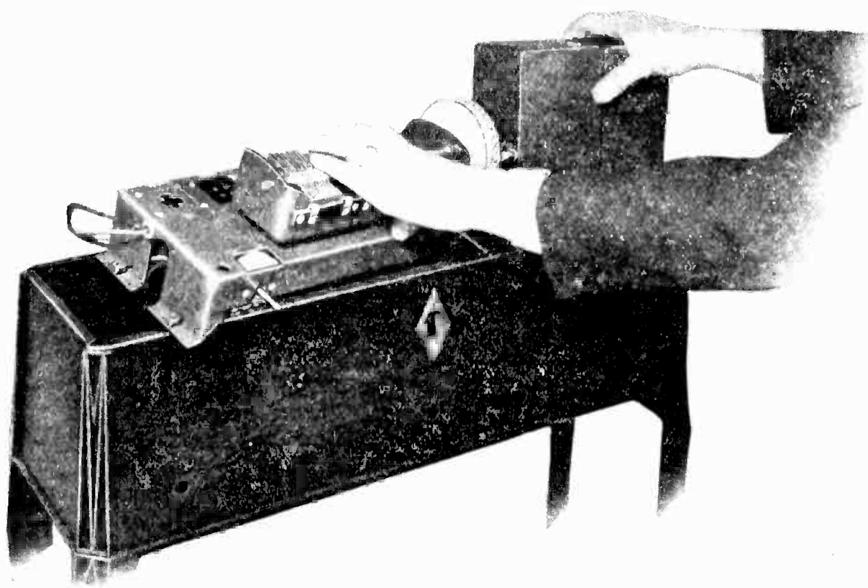


Figure 11—Removing receiver chassis and socket power unit from cabinet in one operation.

(5) RESISTANCE TESTS

The values of the various resistance units of Radiola 33 (D.C.), 220 volts, 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

The replacement procedure, for many parts of Radiola 33 (D.C.), 220 volts, is self-evident and therefore will not be included in these instructions. The continuity wiring diagrams, Figures 9 and 10, show all connections and should be used in making connections to replacement parts. As it is necessary to remove the receiver and S.P.U. from the cabinet in making replacement of most parts, a detailed description of the procedure is given.

(1) REMOVING THE RECEIVER AND S. P. U. CHASSIS FROM THE CABINET

(a) Remove the left front leg and remove the screw under it that holds the receiver assembly. Then replace the leg temporarily.
(b) Remove the seven other screws that hold the receiver assembly and S.P.U. to the bottom of the cabinet.
(c) Remove the screw holding the ground lead at the back of the cabinet (inside).
(d) Remove the three control knobs. All the knobs are of the "push-pull" type and can be removed by simply pulling off.
(e) Remove the collar that holds the switch to the front of the cabinet. The switch should now be pulled clear of the cabinet.
(f) Pull the D.C. cord through the large hole in the bottom of the cabinet.
(g) Grasping the receiver assembly by the tuning condenser assembly, and the S.P.U. by the filter reactor, lift the two assemblies clear of the cabinet. (See Figure 11.)
(h) The units should be replaced in the reverse manner, making sure the asbestos pad is in place beneath the S.P.U.

(2) REPLACING THE RADIO FREQUENCY COILS

The three radio frequency transformers, together with the small fixed condensers across the concentrated primary coils and R.F. compensating condenser are mounted on one strip and must be replaced as a unit.

(3) REPLACING RADIOTRON SOCKETS

The Radiotron sockets are of the gang variety, using one detector socket two A.F. socket strips and one three-gang socket strip for the R.F. amplifying tubes. There is a small Micarta shield placed over all the sockets. This shield is supplied separately and does not come with the socket. The sockets are riveted to the metal chassis. To replace them drill out the old rivets and use screws, nuts and lock washers for securing the new sockets.

(4) REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and drive mechanism are replaced as one unit. Three screws hold the unit to the chassis frame. Be sure to reconnect the ground lead when making the replacement.

(5) REPLACING CONDENSER DRIVE CABLE

It is necessary to remove the chassis from the cabinet to make this replacement.

By referring to Figure 12 a new cable can be placed in the position occupied by the old one.

(6) REPLACING THE TUNING DIAL

It is not necessary to remove the chassis from the cabinet.

(a) Turn the dial so that the bronze clamp that holds the dial in place is accessible.

(b) Remove the bronze clamp by prying its lower end out; this will release dial.

(c) Place the new dial on the drum and clamp in place.

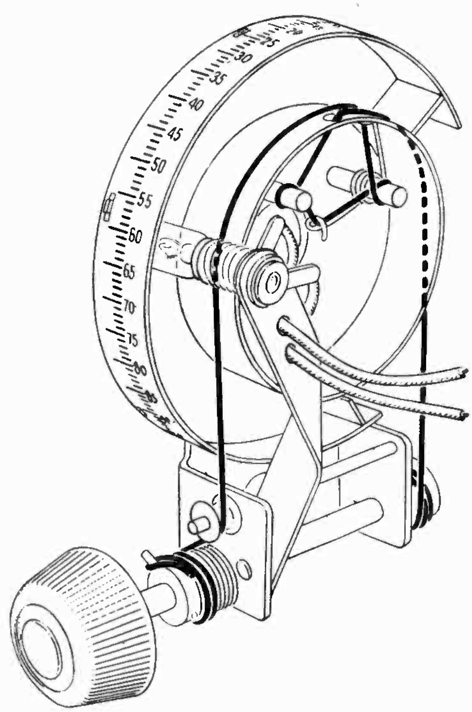


Figure 12—Gang tuning condenser drive mechanism and cable

(7) REPLACING FILAMENT OR UX-171A BIASING RESISTORS

Before the perforated covers can be removed it will be necessary to remove a R.F. line inductor.

(8) REPLACING THE VOLTAGE REGULATING SWITCH

A single nut holds the switch in place. Save the insulating washers for replacing.

(9) REPLACING THE OUTPUT TRANSFORMER

The channel bracket is included with the output transformer and the bracket and transformer assembly should be replaced as a unit.

(10) REPLACING THE RECEIVER BY-PASS CONDENSER PACK

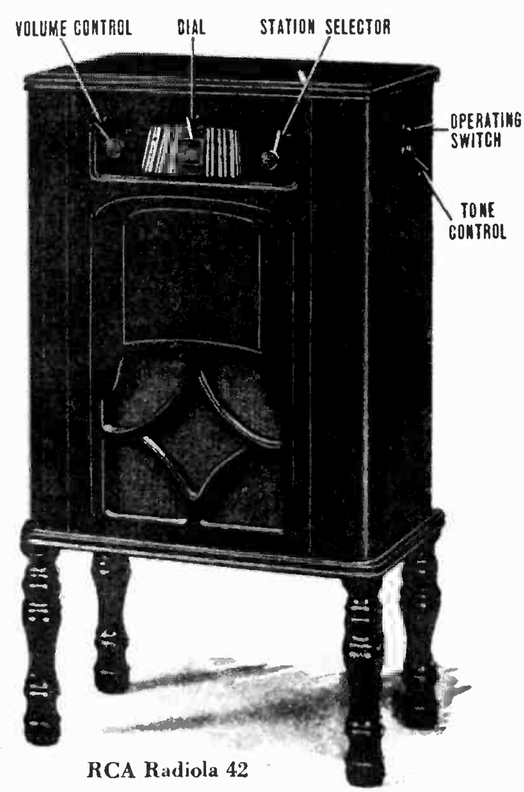
It will be necessary to release the tuning condenser assembly before the tabs holding the condenser pack can be released.

R-33

RCA

Radiola 42

SERVICE NOTES



RCA Radiola 42

First Edition—15 M

RCA Victor Company, Inc.

RADIOLA DIVISION

Camden, New Jersey

REPRESENTATIVES IN PRINCIPAL CITIES

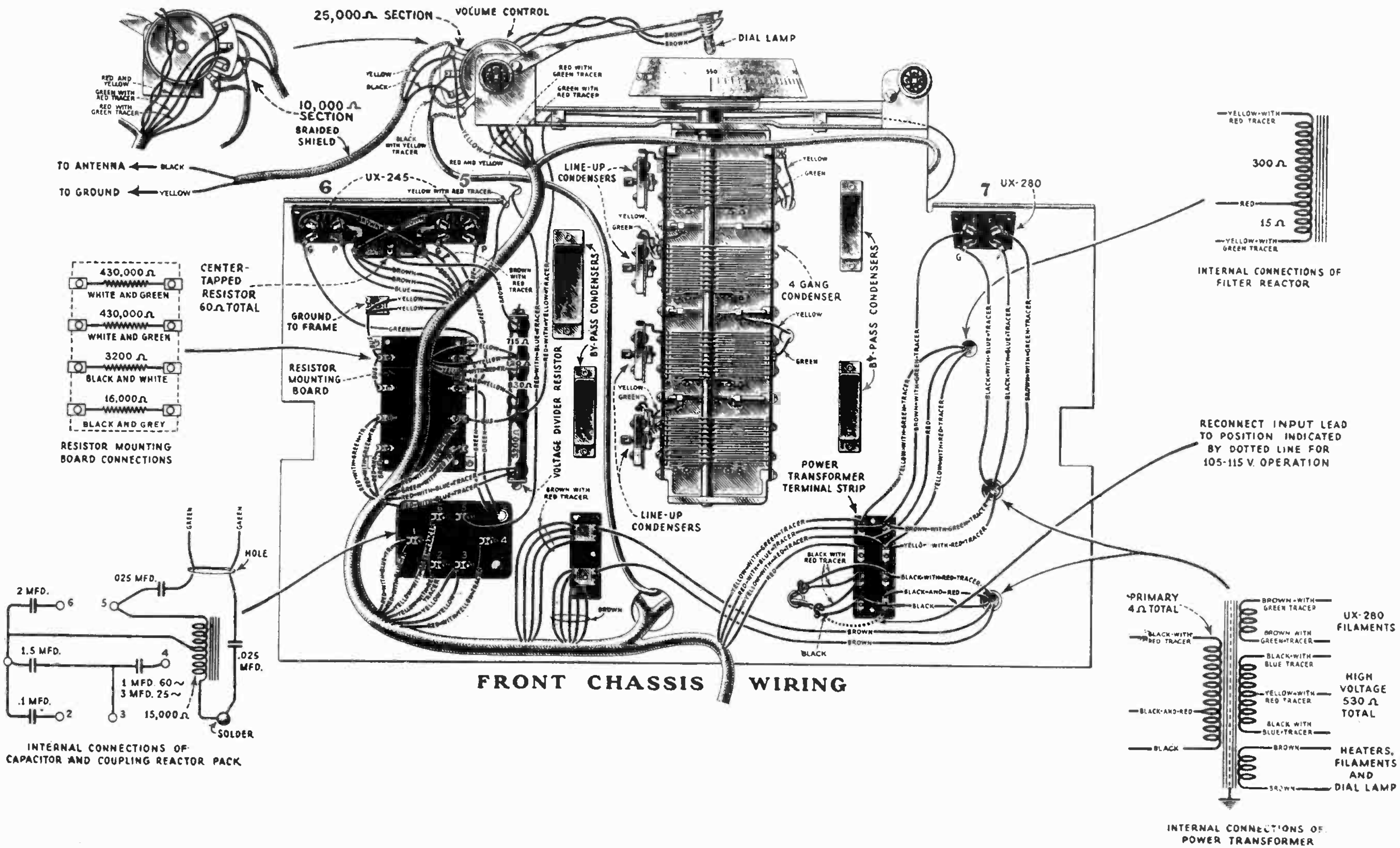


Figure 1—Layout and wiring diagram of chassis (front)

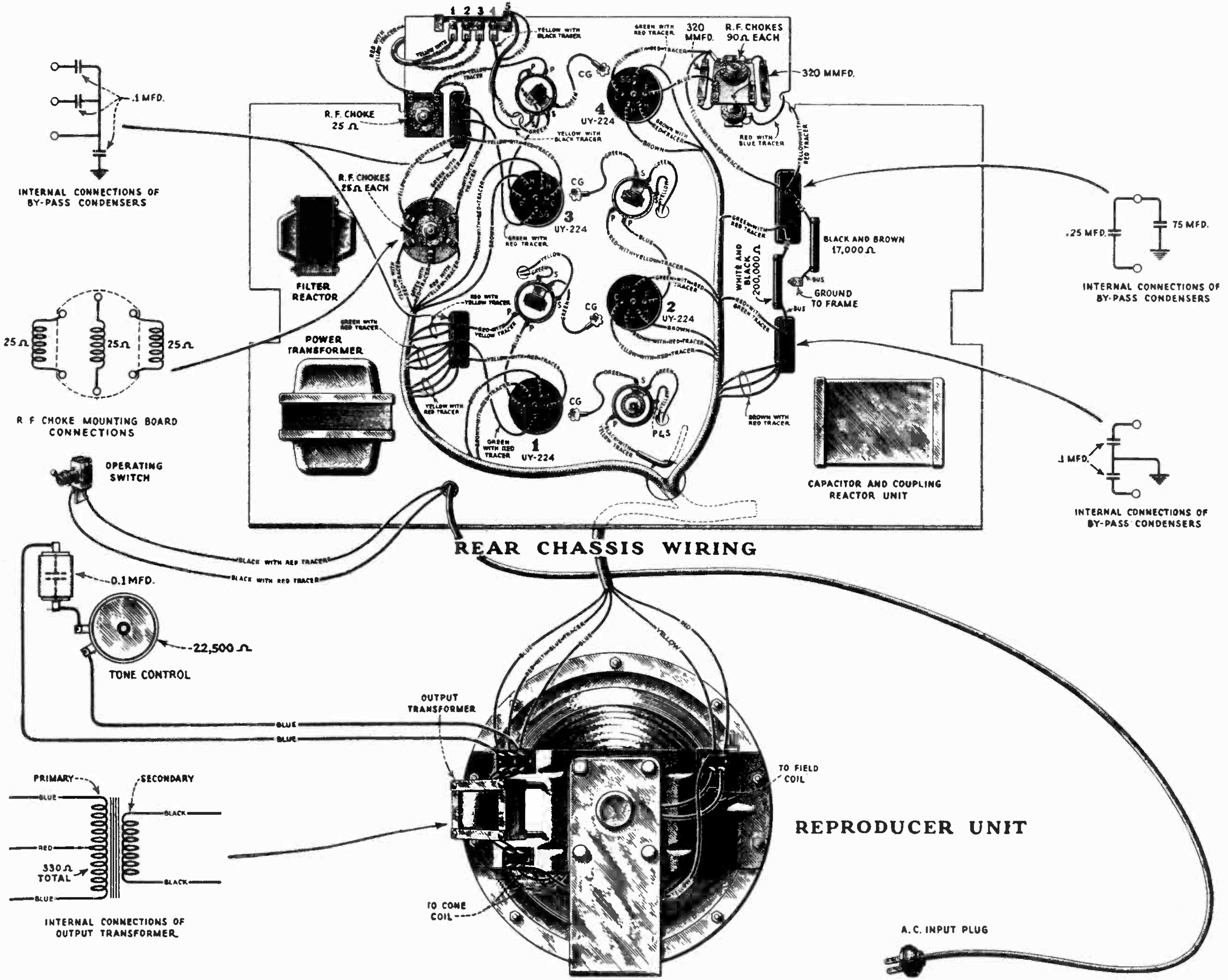


Figure 2—Layout and wiring diagram of chassis (rear) and reproducer unit

RCA RADIOLA 42

SERVICE NOTES

RCA Radiola 42 is a four circuit, tuned radio frequency radio receiver utilizing the chassis and reproducer unit of Radiola 48 together with a tone control. The tone control is mounted on the side directly under the operating switch.

All the information contained in the Radiola 48 Service Notes will therefore apply to the Radiola 42. The wiring diagram is shown in Figures 1 and 2 and the schematic diagram in Figure 3.

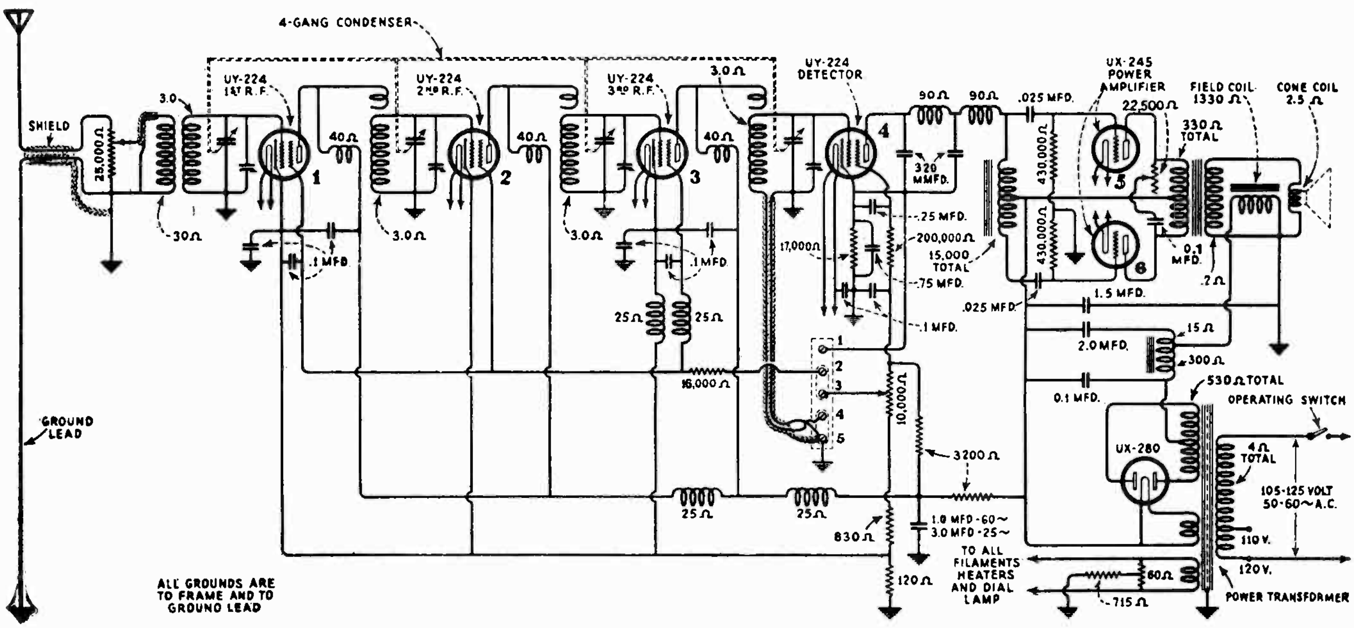


Figure 3—Schematic wiring diagram

It will be noted that a new volume control is used. The antenna section of this unit has a value of 25,000 ohms instead of 50,000 ohms as used in the Radiola 48. This volume control is also being used as a replacement in Radiola 48. The screen grid voltage section has a value of 10,000 ohms and the 12,000 ohm shunt resistor is not used. The 0.005 mfd. condenser across the plates of Radiotrons UX-245 has been omitted due to the connection of the tone control in the same position. When making replacements of the condenser and reactor unit it will be necessary to clip the two leads that are connected to the .005 mfd. condenser close to the container. The reason for this is that the replacement unit supplied is suitable for either the Radiola 42 or 48.

The following list contains the parts used that are not in the Radiola 48 Replacement Parts List.

STOCK NO.	DESCRIPTION
A360	Resistor—Variable tone control resistor—22,500 ohms—(Complete, less knob).
A3028	Washer—For variable resistor unit—(Package of 10).
A2742	Nut—For variable resistor unit—(Package of 5).
A2305	Knob—For variable resistor unit.
A259	Capacitor—Tone control capacitor—.01 mfd.

RCA
Radiolas 44 and 46

SERVICE NOTES

RCA Radiola 46

Second Edition—2M
March, 1931

RCA Victor Company, Inc.

RADIOLA DIVISION

Camden, New Jersey

REPRESENTATIVES IN PRINCIPAL CITIES

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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

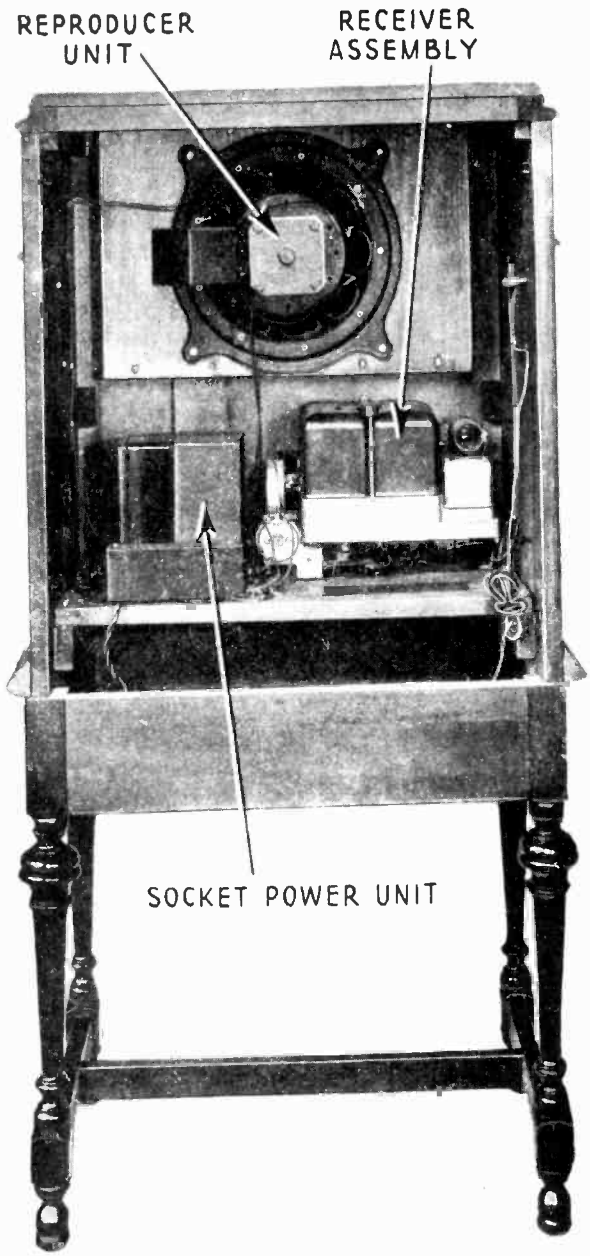


Figure 1—Rear interior cabinet view of Radiola 46

RCA RADIOLAS 44 and 46

SERVICE NOTES
Prepared by RCA Service Division

RATING
105-125 Volts—50-60 Cycles—100 Watts

Models are also available for 105-125 volt 25-40 cycle A.C. lines. The difference between the 50-60 cycle models and the 25-40 cycle models is the power transformer and an additional condenser bank.

INTRODUCTION

RCA Radiolas 44 and 46 are radio receivers utilizing the new A.C. screen grid Radiotrons UY-224, the new power amplifier Radiotron UX-245, and the full wave rectifier Radiotron UX-280. The Radiola 44 is a table model receiver which may be used with either a magnetic or dynamic type loudspeaker, and has special provision for energizing the field of a dynamic speaker that uses 40 milliamperes at 300 volts. The Radiola 46 is a console model utilizing the same chassis and having incorporated therein an RCA dynamic type loudspeaker. Figure 1 shows the rear interior view of Radiola 46 and Figure 2 the parts in the receiver assembly. Figure 3 shows the parts in the S.P.U. of Radiola 44. Figure 4 shows the construction of Radiotron UY-224.

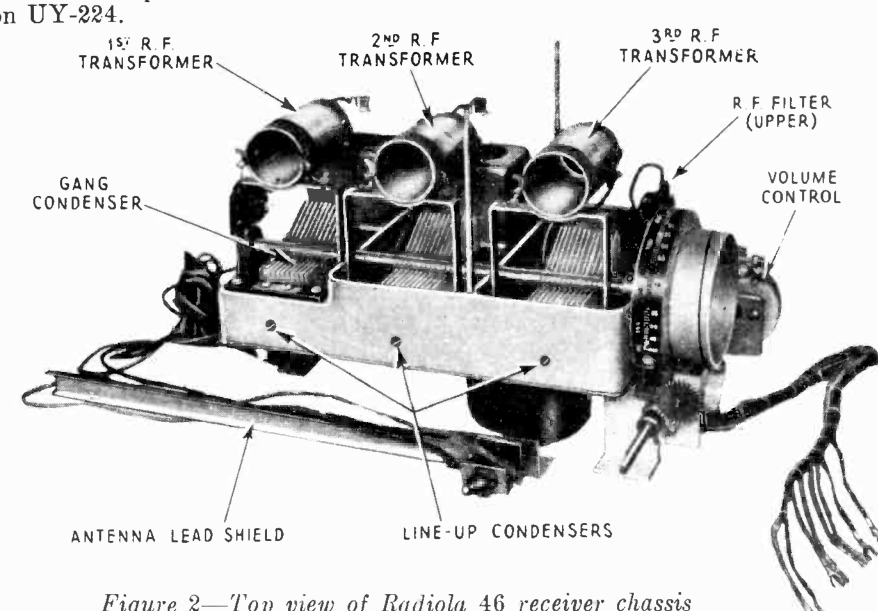


Figure 2—Top view of Radiola 46 receiver chassis

The sensitivity and selectivity of these Radiolas are sufficient for excellent reception and the fidelity is exceptionally good. The use of the power amplifier Radiotron UX-245 gives a large reserve of power that contributes to the quality of reproduction at low as well as high volume.

The following principles are incorporated in the design of Radiolas 44 and 46. Figure 5 shows the schematic circuit diagram of Radiola 44. Figure 6 is a schematic circuit diagram of the socket power unit in Radiola 46, the receiver being the same as Radiola 44.

(a) Three Radiotrons UY-224, one Radiotron UX-245 and one Radiotron UX-280 are used. Two Radiotrons UY-224 are tuned R.F. amplifiers and one Radiotron UY-224 is the power detector. The Radiotron UX-245 is the power amplifier and the UX-280 is the full wave rectifier for converting the A.C. to D.C. for use as plate and grid supply to all other Radiotrons, and field supply to a dynamic reproducer unit.

(b) The circuit consists of two tuned radio frequency stages, a power detector and a power amplifier. The detector has sufficient output to drive the power amplifier without an intermediate audio stage.

(c) By using a high inductance antenna loading coil, variations in antenna constants have little effect on the tuning of the circuits. This eliminates the necessity for a coupling tube or different antenna length connections. In addition this circuit resonates in the broadcast band at about 700 K.C. The purpose of having such a characteristic is to bring up the sensitivity at the low frequency end of the band and thus give the receiver equal sensitivity at all wavelengths.

(d) A Local-Distant Switch is provided which disconnects the antenna at the local position and connects a condenser in its place from the antenna end of the loading coil to ground. The use of this switch gives the best possible operation from both local and distant stations.

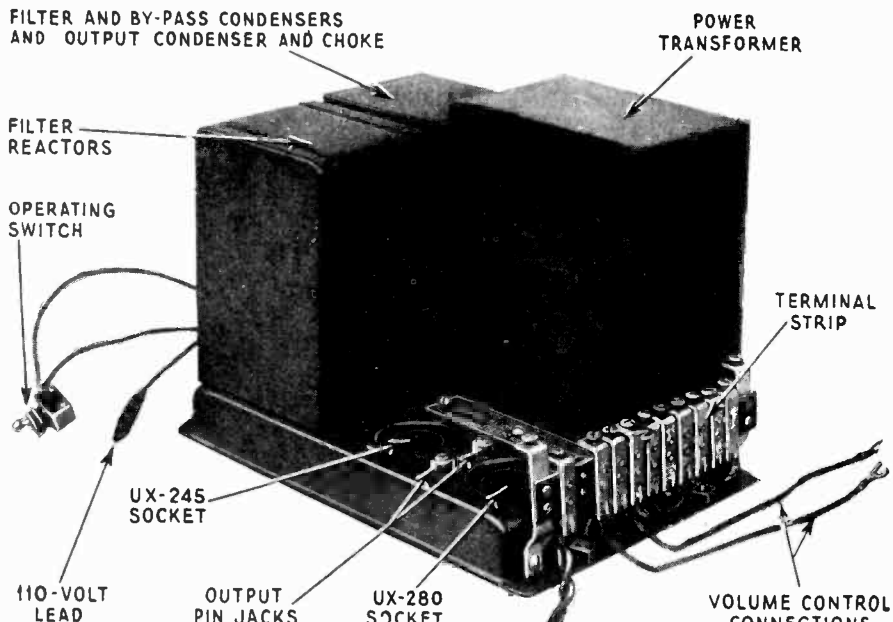


Figure 3—Top view of Radiola 44 socket power unit

(e) The use of screen grid tubes together with proper shielding eliminates the necessity of neutralizing, or other methods of stabilizing.

(f) A high voltage type detector gives improved quality and sufficient output to directly drive the power amplifier. No audio transformer is used in Radiola 44 and 46. The detector is coupled to the power amplifier by means of impedance coupling which eliminates any distortion that might occur if a transformer were used.

(g) The volume control varies the voltage on the screen grid of the two R.F. amplifiers. This provides a smooth means of controlling volume without distortion and gives a positive cut-off even on loud local stations.

Figure 5 shows the sequence of the Radiotrons. The first and second tuned radio frequency stages and the tuned detector, using Radiotrons UY-224, are in the receiver assembly. The power amplifier UX-245 and the full wave rectifier UX-280 are in the Socket Power Unit.

THEORY OF OPERATION OF A. C. SCREEN GRID RADIOTRON

Since the A.C. screen grid Radiotron UY-224 is a new type of tube a brief discussion of the theory on which it and the surrounding circuits operate will give the service man an understanding of the principles involved in the design of Radios 44 and 46.

Radiotron UY-224 has five elements compared with the usual three in battery, or amplifier tubes, and four in the UY-227 indirectly heated cathode type. These elements are namely: a heater, a cathode—both similar with that used in Radiotron UY-227—a plate, a control grid and a screen grid placed on both the inside and outside of the plate. Figure 4 shows the internal construction of Radiotron UY-224.

The outstanding features of the screen grid tube are as follows:

(a) The screen grid effectively shields the control grid from undesirable feed-back effects caused by plate voltage variations through inter-element capacity.

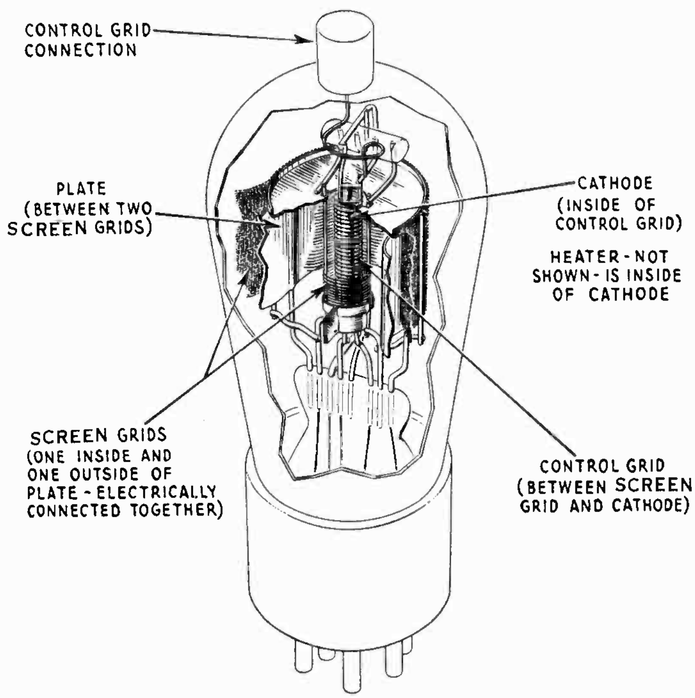


Figure 4—Internal construction of Radiotron UY-224

(b) Placing the control grid close to the cathode and relatively far from the plate increases the amplification constant of the tube enormously which, together with the insertion of the screen grid, increases the A.C. plate resistance. The plate resistance is so high that it is difficult to design an output circuit to obtain full advantage of the amplification of the tube. However, while actual amplification is less than the amplification constant of the tube it is much greater than that obtained with other types of tubes. An example of this amplification in practice is presented in Radiola 44 which with two R.F. stages, has a sensitivity approximately the same as receivers using other tubes in four R.F. stages. This high plate resistance and high impedance output circuit also causes the grid circuits to have considerably less R.F. resistance which, together with decreased coupling between the primary and secondary of the R.F. transformer, gives the receiver good selectivity.

The advantages of high plate resistance are obtained in this tube without sacrificing the additional advantages of high mutual conductance. The positive potential impressed on the screen grid accelerates the flow of plate current and since it is much closer to the cathode than is the plate, it produces a greater acceleration than does the higher voltage impressed upon the plate. The mechanical construction of the screen grid does not permit it to collect many of the electrons composing the plate current, hence, practically the entire plate current passes on through the screen grid to the plate.

(c) The positive potential on the screen grid in relation to the cathode is necessary. Variations of this voltage affect the mutual conductance of the tube in accordance with the above explanation, hence, affords an excellent means of controlling the volume without introducing distortion. The variation in screen grid voltage in the Radiola 44 and 46 is from zero volts at minimum volume to 70 volts positive at maximum volume.

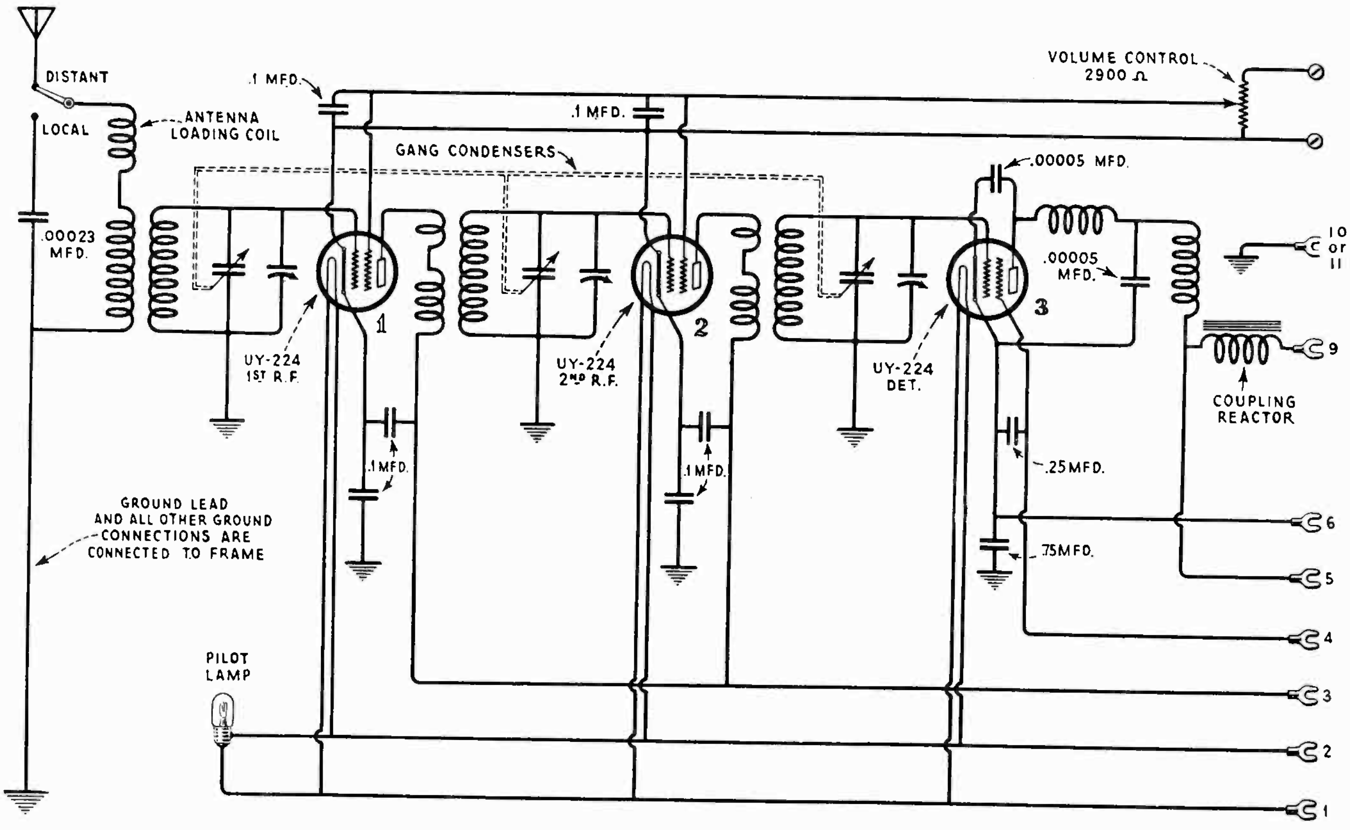


Figure 5—Schematic circuit diagram of

The advantage of the effect noted in (a) is that, provided all external circuits are shielded, there is no feed-back or regeneration, which might cause oscillation in any of the circuits. This eliminates the need for neutralizing condensers, grid resistors and other methods of preventing oscillation in the R.F. circuits. As most of these methods reduce the efficiency of the circuits, their absence means a distinct gain in the performance of the receiver.

PART I—INSTALLATION

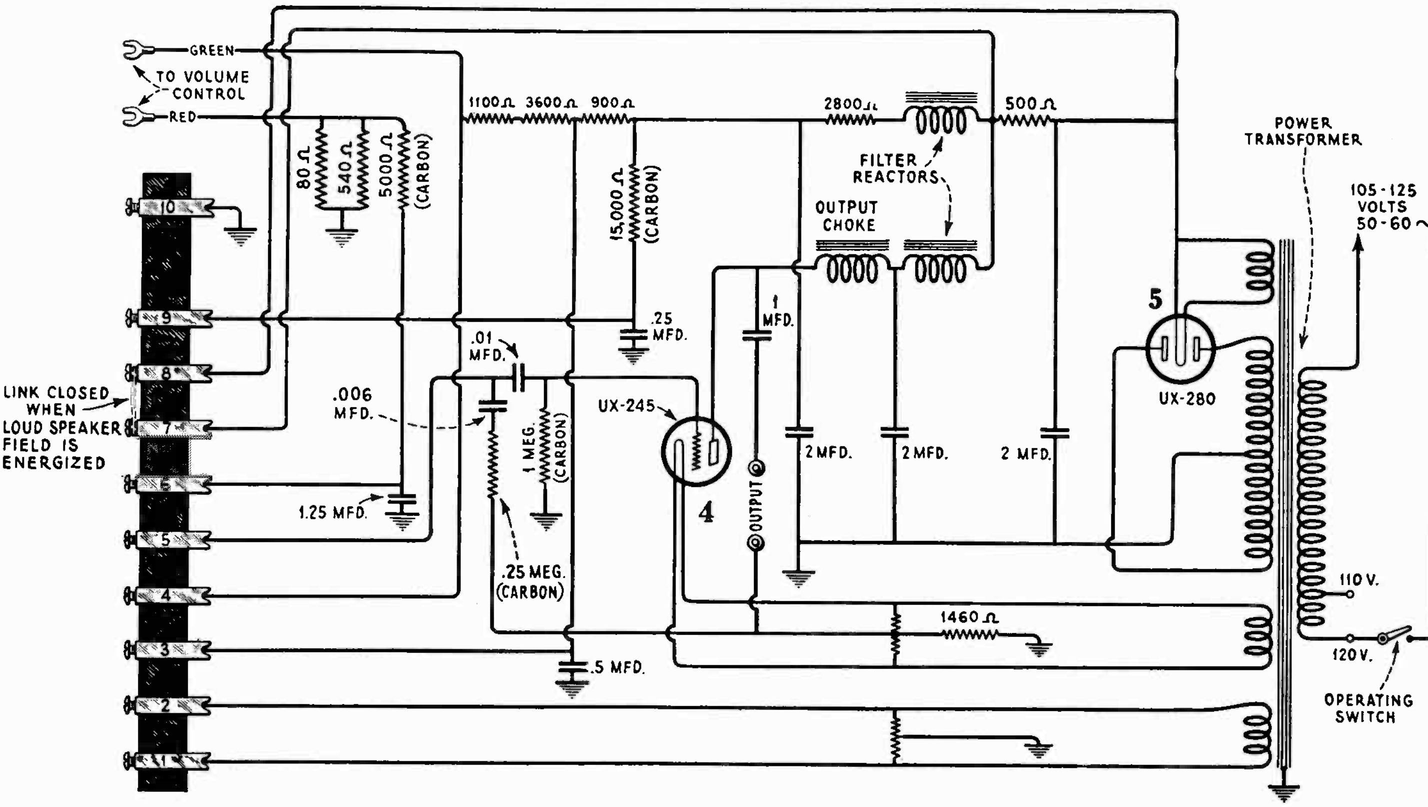
[1] ANTENNA

RCA Radiolas 44 and 46 are somewhat more critical to specific antenna requirements than the usual radio receiver. The antenna installation should therefore be erected with care and kept within specific requirements set for this receiver. The requirements of such an antenna are as follows:

The antenna should be at least 30 feet and not greater than 60 feet long, the best results being obtained with one of approximately 50 feet in length, measured from far end to the ground connection.

A shorter antenna than that suggested will result in possible oscillation at the shorter wavelengths and low sensitivity at the higher wavelengths.

A long antenna will result in low sensitivity in the middle of the scale and if sufficiently long, at the higher wavelengths. Also the long antenna may cause a secondary modulation effect on strong local stations. However should a long antenna be already in use it may be adapted to Radiolas 44 and 46 by inserting a small condenser in series with it and thereby reducing the effective capacity to the receiver. This condenser should be from .00025 mfd. to .0005 mfd. in capacity, the larger condenser being suitable for antennas of 100 feet in length and the small condenser for antennas of greater length. In locations where the pick-up of a



Radiola 44 receiver and socket power unit

short antenna is not sufficiently great, a long antenna and series condenser will probably give the desired results.

The antenna 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 may 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 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 come in contact with any part of the building. Bring the lead-in wire through a porcelain tube insulator to the inside of the house for connection to the receiver. The antenna should not cross either over or under electric light, traction or power lines, 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 Underwriter's Code.

[2] 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 30 to 60 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.

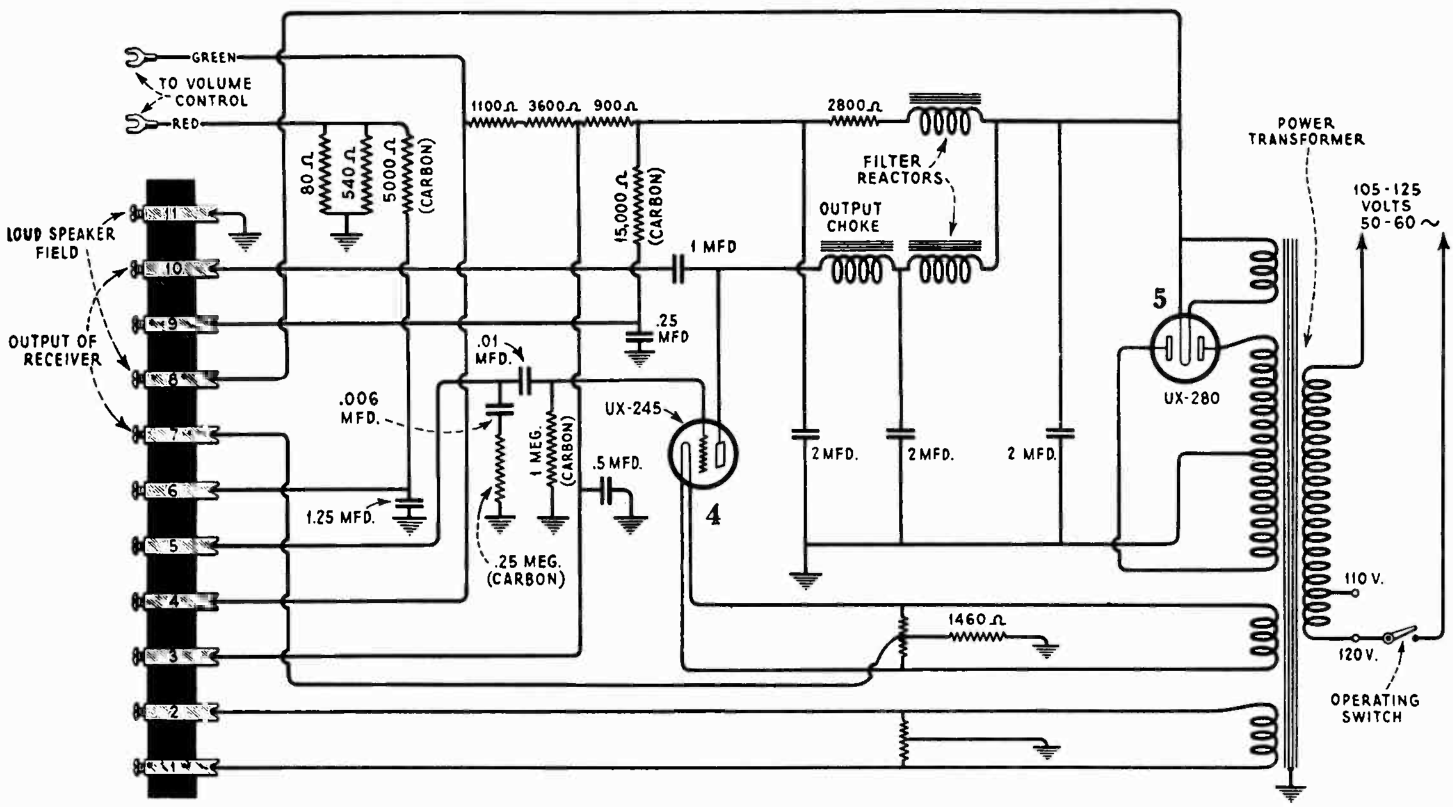


Figure 6—Schematic circuit diagram of Radiola 46 socket power unit

[3] GROUND

A good ground is quite as important as the antenna. Lack of a ground connection will reduce the sensitivity at the low frequencies. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

[4] SPECIAL ANTENNA INSTALLATIONS FOR NOISY LOCATIONS

In line with other receivers, when Radiola 44 or 46 is installed in some city locations, such as apartment houses, hotels and office buildings, it is possible that the level of noise compared with the signal strength of the desired station may be such that the station cannot be received without an objectionable noise background. This noise may be defined as inductive interference from electrical devices such as elevator motors, generators, violet ray machines, professional equipment etc. It may have no apparent radio frequency peak, or it may have a broad peak.

A simple method that will usually increase the ratio of signal to noise and thereby obtain satisfactory reception is as follows:

Erect as long and high an antenna as possible, and then couple it to the antenna lead of the receiver through a small coupling condenser. This condenser with a 200-foot antenna should be about .0003 mfd. and smaller with larger antennas. The effect of the long antenna is to increase the pick-up to a point where it will be proportionately higher than the noise level. The series condenser then reduces the effective antenna capacity and limits the input energy to the receiver. It does not however change the noise to signal ratio and generally a setting of the volume control that will give room volume, will not be sufficiently advanced to give a noise background. If the foregoing suggestion does not remedy the trouble the problem may be analyzed as follows:

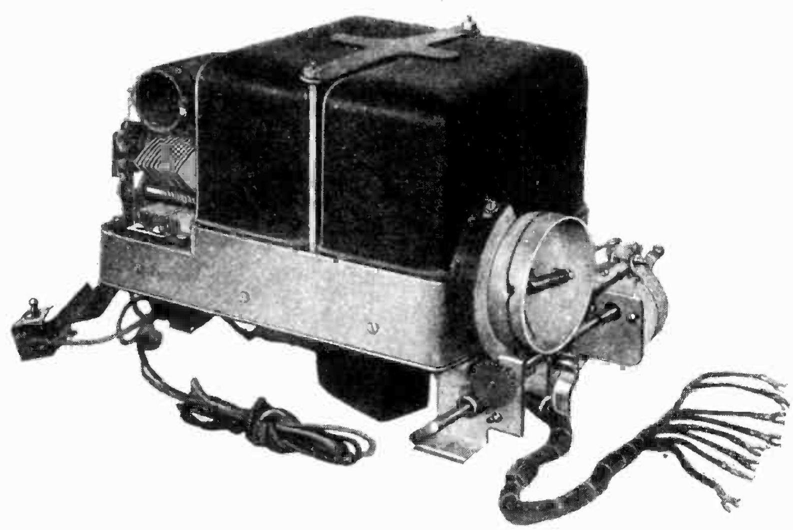


Figure 7—Top view of receiver assembly with shields in place

The effect of the noise may be divided into the following three general classes:

(a) Where the noise level is zero with no antenna or ground, but is equally great on either an indoor or outdoor antenna.

(b) Where the noise is equally great with the antenna and ground either connected or disconnected.

(c) Where the noise level is greater when the outside antenna is connected than when an inside antenna is used; the inside antenna, however, not giving sufficient pick-up for satisfactory reception.

In (a) where the noise level is zero with no antenna or ground connected, but equally great with either an indoor or outdoor antenna, it is at once apparent that the interference is not being brought into the receiver over the power supply lines. It has been found in such cases that an antenna five feet long inside the room picked up as much noise as when an entire outside antenna lead-in were used. This indicates that the noise is within the building and, in the case of the outside antenna, is being picked up on that portion of the lead-in that enters and goes through the building. In such cases the receiver should be located close to the point where the outside lead-in enters the building. If this is impractical the Radiola can be placed in any location and a copper braid placed over the inside portion of the lead-in wire. This braid is not grounded. If the noise level is still appreciable a good receiver ground with a short lead must be obtained. A long lead is not desirable, as it may pick up noise.

In (b) the noise is picked up with no antenna or ground connected to the receiver. This indicates the noise is entering the receiver through the power lines. In this case filters must be placed in the power supply at the source of the noise or at the receiver, depending on conditions. If the trouble is cleared up in this manner when the antenna and ground are disconnected, but again appears with the use of the antenna system, the remedies suggested in (a) must also be applied.

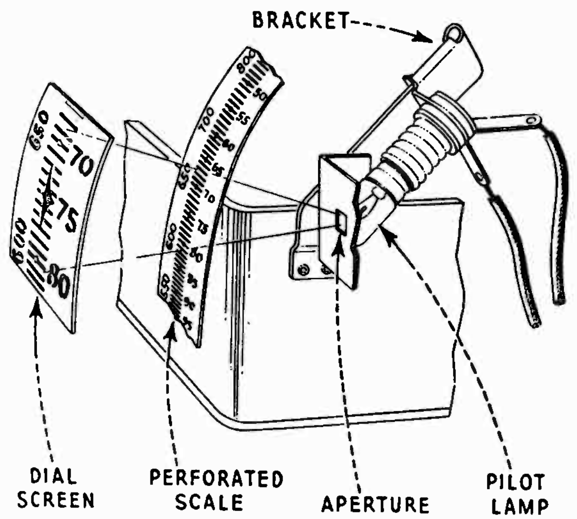


Figure 8—Tuning scale and pilot lamp assembly

In (c) the noise is greater when the outside antenna is connected than when an inside antenna is used. The use of the inside antenna, however, does not give sufficient pick-up for satisfactory reception. In this case the pick-up is probably occurring on the lead-in wire between the Radiola and the antenna. Copper braid should be placed over the entire lead-in from the receiver to the flat portion of the antenna. Also changing the direction of the antenna should be tried and the lead-in connected from the end of the antenna that gives the best results. The copper braid should not be grounded. The conditions existing in any locality must be analyzed and placed in its correct category. A little patience and experimenting will usually result in a satisfactory installation.

[5] RADIOTRONS

The correct location of the tubes is plainly indicated in Figures 15 and 16. Remove the two copper shields by releasing their clamp and place the three UY-224 Radiotrons in the sockets of the receiver assembly. Replace the shields and tighten clamp sufficiently to make good contact between the shield and the main casting. Figure 7 shows the shields in their correct position in the receiver assembly. Care should be taken not to place the Radiotron UX-245 in the UX-280 socket as filament damage will result when the current is turned "On."

Interchanging the three Radiotrons, UY-224, may have considerable effect on the sensitivity of the receiver. It is therefore recommended, when installing the Radiola, that these Radiotrons be interchanged until a combination is found that will give best results.

If, when adjusting the station selector and volume control, no stations are heard examine the Radiotrons. Possibly a Radiotron has been damaged in transit. Interchanging with others of the same type known to be in good condition will isolate the damaged one.

[6] ADJUSTMENT FOR LOW LINE VOLTAGES

A lead is provided on the side of the S.P.U. for use when Radiolas 44 and 46 are connected to lines, the voltage of which never exceeds 115 volts. A good plan is to allow the lead to remain as connected in manufacture unless unsatisfactory operation is experienced. Should adjustment be necessary, however, proceed as follows:

(a) Open the top of Radiola 44 or the rear panel of Radiola 46.

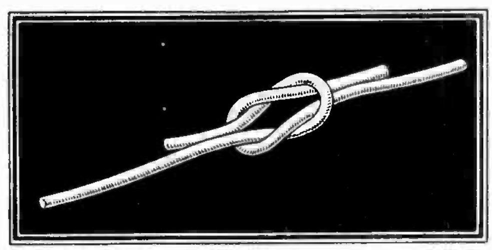


Figure 9—Square knot used in repairing drive cord

(b) Connected to the operating switch will be found two soldered connections, one of which has a transformer lead (black with red tracer) connected to the switch. Unsolder this connection and tape up the lead so that it will not ground or short to other parts.

(c) A black and red lead will be found taped up and not used. Untape this lead and clean the end for soldering.

(d) Solder this lead just untaped to the switch connection from which the black with red tracer lead has been removed.

In the case of Radiola 46 the leads are not soldered directly on the switch but to two taped connections instead.

The 110-volt tap of the transformer is now properly connected and the Radiola may be used on 105-115 volt lines with maximum efficiency. Figures 20 and 21 illustrate the changes to be made.

[7] JERKY ACTION OF STATION SELECTOR

Should operation of the station selector be stiff or jerky a little oil dropped on each condenser bearing will effectively remedy this condition. When experiencing this trouble it is also well to check the cable tension spring to make sure that suitable tension is being applied to the condenser drive cable.

[8] USE OF LOCAL-DISTANT SWITCH

A switch is provided on Radiolas 44 and 46 termed the Local-Distant Switch. This switch at the local position disconnects the antenna and connects a .00023 mfd. condenser across the antenna point of connection to ground. The purpose of this switch is to prevent the strong carrier of a local station from overloading the tubes, thereby causing distortion. Also under certain conditions a very powerful local station may impose its modulation frequency upon the carrier wave of a station to which the receiver is tuned. Both of these conditions happen only when the switch is improperly operated. Keep the switch as a general rule at the local position, unless sufficient pick-up is not obtained to receive the desired signal, when the switch may be thrown to the distant position.

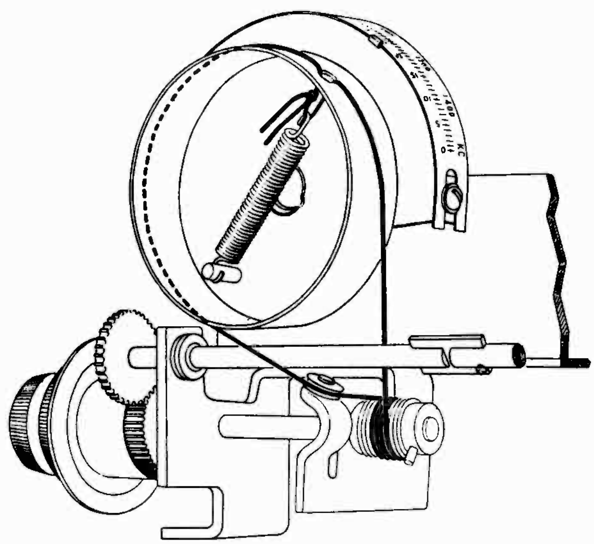


Figure 10—Drive cord arrangement

[9] INSTALLATION OF PILOT LAMP

A projection type of dial lighted by a small concentrated filament lamp is used in Radiolas 44 and 46. The lamp is mounted so that its rays pass through the pierced scale of the dial and then project the scale divisions on an amber window on the front of the cabinet. It is therefore important to mount the lamp so that its rays will pass through the correct openings to fully illuminate the scale readings on the window. Figure 8 shows the general arrangement of the pilot lamp and dial.

To install the pilot lamp proceed as follows:

Turn the station selector counter-clockwise to its extreme position so that the pilot lamp mounting will be accessible. Open the lid of Radiola 44 or remove rear panel of Radiola 46 and remove the socket clamp from its bracket and screw the lamp firmly into the socket. Replace the socket clamp on its bracket.

Now turn the power "On" at the operating switch. With the station selector in the extreme counter clockwise position adjust the socket clamp on its bracket until the zero mark on the scale projected on the dial screen is about ¼ inch below the index pointer.

To replace a bulb pull the socket back from its position and remove the old bulb. Place the new one in the socket and screw in tightly. The socket is then pushed down until the front window is properly illuminated. There may be a slight variation in the centering of the filaments of various lamps which might tend to throw the light too much to one side of the window. If this happens pull the socket out and bend the metal arm that holds the socket to one side until the rays of the lamp properly illuminate the scale window. Now tune in a station, the dial setting of which is known. If the dial setting for the station tuned in is different from that formerly obtained pull the lamp back or push it forward until the dial reads the same as that previously obtained for that station. Also in some cases it may be necessary to remove a little solder from the base of the bulb with a file or knife.

[10] SHIELDS

Two large shields are used to cover the second R.F. and detector stages. Also two tube shields are placed around the first and second R.F. tubes. The two tube shields fit snugly in place into the base casting. The two large shields over the second R.F. and detector stages have clamps on each side that make contact with the rotor shaft of the gang condenser. Also an external clamp is provided to hold the shields in place.

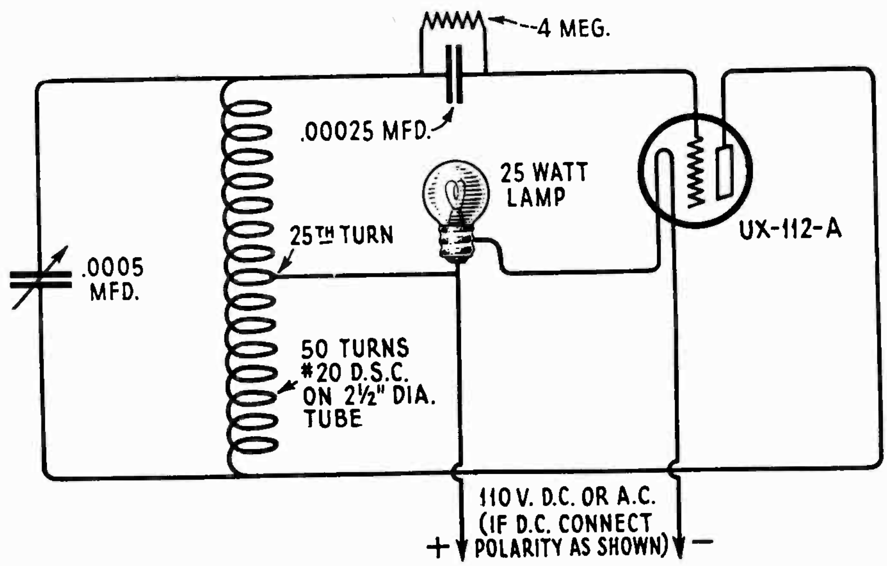


Figure 11—Schematic circuit diagram of modulated oscillator

The proper placing of the shields is very important, because unless the circuits are shielded as intended oscillation will occur. Therefore, whenever replacing tubes, or whenever the shields are removed for any reason, see that they are properly returned to their normal position.

[11] CONNECTIONS FOR SUPPLYING FIELD CURRENT TO EXTERNAL DYNAMIC LOUD SPEAKERS—RADIOLA 44 ONLY

Provision is made in Radiola 44 for supplying the field current to a dynamic loudspeaker the field of which has a rating of 300 volts, 40 milliamperes. In order to make such a connection to the receiver proceed as follows:

(a) Lift lid of cabinet and remove the cover of the S.P.U. terminal strip.

(b) Close the link between terminals 7 and 8, counting from the terminal nearest the front of the Radiola.

(c) Connect the loudspeaker field leads to terminals 7 or 8 (connected by link) and terminal No. 10. Be careful not to disturb the connection already connected to terminal No. 10.

The field is now properly connected and the terminal strip cover should be replaced and the lid closed. The output of the receiver is connected in the usual way to the loudspeaker by connecting the loudspeaker input leads to the output pin jacks on the S.P.U. of Radiola 44.

PART II—SERVICE DATA

[1] ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna, or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By throwing the "local-distant" switch to the "local" position and noting whether the noise decreases or not, the service man can determine whether the cause of the noise is within or external to the receiver and plan his work accordingly.

[2] RADIOTRON SOCKETS AND PRONGS

The sockets used in Radiolas 44 and 46 are three single UY sockets in the receiver assembly and a two-gang UX socket used in the S.P.U. A socket contact may not be in its correct

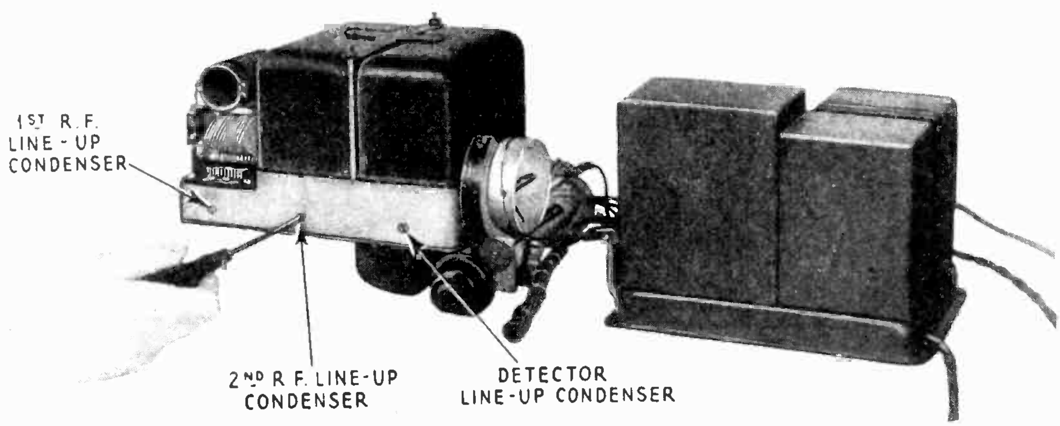


Figure 12—Method of adjusting the line-up condensers

position and the forced insertion of a tube will bend or break it. If care is exercised and the Radiotron inserted gently, little trouble will be experienced with socket contacts. A bent one will be noticed on inspection and may be corrected by inserting a narrow instrument in the socket hole and pushing the contact into its correct position. A badly bent or broken socket contact must be replaced either individually or by replacing the socket.

In addition to the tube contacts there are provided small spring clips that connect to the control grid connection at the top of the Radiotrons UY-224. These must fit snugly and make good connection. Whenever a tube is replaced care should be taken to make sure that the spring clip is replaced on the tube and that it makes a good clean tight connection.

Dirty Radiotron prongs or contacts may cause noisy or intermittent operation in the receiver. It is therefore advisable to periodically clean them with fine sandpaper to insure good contact. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs carefully to make certain that all particles of sand are removed.

If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

[3] IMPROPERLY OPERATING VOLUME CONTROL

The volume control in Radiolas 44 and 46 is operated through a gear arrangement, half of which is the control knob. The shaft is broken with an insulating strip as the rotating arm is not at ground potential.

Should the volume control slip and not follow the control knob first make sure the knob is tight against the cabinet and the station selector knob tight against the volume control knob. Then examine the insulating strip and make sure it is still in its correct position.

Noise or grating noises occurring when the volume control is adjusted can generally be remedied by turning the control knob to each extreme position several times. If this does not clear up the trouble a little alcohol applied with a smoking pipe cleaner to the resistance strip will dissolve any dirt or rosin.

Excessive pressure applied after the control has been moved to the stop position may bend the moving arm and subsequent use may wear and cut the wire. Users should therefore be cautioned not to try to turn the knob beyond the stops at each extreme.

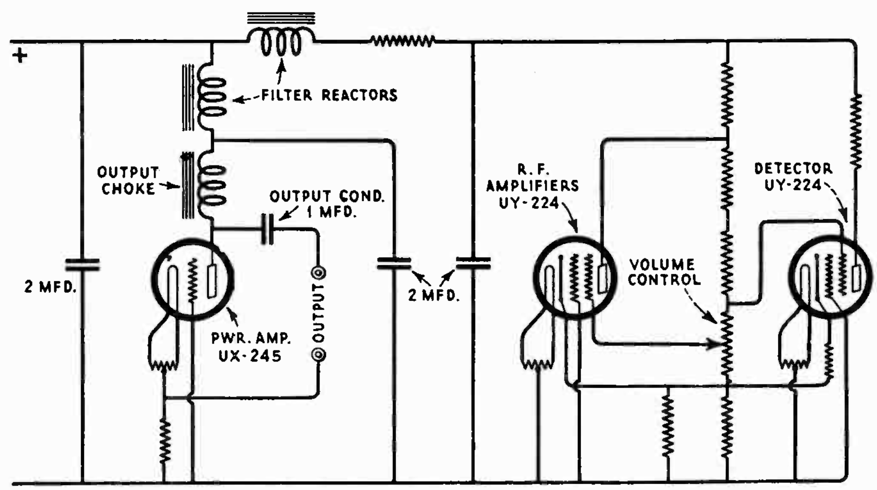


Figure 13—Abridged schematic circuit diagram of voltage supply system

[4] BROKEN CONDENSER DRIVE CORD

The main tuning condensers are controlled by the station selector knob, the motion of which is transmitted by means of a rugged fish line to the drum on the end of the tuning condensers. Should this cord become broken, and a new one not be available, a temporary repair may be made by tying the two ends together by means of a square knot (see Figure 9), and then replacing the cord in its correct position as shown in Figure 10. The shortening caused by the knot can be compensated for by untying the knot at the tension spring end and using a part of the spare length. The tying of the knot at the ends of the cord should be the last operation, because the correct amount of tension can then be obtained at the tension spring. Figure 10 shows the arrangement of the drive cord over the drums. This should be followed when replacing the cord.

[5] ADJUSTING LINE-UP CONDENSERS

Three small adjustable condensers are provided on the receiver assembly for lining up the three tuning circuits. These condensers are in parallel to the main tuning condensers and compensate for small variations in the tuning circuits—which are made noticeable by the receiver becoming insensitive. The following procedure may be used to readjust them.

(a) Remove the receiver assembly and S.P.U. from the cabinet as described in Part IV, Sections 1 and 2 and place the units in operating condition.

(b) Procure a modulated oscillator that will give a signal at 1500 K.C. and 600 K.C. or, if such an oscillator is not available, tune to a broadcast signal. The circuit diagram and electrical constants of a suitable oscillator are shown in Figure 11. The General Radio Test Oscillator Type 360 is suitable for this purpose. If the oscillator is available, place it in operation at 1500 K.C. or tune in a signal of approximately this frequency.

(c) After tuning in the signal adjust the volume control so the signal is of moderate strength.

(d) Place Local-Distant Switch at "local" position and adjust the three condensers successively from the detector stage to the antenna stage (See Figure 12), for the position of the loudest signal. This may be done with any type of screwdriver, as the adjusting screws are at ground potential.

(e) After adjusting at 1500 K.C. the various adjustments should be checked at 600 K.C. Should an increase (turning condenser to the right) or a decrease of capacity be necessary at 600 K.C. leave the line-up condensers in the position previously found at 1500 K.C. The adjustment required should then be made by removing the second R.F. and detector stage shields, and bending the end plates of the tuning condensers. Bending the end plate toward the adjacent plate increases the capacity of the condenser and bending it in the opposite direction decreases its capacity.

(f) After lining up at 600 K.C. by bending the condenser plates a re-check should be made at 1500 K.C. Any re-adjustments found necessary should be made. The use of a 1500 K.C. signal is very important because if the adjustment is made at a lower frequency the amount of capacity used at the line-up condensers may be such that the receiver will not tune as high as 1500 K.C.

The two chassis units should now be returned to the cabinet in the reverse manner of that used to remove them.

[6] EXCESSIVE HUM

Should excessive hum develop during operation it may be caused by one of the following conditions:

(a) External pick up. Throw switch to local position and see if hum disappears.

(b) A.C. input plug reversed. Try reversing its position.

(c) Open center tapped resistance unit in S.P.U.

(d) Shorted by-pass and filter condensers. This will generally be accompanied by inoperation in addition to hum.

(e) Low emission Radiotron UX-280.

(f) Defective dynamic speaker, if used.

(g) Open resistance unit. This will generally be accompanied by inoperation.

(h) By-pass condenser improperly connected. If the .25 mfd. and .75 mfd. tapped connections of the receiver 1 mfd. by-pass condenser are reversed a loud hum may be present. Connect correctly.

(i) Loudspeaker hum. Hum may also be caused by the loudspeaker cone being out of center. Check on this condition by releasing the center screw so that the cone can find its own center, and then tighten the center screw.

(j) Hum present only when a loud signal is tuned in. Should a hum be obtained when a loud signal is being received from a nearby carrier it may be due to the generator hum of the station being impressed on the carrier wave of the station. Due to the excellent low frequency response in Radiolas 44 and 46 the hum may be objectionable. In other cases the hum may be present in the receiver. In such cases connecting a 1 mfd. condenser from S.P.U. terminal No. 3 to ground will remedy this condition.

(k) 25-cycle flutter and hum. In some 25-cycle locations, a flutter or hum may be experienced. This may be cured by connecting a 2 mfd. condenser from terminal No. 8 to ground and a 1 mfd. condenser from terminal No. 3 to ground. The RCA Service Division is prepared to furnish a unit containing these capacitors, having three 12-inch leads for making suitable connections. This is known as RCA Part No. 6082.

[7] ACOUSTIC HOWL

Acoustic howl is caused by the sound waves generated by the loudspeaker vibrating the elements in the Radiotrons. This vibration is amplified electrically and reproduced in the reproducer unit. Conditions being favorable the howl may increase in intensity and drown out the broadcast signal.

In Radiola 44 this can be remedied by changing the position of the loudspeaker or its relative angle in relation to the receiver. Also interchanging the Radiotrons in the receiver assembly will help.

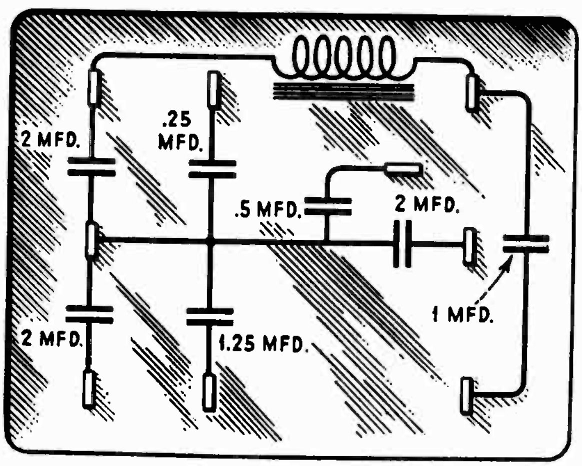


Figure 14—Internal connections of the condenser bank

[8] LOW VOLUME

Low volume may be caused by any of the following conditions:

(a) Defective Radiotrons. Check and make any replacement necessary.

(b) Poor antenna system. Install antenna as suggested in Part I, Section 1.

(c) Defective receiver assembly. Check by means of continuity test and make any replacement necessary. Also check adjustments of line-up condensers as described in Part II, Section 5.

(d) Defective S.P.U. Check by means of Continuity Test, Part III, Section 4, and make any repairs necessary.

(e) Defective loudspeaker. Check the loudspeaker by substituting one known to be in good condition.

(f) Incorrect number of turns in twisted portion of leads under shield to local-**distant** switch. The loading coil and condenser leads (green and black) should make **two** complete turns inside of the shield with the antenna lead making one turn.

[9] DISTORTED OR NOISY REPRODUCTION

Poor quality or noisy reproduction may be caused by:

(a) Defective Radiotrons. Though the Radiola may be in operating condition a defective Radiotron in any stage will cause distortion. Excessive noise may be due to a defective Radiotron UX-245 or UX-280.

(b) Defective coupling choke, output choke, output condenser, coupling condenser, UX-245 grid resistor or the resistor and condenser used to tune the coupling choke. These parts are all associated with the output tube and a defect in any of them will cause distortion.

(c) Receiver Oscillation. Signals received while the receiver is oscillating will be distorted. Reduce the volume control or apply the remedies suggested in Part II, Section 11.

(d) Defective loudspeaker. Make the necessary repairs.

(e) Defective S.P.U. Check by means of continuity test as described in Part III—Section 4.

[10] AUDIO HOWL

Audio howl may be caused by any of the following conditions:

(a) Receiver oscillation. Check as described in Part II, Section 11.

(b) Open by-pass condensers. An open in any of the by-pass condensers may cause howl.

(c) Vibrating elements in the receiver Radiotrons. A gradually developed howl may be due to the loudspeaker causing the receiver Radiotron elements to vibrate. Check as described in Part II, Section 7.

[11] UNCONTROLLED OSCILLATIONS

Should Radiola 44 or 46 oscillate throughout or in any part of the tuning range, it may be due to:

(a) Shields not properly in place or not making contact with the base because of dirt. The correct placing of the shields both around the tubes and over the entire stage is important to prevent oscillation. Remove all dirt with fine sandpaper.

(b) Shield over antenna lead to local distant switch not grounded or properly covering the leads.

(c) Defective R.F. filter in detector plate circuit. There are two filters, one of which is shunted by two condensers in the plate circuit of the detector. Should the filters become defective or the condensers open, oscillation will occur.

(d) Contact clips between shield and condenser shaft broken or not making good contact.

(e) Open by-pass condenser. Should any of the by-pass condensers in the receiver assembly be open, oscillation will occur.

(f) Defective Radiotron UY-224. A defective Radiotron UY-224 may cause oscillation and should be replaced by a Radiotron known to be in good operating condition.

(g) In some cases interchanging the three Radiotrons UY-224 will be necessary to stop oscillation at the maximum setting of the volume control.

[12] VOLTAGE SUPPLY SYSTEM

The voltage supply system used in Radiolas 44 and 46 is a combination parallel arrangement, with some circuits also using series resistors. Figure 13 is an abridged schematic circuit that illustrates the method employed to obtain the correct potentials.

PART III—ELECTRICAL TESTS

[1] TESTING FILTER CONDENSERS AND OUTPUT CONDENSER AND CHOKE

The filter condensers and output condenser and choke are all in one metal container. The internal wiring diagram is shown in Figure 14.

The choke can best be tested by clicking across the ends. The condensers are tested by charging them with approximately 200 volts D.C. and then noting their ability to hold the charge. After charging, short circuiting the condenser terminals with a screwdriver should produce a flash, the size of the flash depending on the capacity of the condenser and the voltage used for charging. A condenser that will not hold its charge, or a choke that clicks open is defective and requires replacement of the entire unit.

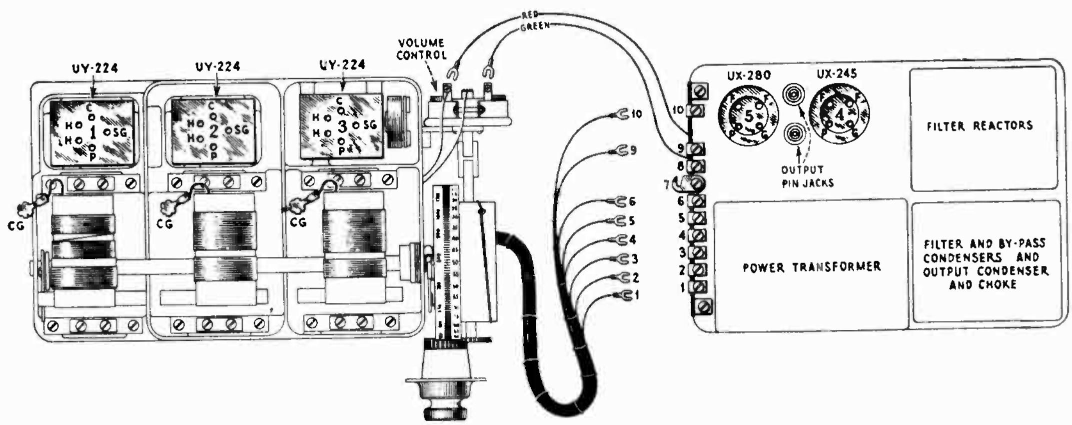


Figure 15—Layout showing location of the various Radiotron sockets, S.P.U. terminal numbers, and main parts of Radiola 44

[2] CHECKING RESISTANCE VALUES

The values of the various resistance units of Radiolas 44 and 46 are shown in the schematic diagram, Figures 5 and 6. 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.

For resistances of low value, 5000 ohms or less, use a voltmeter having a resistance not greater than 100 ohms per volt. For high values of resistance use a meter of 1000 ohms or more per volt. The Weston Meters, Type 301 or 280, each have a resistance of 62 ohms per volt and are satisfactory for the low values. Use sufficient battery to give a good deflection on the meter, for example, a 45-volt "B" battery for a 0-50 volt meter. Take two readings, one of the battery alone, and one of the battery with the unknown resistance in series. Then apply the following formula.

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

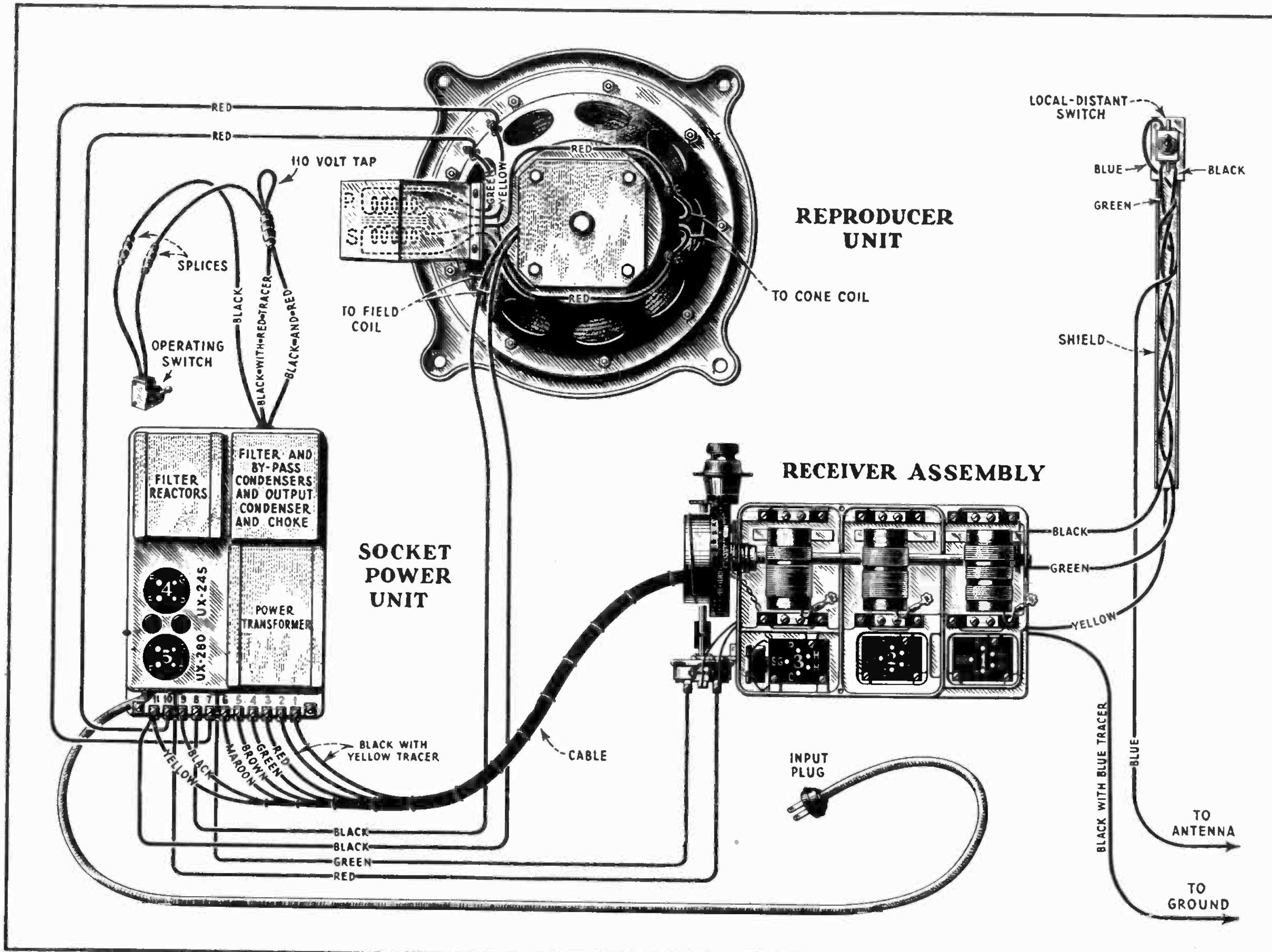


Figure 16—Radiola 46 Radiotron sockets, socket power unit terminals and main assemblies

[3] VOLTAGE READINGS

The following readings are taken with a Weston Model 537, Type 2, or other test set giving similar readings. These voltages are not exactly correct, due to the oscillating condition of the circuits. However, they enable the service man to obtain an accurate check on the continuity of the circuits to the various sockets. The screen grid voltages are not readable, due to the reversal of the polarity at the contact points.

When making tests remove only the shield and control grid connection of the tube whose voltage is under measurement. Do not tie the control grid connection to the control grid cap of the tube in the test set. It is not practical to test the control grid voltage directly at the sockets.

SOCKET VOLTAGES—RADIOLAS 44 OR 46

Volume Control at Minimum

Socket No.	*Cathode to Heater Volts*	*Fil. to control grid Volts*	*Cathode or fil. to plate Volts*	*Plate Current Millamperes*	*Filament or Heater Volts*
1	2.1	—	190	0	2.35
2	2.1	—	185	0	2.35
3	18	—	120	3.0	2.35
4	—	6.0	225	29.0	2.35

Volume Control at Maximum

Socket No.	*Cathode to Heater Volts*	*Fil. to control grid Volts*	*Cathode or fil. to plate Volts*	*Plate Current Millamperes*	*Filament or Heater Volts*
1	2.1	—	165	3.5	2.35
2	2.1	—	165	3.0	2.35
3	16	—	115	2.0	2.35
4	—	6.0	225	29.0	2.35

TERMINAL STRIP VOLTAGES

Radiola 44

The following voltages taken at the S.P.U. terminal strip with the receiver operating and all tubes and shields in place are correct when the line voltage is within the limits for the transformer tap being used.

Terminals	*Volume Control at*		*Voltage Measured*
	Minimum	*Maximum*	
1 to 2	2.5 A.C.	2.5 A.C.	Heater voltage of Radiotrons UY-224
3 to • red V.C. lead	185 D.C.	170 D.C.	Plate voltage of Radiotrons Nos. 1 and 2
4 to 6	70 D.C.	60 D.C	Screen grid voltage of Radiotron No. 3
6 to 9	195 D.C.	180 D.C.	Plate voltage of Radiotron No. 3
6 to 10	5.0 D.C.	5 D.C.	Control grid voltage of Radiotron No. 3
8 to 10	330 D.C.*	330 D.C.*	Total D.C. output from rectifier
Red V.C. lead to 10	2.1 D.C.	2.1 D.C.	Control grid voltage of Radiotrons Nos. 1 and 2
Arm of V.C. to red V.C. lead	0	70 D.C.	Screen grid voltage of Radiotrons Nos. 1 and 2

* This voltage is 320 when link is closed and dynamic type loudspeaker is used.

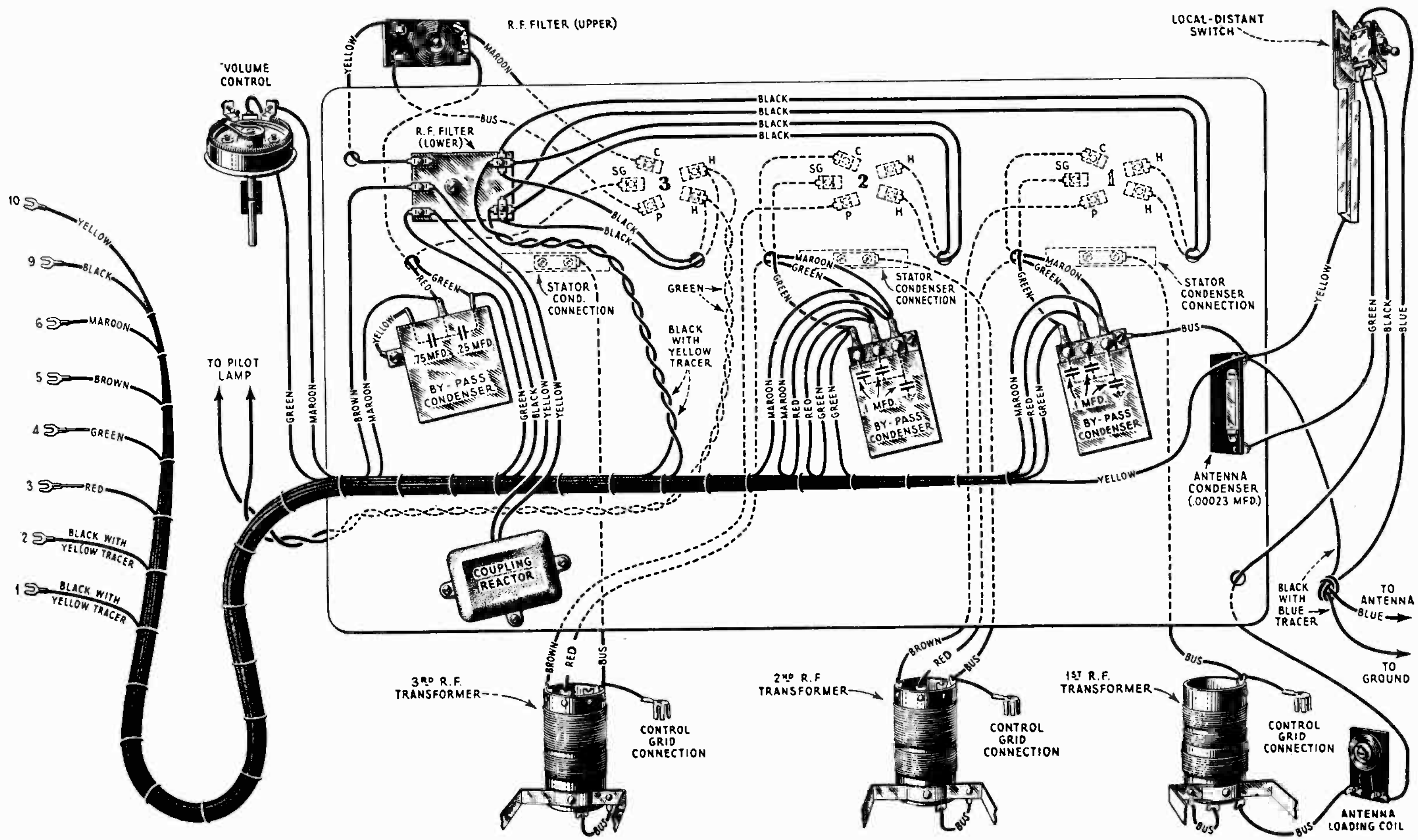


Figure 17—Wiring diagram of Radiola 44 receiver assembly

Terminals	Volume Control at		Voltage Measured
	Minimum	*Maximum*	
1 to 2	2.5 A.C.	2.5 A.C.	Heater voltage of Radiotrons UY-224
3 to red V.C. lead	185 D.C.	170 D.C.	Plate voltage of Radiotrons Nos. 1 and 2
4 to 6	70 D.C.	65 D.C.	Screen grid voltage of Radiotron No. 3
6 to 9	195 D.C.	180 D.C.	Plate voltage of Radiotron No. 3
6 to 11	5.0 D.C.	5 D.C.	Control grid voltage of Radiotron No. 3
8 to 11	320 D.C.	320 D.C.	Total D.C. output from rectifier
Red V.C. lead to 11	2.1 D.C.	2.1 D.C.	Control grid voltage of Radiotrons Nos. 1 and 2
Arm of V.C. to red V. C. lead	0	70 D.C.	Screen grid voltage of Radiotrons Nos. 1 and 2

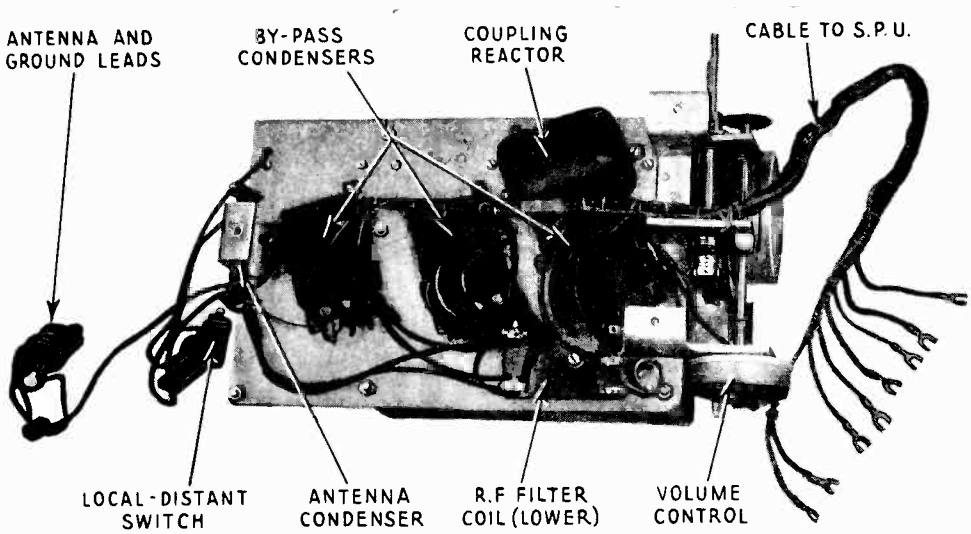


Figure 18—Sub-chassis view of receiver assembly

[4] RADIOLAS 44 AND 46 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly and socket power unit of Radiolas 44 and 46. Disconnect the antenna and ground leads; the cable connections at the terminal strip of the S.P.U.; the loudspeaker cord, and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series; or a voltmeter with sufficient battery to give a good deflection when connected across the battery terminals should be used in making these tests.

The resistance of the various circuits are also shown in the column "Correct Effect." Checking the resistance of the circuits adds an additional check on their correct functioning. This may be done by means of direct reading "Ohmmeter," a resistance bridge, the voltmeter ammeter method or the method suggested in Part III, Section 2.

The receiver and S.P.U. Radiotron sockets, numbers, lugs and terminals used in making these tests are shown in Figure 15 for Radiola 44 and Figure 16 for Radiola 46. The Radiola 44 S.P.U. wiring diagram is shown in Figure 20 and the receiver assembly wiring diagram in Figure 17. The Radiola 46 S.P.U. wiring diagram is shown in Figure 21 and the receiver assembly in Figure 19.

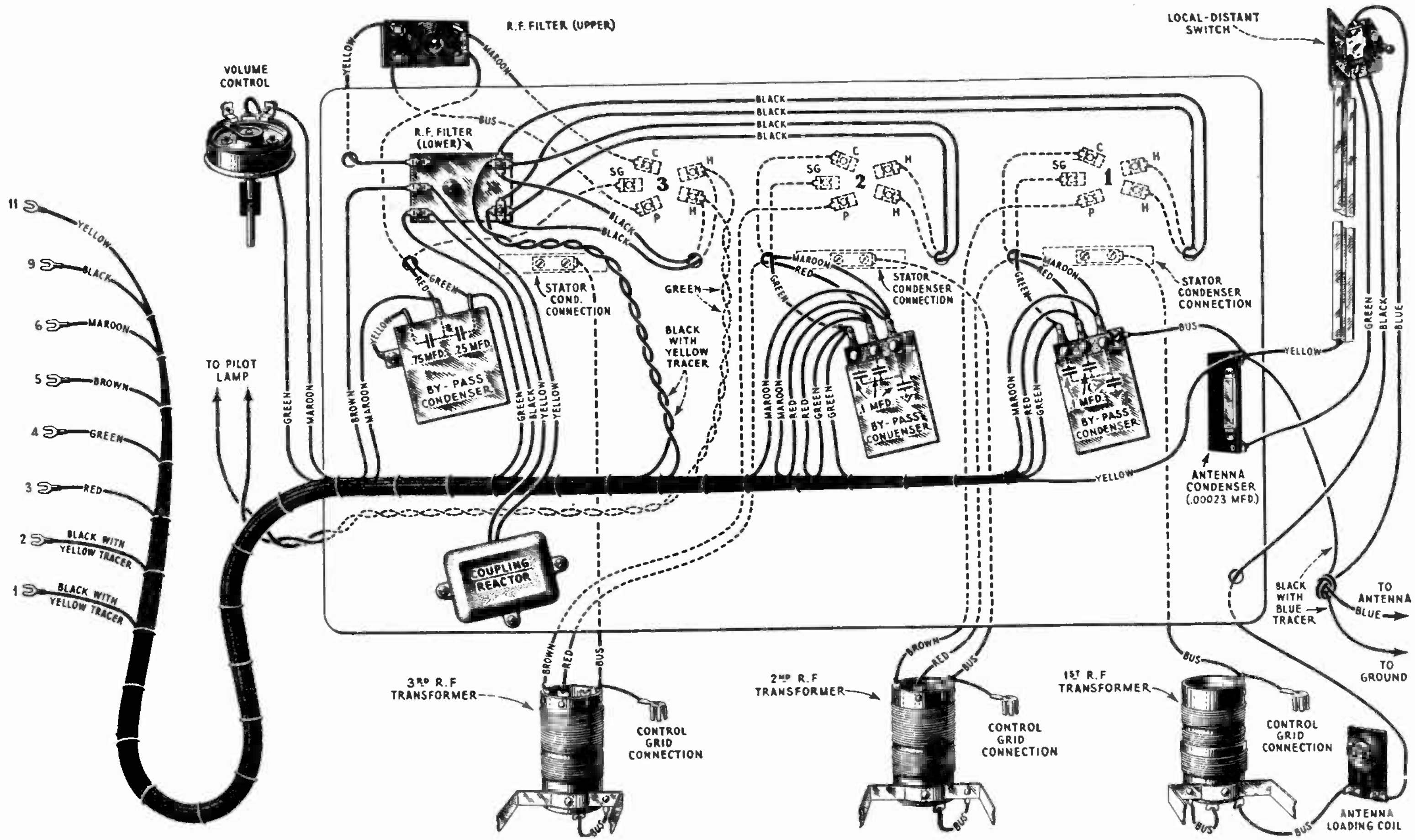


Figure 19—Radiola 46 receiver assembly wiring diagram

CONTINUITY TESTS
Radiola 44 or 46 Receiver Assemblies

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
Grid	CG1 to Gnd.	Closed (3 Ohms)	Open	Open secondary of 1st R.F. transformer
			Short	Shorted tuning or trimming condenser
	SG1 to Arm of Volume Control	Closed (Short)	Open	Open connection
	CG2 to Gnd.	Closed (3 Ohms)	Open	Open secondary of 2nd R.F. transformer
			Short	Shorted tuning or trimming condenser
	SG2 to Arm of Volume Control	Closed (Short)	Open	Open connection
	CG3 to Gnd.	Closed (3 Ohms)	Open	Open secondary of 3rd R.F. transformer
	SG3 to Lug No. 4	Closed (Short)	Open	Open connection
	Across Volume Control	Closed (2900 Ohms — V.C. at max. volume)	Open	Open volume control
			Short	Shorted 1 mfd. condenser
Plate	P1 to Lug No. 3	Closed (60 Ohms)	Open	Open primary of 1st R.F. transformer
	P2 to Lug No. 3	Closed (60 Ohms)	Open	Open primary of 2nd R.F. transformer
	P3 to Lug No. 5	Closed (400 Ohms)	Open	Open R.F. filter coils
			200	Both .00005 mfd. condensers shorted
	P3 to Lug No. 9	Closed (6000 Ohms)	Open	Open R.F. filter coils or coupling reactor
			5800	Both .00005 mfd. condensers shorted
Heater	*Unscrew Pilot Lamp*			
	One heater contact of sockets 1, 2 and 3 to Lugs 1 or 2	Closed (Short)	Open	Open connection
	Other heater contact of sockets 1, 2 or 3 to Lugs 1 or 2	Closed (Short)	Open	Open connection
Miscellaneous	Ant. to Gnd. (switch at "distant" position)	Closed (30 Ohms)	Open	Open antenna loading coil or primary of 1st R.F. transformer
	C1 to Gnd.	Open	Closed	Shorted .1 mfd. condenser
	C1 to P1	Open	Closed	Shorted .1 mfd. condenser
	C2 to Gnd.	Open	Closed	Shorted .1 mfd. condenser
	C2 to P2	Open	Closed	Shorted .1 mfd. condenser
	C3 to Gnd.	Open	Closed	Shorted .75 mfd. condenser
	C3 to SG3	Open	Closed	Shorted .25 mfd. condenser
	C3 to P3	Open	Closed	Either .00005 mfd. condenser in R. F. filter shorted
	C3 to Lug No. 6	Closed (Short)	Open	Open connection

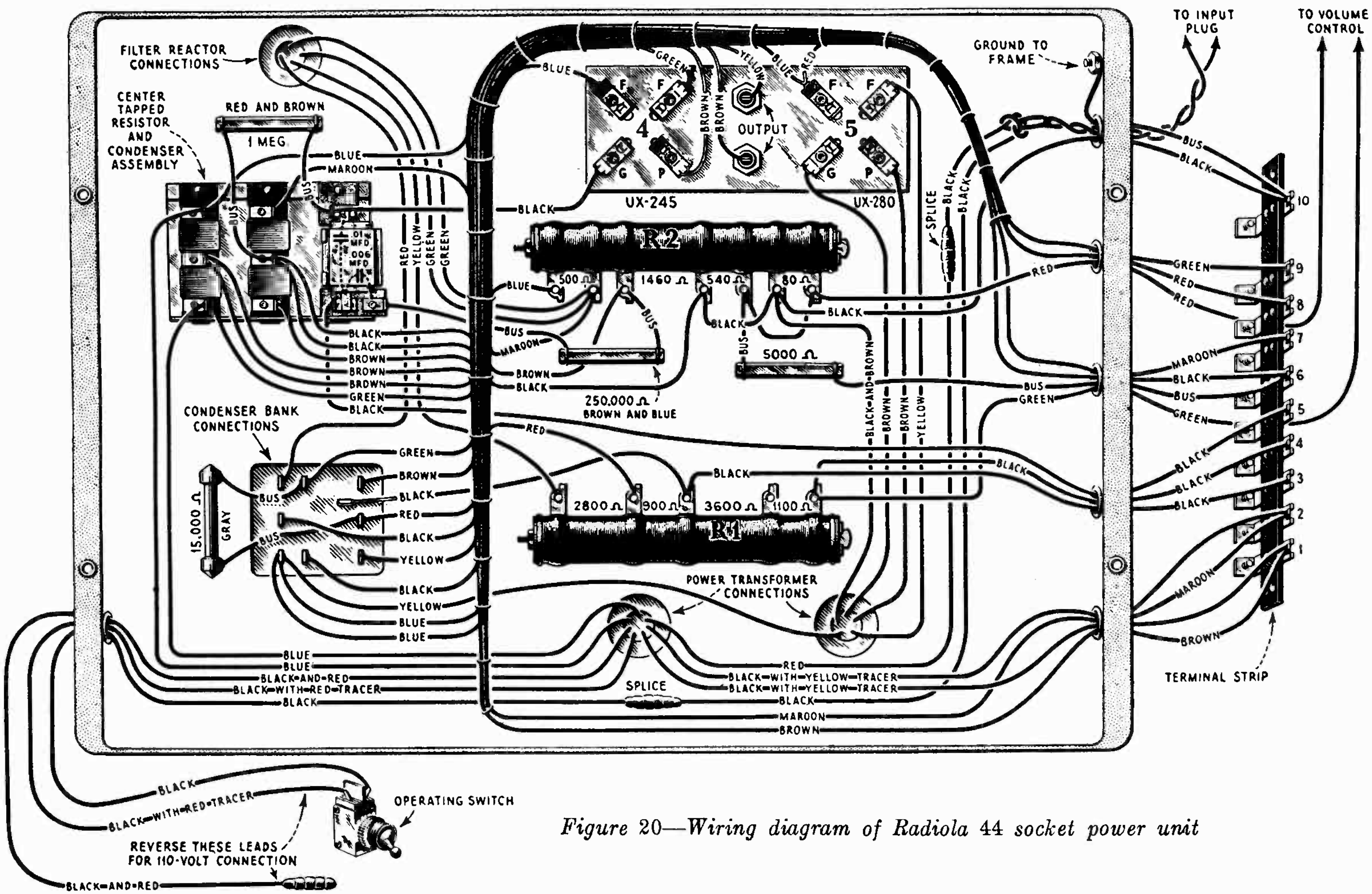


Figure 20—Wiring diagram of Radiola 44 socket power unit

CONTINUITY TESTS

Radiola 44 Socket Power Unit

Test Terminals	*Correct Effect*	*Incorrect Effect*	
		Indication	*Caused by*
1 to 2	Closed (Short)	Open	Open UY-224 heater winding and center tapped resistance unit
		50 Ohms	Open UY-224 heater winding
3 to 4	Closed (4700 Ohms)	Open	Open 3600 or 1100-ohm section of R-1
3 to 7	Closed (5400 Ohms)	Open	Open 2800 or 900-ohm section of R-1 or filter reactor
3 to 9	Closed (15,900 Ohms)	Open	Open 15,000-ohm resistor or 900-ohm section of R-1
5 to G4	Open	Closed	Shorted .01 mfd. condenser
5 to 10	Open	Closed (weak)	Shorted .006 mfd. condenser
		Short	Grounded .006 mfd. condenser or connections
6 to 10	Closed (5070 or 5420 Ohms)	Open	Open 5000-ohm resistor or 540 and 80-ohm section of R-2 (in some receivers the 5000-ohm resistor is replaced by two, one being 2000 ohms and one 3350 ohms connected in series)
7 to 8 (Link open)	Closed (500 Ohms)	Open	Open 500-ohm section of R-2
7 to P4	Closed (1400 Ohms)	Open	Open filter reactor or output choke
10 to G4	Closed (weak) (1 meg.)	Open	Open 1 meg. resistor
		Short	Shorted or grounded 1 meg. resistor or connection
P5 to G5	Closed (250 Ohms)	Open	Open high voltage winding of power transformer
Across fil. contacts of socket No. 4	Closed (Short)	Open	Open UX-245 filament winding and center tapped resistor
		50 Ohms	Open UX-245 filament winding
Across fil. contacts of socket No. 5	Closed (Short)	Open	Open UX-280 filament winding
One output jack to 10	Closed (1460 Ohms)	Open	Open 1460-ohm section of R-2
Other output jack to P4	Open	Closed	Shorted 1 mfd. output condenser
Red. V.C. lead to 10	Closed (70 Ohms)	Open	Open 80 and 540-ohm sections of R-2
Across A.C. input plug (Op. Sw. "On")	Closed (4 Ohms)	Open	Open primary of power transformer or defective operating switch

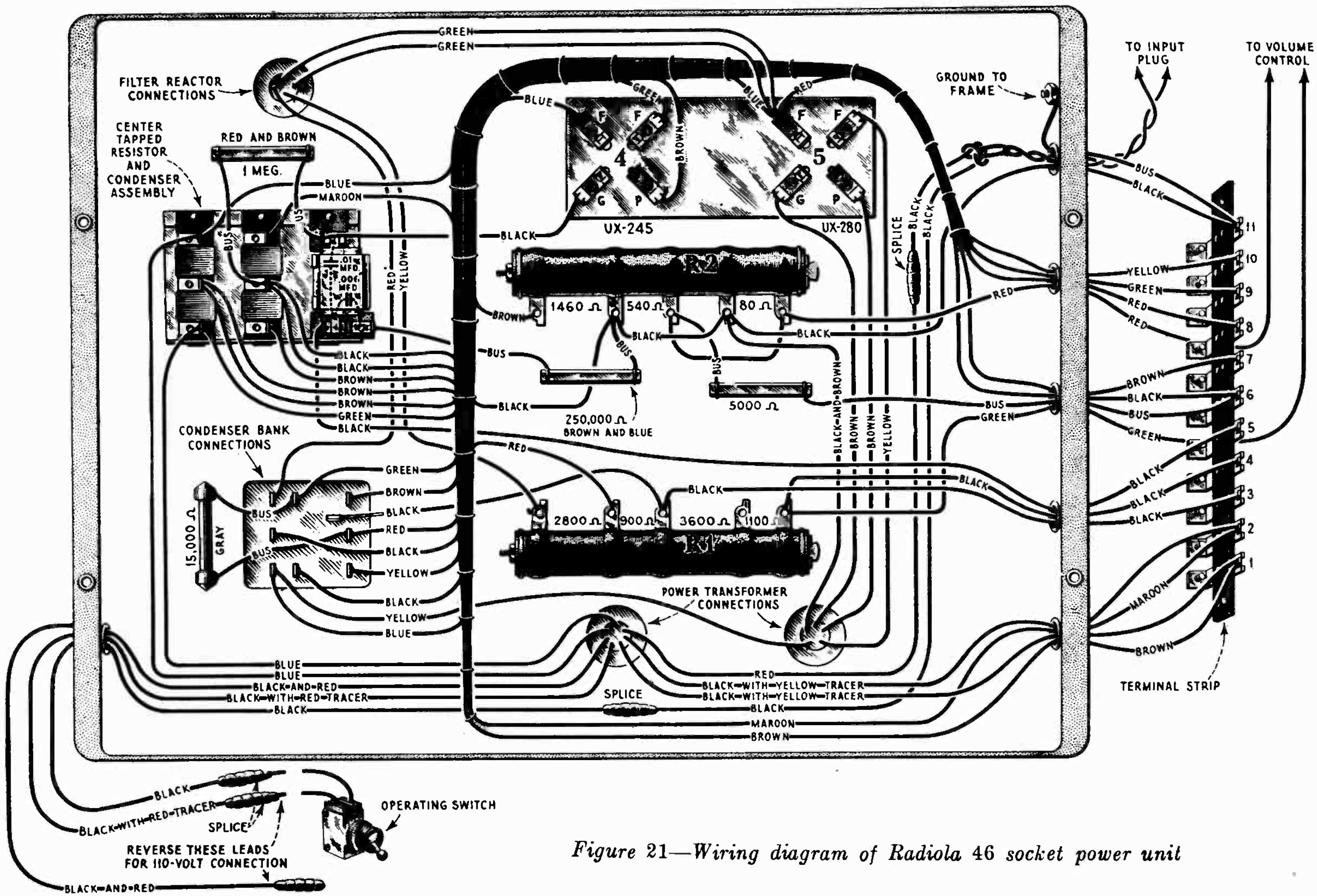


Figure 21—Wiring diagram of Radiola 46 socket power unit

CONTINUITY TESTS

Radiola 46 S. P. U.

Test Terminals	*Effect Correct*	*Incorrect Effect*	
		Indication	*Caused by*
1 to 2	Closed (Short)	Open	Open UY-224 heater winding and center tapped resistance unit
		50 Ohms	Open UY-224 heater winding
3 to 4	Closed (4700 Ohms)	Open	Open 3600 and 1100-ohm section of R-1
3 to 8	Closed (5400 Ohms)	Open	Open 2800 or 900-ohm section of R-1 or filter reactor
3 to 9	Closed (15,900 Ohms)	Open	Open 15,000-ohm resistor or 900-ohm section of R-1
5 to G4	Open	Closed	Shorted .01 mfd. condenser
5 to 11	Open	Closed (weak)	Shorted .006 mfd. condenser
		Short	Grounded .006 mfd. condenser or connections
6 to 11	Closed (5070 or 5420 Ohms)	Open	Open 5000-ohm resistor or 540 and 80-ohm section of R-2 (in some receivers the 5000-ohm resistor is replaced with two, one being 2000 ohms and one 3350 ohms connected in series)
7 to 11	Closed (1460 Ohms)	Open	Open 1460-ohm section of R-2
10 to P4	Open	Closed	Shorted 1 mfd. output condenser
11 to Gnd.	Closed (Short)	Open	Open connection
G4 to 11	Closed (weak)	Open	Open 1 meg. resistor
	(1 meg.)	Short	Shorted or grounded 1 meg. resistor or connections
P4 to 8	Closed (1400 Ohms)	Open	Open filter reactor or output choke
P5 to G5	Closed (250 Ohms)	Open	Open high voltage winding of power transformer
Red. V.C. lead to 11	Closed (70 Ohms)	Open	Open 80 and 540-ohm section of R-2
Across fil. contacts of socket No. 4	Closed (Short)	Open	Open UX-245 filament winding and center tapped resistor
		50 Ohms	Open UX-245 filament winding
Across fil. contacts of socket No. 5	Closed (Short)	Open	Open UX-280 filament winding
Across A.C. input plug (Op. Sw. "On"	Closed (4 Ohms)	Open	Open primary of power transformer or defective operating switch

PART IV—MAKING REPLACEMENTS

The various assemblies and parts of Radiolas 44 and 46 are readily accessible and replacements can be made easily. The following detailed procedure outlines the simplest methods to be used when making replacements.

[1] REMOVING R-44 RECEIVER ASSEMBLY FROM CABINET

When making any replacements in the receiver assembly it is first necessary to remove it from the cabinet. The following procedure should be used:

(a) Remove the escutcheon that holds the Local-Distant Switch in place and then remove the switch and shield from the escutcheon by removing the collar that holds the switch.

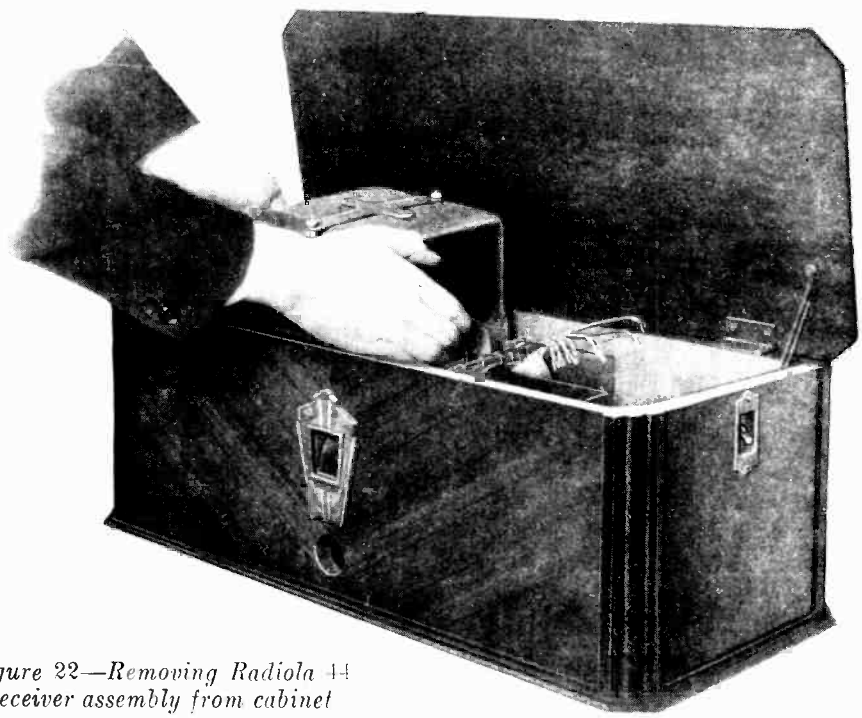


Figure 22—Removing Radiola 44 receiver assembly from cabinet

(b) Remove the cable connections to the S.P.U. terminal strip. Also remove the two S.P.U. connections to the volume control.

(c) Remove the two knobs from the station selector shaft. These are just pulled "off."

(d) Remove the three machine screws and washers that hold the receiver assembly to the bottom of the cabinet. The chassis may now be lifted clear of the cabinet and placed in a position convenient for work. (See Figure 22.) After the replacement has been made it should be returned to the cabinet in the reverse manner of that used to remove it. When replacing the tuning control and volume control knobs make certain that the gear teeth on the volume control knob meshes with the gear on the volume control shaft.

(e) Just before tightening the screws that hold the receiver assembly to the cabinet place the Radiola in operation and note whether or not the dial screen is properly illuminated. Should the light be off to one side the chassis may be shifted slightly until the screen is properly illuminated. The screws are then tightened.

[2] REMOVING R-44 S. P. U. FROM CABINET

To remove the S.P.U. from the cabinet proceed as follows:

(a) Remove the operating switch from its escutcheon plate by removing the escutcheon and then twisting the switch mechanism until the collar and the switch will come clear of the escutcheon.

(b) Remove all connections to the S.P.U. terminal strip and the two leads to the volume control.

(c) Remove the four machine screws that hold the S.P.U. to the bottom of the cabinet. The S.P.U. may now be lifted clear of the cabinet (See Figure 23) and placed in a position convenient for work. It is replaced in the cabinet in the reverse manner of that used to remove it.

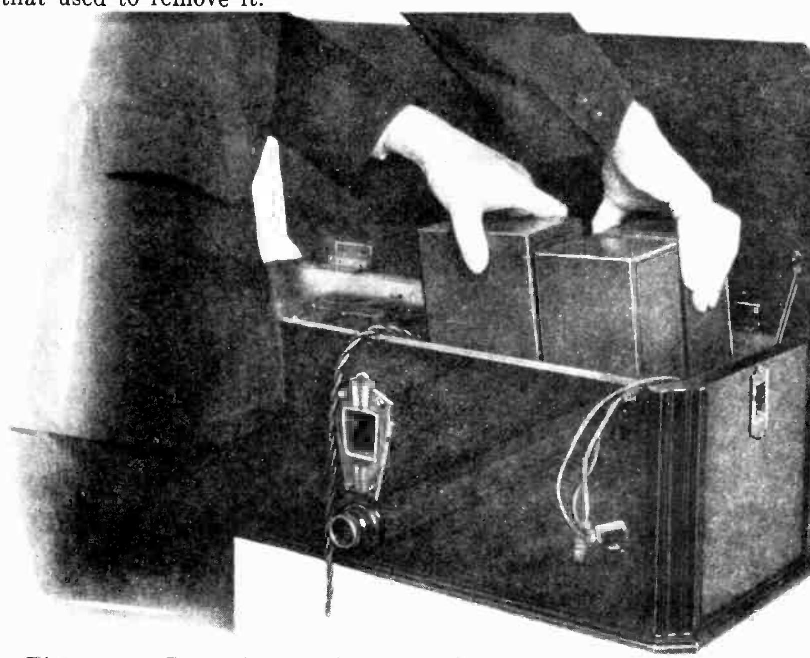


Figure 23—Removing Radiola 44 socket power unit from cabinet

[3] REMOVING R-46 RECEIVER ASSEMBLY FROM CABINET

To remove the receiver assembly from Radiola 46 proceed as follows:

(a) Remove the back from the cabinet by pulling at top and lifting clear.

(b) Remove the shield and all receiver connections to the S.P.U. terminal strip. Also remove the two S.P.U. connections to the volume control.

(c) Remove the volume control and station selector knob. These are merely pulled "off" the shaft.

(d) Remove the escutcheon that holds the "Local Distant" switch in place and then remove the switch and shield by removing the collar that holds the switch. It will also be necessary to remove the staples that hold the shield to the side of the cabinet.

(e) Remove the three machine screws and washers that hold the receiver assembly to the bottom of the cabinet. The chassis may now be lifted clear of the cabinet, and placed in a position convenient for work (see Figure 24). After the replacement has been made it should be returned to the cabinet in the reverse manner of that used to remove it. When replacing the tuning control and volume control knobs make certain that the gear teeth on the volume control knob meshes with the gear on the volume control shaft.

(f) Just before tightening the screws that hold the receiver assembly to the cabinet, place the Radiola in operation and note whether or not the dial screen is properly illuminated. Should the light be off to one side the chassis may be shifted slightly until the screen is properly illuminated. The screws are then tightened.

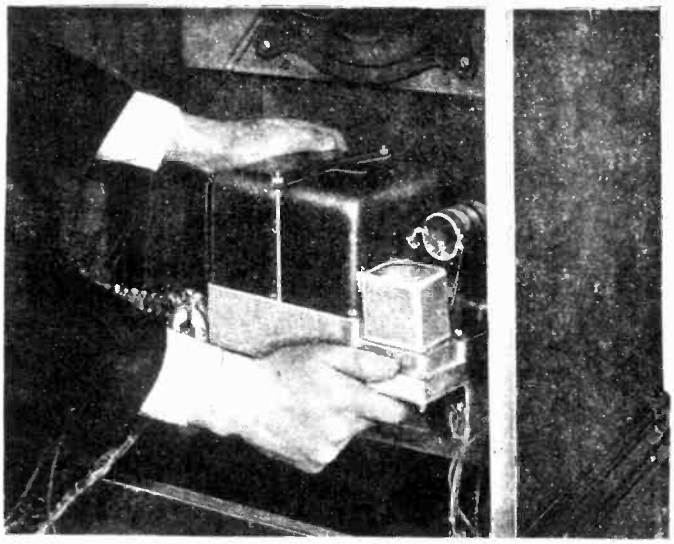


Figure 24—Removing receiver assembly from Radiola 46

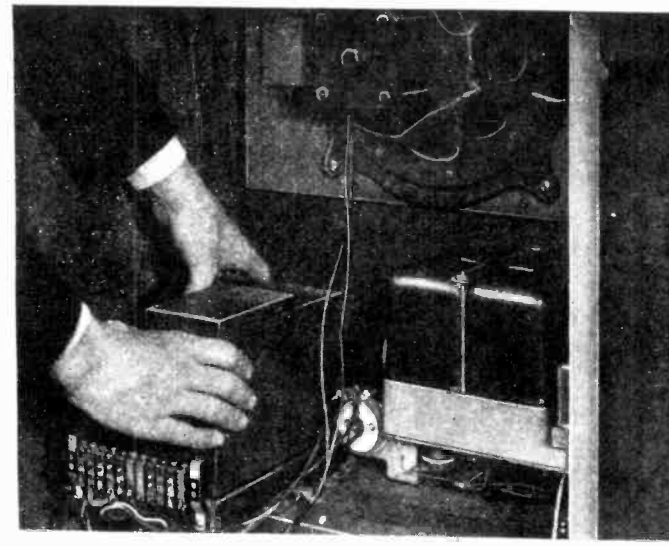


Figure 25—Removing socket power unit from Radiola 46

[4] REMOVING R-46 S. P. U.

To remove the Radiola 46 S.P.U. proceed as follows:

(a) Remove the back from the cabinet by pulling it at the top and lifting clear.

(b) Remove the operating switch from its escutcheon plate by removing the escutcheon and then twisting the switch mechanism until the collar and switch will come clear of the escutcheon.

(c) Remove all connections to the S.P.U. terminal strip and the two leads to the volume control.

(d) Remove the four machine screws that hold the S.P.U. to the cabinet. The S.P.U. may now be lifted clear of the cabinet and placed in a convenient place for work (Figure 25).

It is replaced in the cabinet in the reverse manner of that used to remove it.

[5] REMOVING R-46 REPRODUCER ASSEMBLY

To remove the Radiola 46 reproducer unit proceed as follows:

(a) Remove back from cabinet by pulling at top and lifting clear.

(b) Release the field coil leads at the S.P.U. terminal strip and the input leads of the terminals on the reproducer frame.

(c) Remove the four screws that hold the reproducer assembly to the baffle board, being careful to hold the assembly to prevent falling. It may now be removed to a place convenient for work and any necessary repairs made (Figure 26).

(d) After the necessary work has been completed the assembly may be replaced in the reverse manner of that used to remove it.

Figure 26—Removing reproducer unit from Radiola 46

To center the cone of the reproducer unit proceed as follows:

(a) Remove reproducer assembly as described above.

(b) Loosen center screw of cone, but do not remove it.

(c) Insert three cardboard strips about the thickness of a visiting card, 1½" x ¼" in size, through the center web of the cone into the space between the pole piece and the cone. This will give the same clearance on all sides of the pole piece.

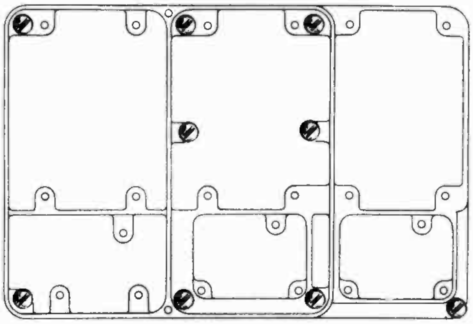


Figure 27—Screws to be removed in replacing trimming condenser

(d) Tighten the center screw holding the web of the cone and remove the three strips. The cone is now properly centered.

(e) Replace the reproducer unit in the reverse order of that used to remove it.

[6] REPLACING R. F. LINE-UP CONDENSERS

Three line-up condensers are used to properly align the R.F. stages. These are small adjustable condensers, that are paralleled across the three tuning condensers. Should replacement be necessary proceed as follows:

(a) Remove receiver assembly from cabinet as described in Part 4, Sections 1 and 3.

(b) Remove the shield and eight machine screws and nuts as shown in Figure 27. This allows the bottom plate of the assembly to be dropped sufficiently to gain access to the tuning condenser.

(c) The trimming condenser is now released by removing the adjusting screw and the two screws that hold the trimming condenser and one end of the variable condenser to the small dilecto strip. The new condenser may now be inserted in place of the old one, making sure the mica piece is next to the side of the casting. Replace all screws, being careful not to disturb the alignment of the tuning condenser, one end of the stator of which has been released.

(d) After reassembling, the receiver must be placed in operation and the tuning condenser just replaced adjusted as described in Part II, Section 5.

(e) All units may now be replaced and the Radiola returned to normal operation.

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.

Indications	*Cause*	*Remedy*
No Signals	Defective operating switch	Repair or replace switch
	Defective volume control	Replace volume control
	Defective R.F. transformer	Replace R.F. transformer
	Defective coupling reactor	Replace coupling reactor
	Defective by-pass condenser	Replace by-pass condenser
	Defective S.P.U.	Check S.P.U. and replace any defective part. P. III, S. 3
Weak Signals	"Local Distant" switch not on "Distant" position	Throw switch to "Distant" position P. I, S. 8
	Line-up condensers not adjusted properly	Adjust line-up condensers properly. P. II, S. 5
	Defective main tuning condensers	Check main tuning condensers and make adjustments necessary. P. II, S. 5.
	Defective parts in receiver assembly	Replace any defective parts in receiver assembly
	Defective parts in S.P.U.	Replace any defective parts in S.P.U.
	Low line voltage	Adjust transformer for low line voltage. P. I, S. 6
Poor Quality	Defective coupling reactor, condenser or resistor in coupling circuit	Replace any defective parts
	Defective output condenser or choke	Replace output condenser and choke
	"Local Distant" switch not properly operated	Operate "Local Distant" switch correctly. P. I, S. 8
Audio Howl	Receiver oscillating	Correct cause of oscillation. P. II, S. 11
	Defective audio system	Correct and repair any defect
	Open grid in any stage	Check circuit and repair defect. P. III, S. 4
Uncontrolled Oscillation	Shields not in place or making good contact	Place shield correctly and secure good contact. P. I, S. 10
	Tube shields not in place	Place tube shields correctly. P. I, S. 11
	Defective R.F. filter	Replace defective R.F. filter. P. II, S. 11
Radiotrons fail to light	No. A.C. line voltage	Turn A.C. line voltage "On"
	Operating switch not "On"	Turn operating switch "On"
	Defective A.C. input cord	Repair or replace defective cord
	Defective power transformer	Replace defective power transformer

RCA

Radiola 46 (D. C.)

SERVICE NOTES

RCA Radiola 46 (D.C.)

First Edition—5M

RADIO-VICTOR CORPORATION OF AMERICA
233 BROADWAY, NEW YORK CITY

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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 Department 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 Department 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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

PART V—CONTINUITY TESTS

ILLUSTRATIONS

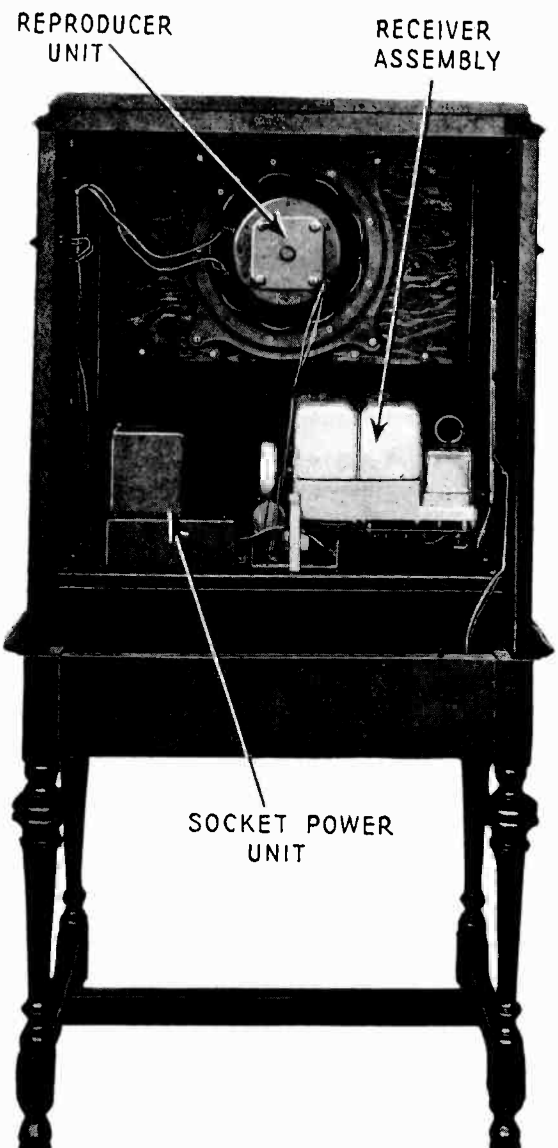

Figure 1—Rear interior cabinet view of Radiola 46 (*D. C.*)

RCA RADIOLA 46 (D. C.)

SERVICE NOTES

Prepared by RCA Service Department

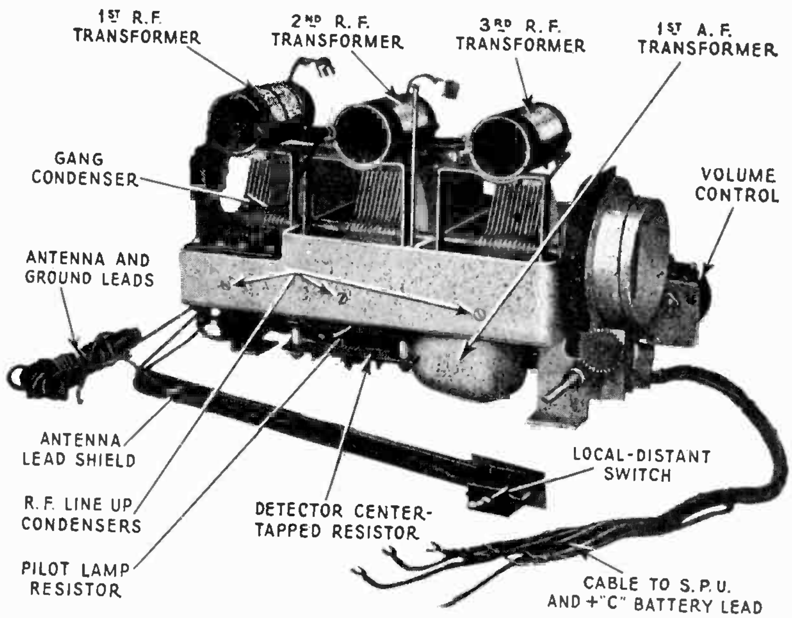

Figure 2—Top view of receiver chassis with shields removed.

ELECTRICAL SPECIFICATIONS

Voltage Rating	107½-127½ Volts D. C.
Power Consumption	55 Watts Maximum
Recommended Antenna Length	25-60 Feet
Type of Circuit	Screen Grid Tuned R. F.
Number and Type of Tubes	Two UX-222, 2 UX-112A and 2 UX-171A
Number of R. F. Stages	2
Type of Detector	Grid Condenser and Leak
Number of A. F. Stages	2—Last Stage Push-Pull
Type of Loudspeaker	Electro Dynamic (107½-127½ Volts D. C.) (100-125 M. A. Field)

PHYSICAL SPECIFICATIONS

Height	50¼ Inches
Width	26⅛ Inches
Depth	16 Inches
Weight, Net	100 Pounds
Weight, Packed in Standard Packing Case	145 Pounds
Size of Packing Case	20"x30½"x54"

INTRODUCTION

RCA Radiola 46 (D.C.) is a console model screen grid radio receiver operating on house lighting D.C., 107½-127½ volts. The electro dynamic speaker employed is of the RCA 106 type. RCA screen grid Radiotrons UX-222 are employed as radio frequency amplifiers, Radiotrons UX-112A as the detector and first audio stage and Radiotrons UX-171A as the push-pull second audio stage. An external "C" battery is used to make available as high a plate voltage as possible for the UX-171A's. Figure 1 illustrates a rear interior cabinet view of Radiola 46 (D.C.). Figure 2 is a top view of the receiver chassis with shields removed. Figure 3 is a sub-chassis view of the receiver, and Figures 4 and 5 are top and bottom views of the socket power unit.

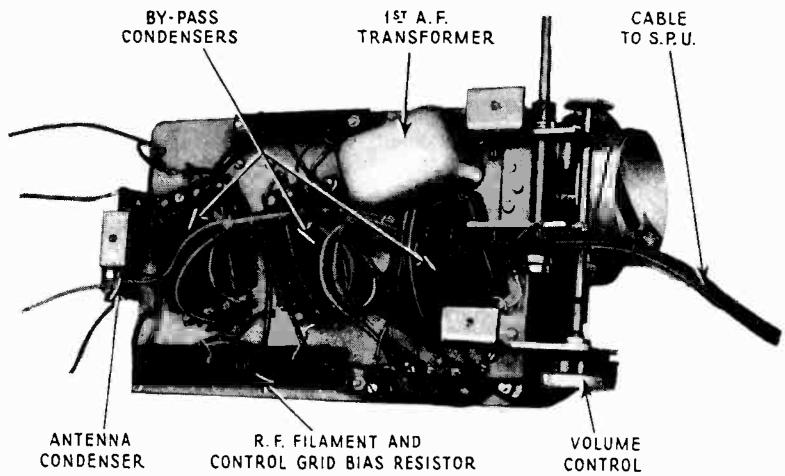

Figure 3—Sub-chassis view of receiver

Circuit features (See Figure 6) of this Radiola are:

(a) Two tuned R.F. stages, tuned grid leak type detector, first audio stage and a second audio stage employing two UX-171A Radiotrons in push-pull connection.

(b) Local-distant switch provides be t reception on both loud and weak signals. At the local position a .00023 mfd. condenser is connected from the antenna connection to ground. This condenser, or when the switch is at "distant," antenna to ground capacity, causes the circuit to resonate in the broadcast band, about 700 K.C., and thereby brings up the sensitivity of the low frequency end. The result is that the receiver has about equal sensitivity throughout the tuning range.

(c) The use of screen grid tubes together with proper shielding, eliminates the necessity of neutralizing or other methods of stabilizing.

(d) The volume control varies the voltage on the screen grid of the two R.F. tubes. This provides a smooth means of control which, together with the local-distant switch, provides a positive cut-off even on loud local stations.

PART I—INSTALLATION

Information on the various points dealing with installation as listed below can be obtained by referring to the Service Notes or Instruction Books mentioned.

Antenna (Indoor or Outdoor)—See R-44 and 46 Service Notes, pp. 8-12.
Ground—See R-44 and 46 Service Notes, p. 10.
Shields—See R-44 and 46 Service Notes, p. 15.
"C" Battery and Connections—See R-46 (D.C.) Instruction Book, pp. 4 and 8.
Line Voltage Adjustment—See R-46 (D.C.) Instruction Book, p. 7.
Use of "Local-Distant" Switch—See R-44 and 46 Service Notes, p. 14.

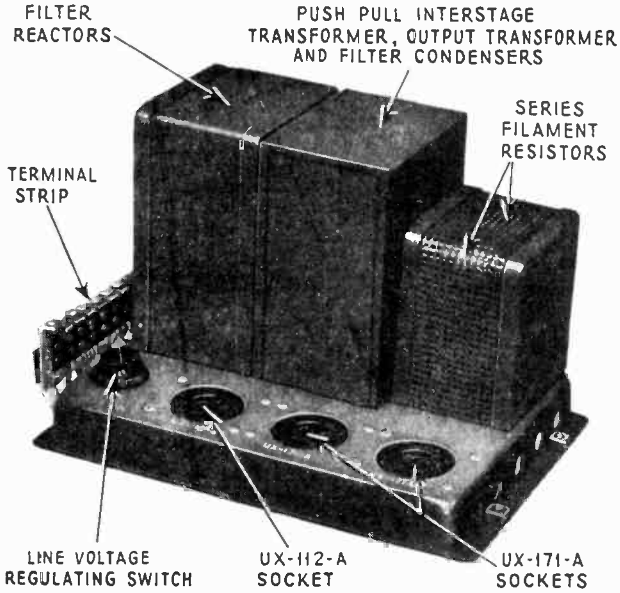

Figure 4—Top view of socket power unit

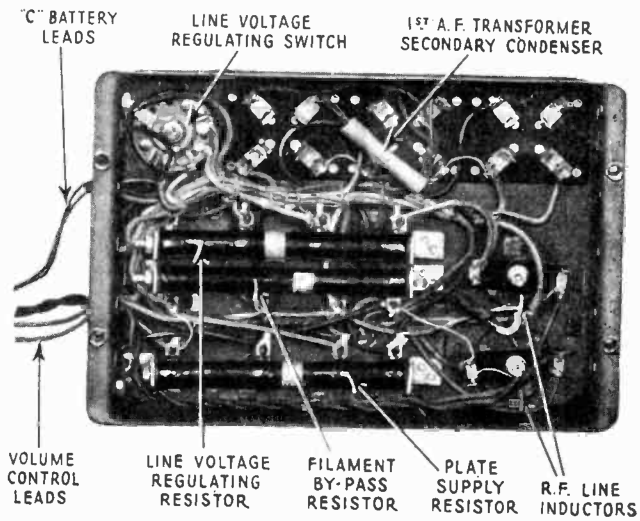

Figure 5—Sub-chassis view of socket power unit

PART II—SERVICE DATA

Service data on the following subjects can be obtained from the Service Notes and Instruction Books mentioned below.

Antenna System Failures—See R-44 and 46 Service Notes, p. 16.
Radiotron Sockets and Prongs—See R-44 and 46 Service Notes, p. 16.
Broken Condenser Drive Cord—See R-44 and 46 Service Notes, p. 17.
Adjusting R. F. Line-up Condensers—See R-44 and 46 Service Notes, p. 17.
Service Data on Reproducer Unit—See R-44 and 46 Service Notes, pp. 34 and 35.

SERVICE DATA CHART

The following service data chart indicates various troubles by their symptoms and gives the specific remedy necessary.

Indication	Cause	Remedy
No Reproduction	No line voltage	Check line voltage with 0-150 v. D.C. voltmeter
	Input plug in wrong position	Reverse input plug
	Defective Radiotrons	Replace
	Defective operating switch	Replace
	Defective volume control	Replace
	Wrong "C" battery connections, or defective "C" battery	Connect battery correctly, or replace (Complete instructions are given in R-46 (D.C.) Instruction Book, pp. 4 and 8)
	Defective Local-Distant Switch	Replace
	Defective parts in receiver	Check by means of continuity tests and make any replacement necessary
	Defective reproducer unit	Repair any defect in reproducer unit
Low Volume	Defective Radiotrons	Replace
	Poor antenna system	Install antenna as suggested in R-44 and 46 Service Notes, pp. 8 to 12
	R.F. line-up condensers out of adjustment	Adjust line-up condensers as described in R44-46 Service Notes, p. 17
	Defective parts in receiver	Check by means of continuity test and make any replacement necessary
	Defective reproducer unit	Check by means of external speaker known to be in good operating condition and make any replacement necessary
Distorted Reproduction	Defective Radiotrons	Replace
	Defective interstage A. F. transformer, push-pull transformer, output transformer, or other parts	Check parts by means of continuity test and make any replacement necessary
	Receiver oscillation	Should the Radiola oscillate, all signals will be weak, distorted, and accompanied by a whistle. See section on "Oscillation" for remedies
	Wrong "C" battery connections or defective "C" battery	Connect battery correctly or replace. Complete instructions are given in R46 (D.C.) Instruction Book, pp. 4 and 8
	Defective reproducer unit	Check by means of external speaker known to be in good operating condition and make any replacement necessary

Indication	Cause	Remedy
Acoustic Howl	Radiotron selection	Interchange Radiotrons, especially the detector
	Defective detector socket mounting	Check detector socket mounting
	Reproducer unit mounting	Check mounting of reproducer unit, and make sure it is properly supported
Audio Howl	Oscillation	Receiver oscillation will cause a whistle when the receiver is tuned through a broadcasting station's carrier wave. See section on "Oscillation" for remedies
	Defective by-pass condenser	An open in any of the by-pass condensers or connections may cause an audio howl
	Defective center tapped detector filament resistor	A defective center tapped detector filament resistor may cause audio howl
	Radiotrons	Vibrating elements in Radiotrons will cause a gradually developed howl. See section, "Acoustic Howl." Try changing the UX-171A's in the push-pull stage
	Defective audio system	A defective audio system may cause a howl
Excessive Line Noise	Defective R.F. line inductors, filter condensers, or connections	Check and replace parts where necessary
Oscillation	Shields not in place or not making good contact	Place the tube shield over sockets 1 and 2 and the stage shields over sockets 2 and 3. If oscillation does not stop clean points of contact between base and all shields
	Antenna lead shields not grounded	Ground antenna lead shield properly
	Shield contact clips not clamping condenser shaft properly	Bend shield contact clips so that a good firm contact is made to the condenser rotor shaft
	Open by-pass condenser	An open by-pass condenser or one improperly connected may cause oscillation. Check and replace if necessary
	Defective Radiotrons	A defective Radiotron UX-222 may cause oscillation. Interchanging with one known to be in good condition will remedy the trouble
Improper Scale Reflection	Pilot lamp improperly set	See R44-46 Service Notes. Try rotating pilot lamp in socket to improve image. Slight filing of the soldered tip will help to do this

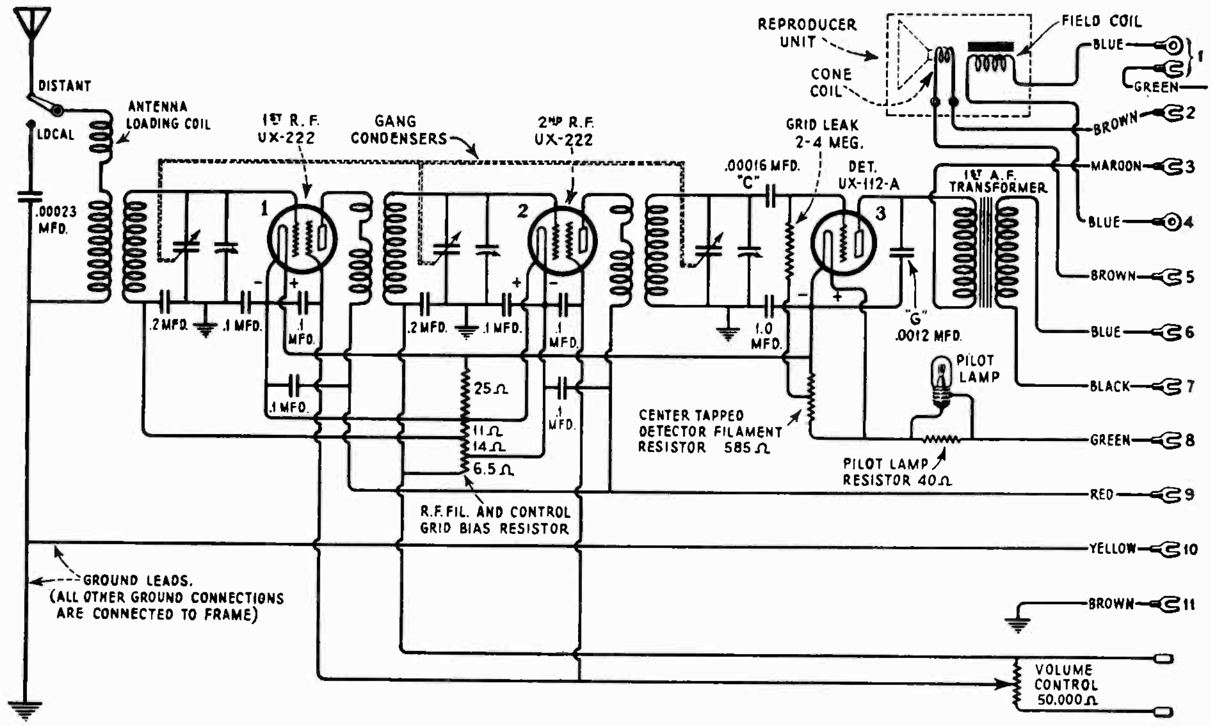

Figure 6—Schematic circuit

PART III—ELECTRICAL TESTS

(1) TESTING CONDENSERS

Most of the condensers in the RCA Radiola 46 (D.C.) can be tested by the continuity tests given in Part V. If further tests are desirable the 0.5 mfd. and larger condensers may be tested by charging with any D.C. voltage available, preferably as high as 150 volts, and shorting their terminals with a screw driver. An O.K. condenser will give a good spark when such a short is made. A leaky condenser will give no spark and a shorted condenser will give a spark when an attempt is made to charge it.

Small condensers may be click tested for shorts or conveniently replaced by new ones to check on their operating condition.

(2) VOLTAGE READINGS

The following readings are taken with a Weston Model 537, Type 2, or other test set giving similar readings. These voltages are not exactly correct, due to the oscillating condition of the circuits. However, they enable the service man to obtain a check on the continuity of the circuits to the various sockets. The screen grid voltages are not readable, due to the reversal of the polarity at the contact points.

When making tests remove only the shield and control grid connection of the tube whose voltage is under measurement. Do not tie the control grid connection to the control grid cap of the tube in the test set. It is not practical to test the control grid voltage directly at the sockets.

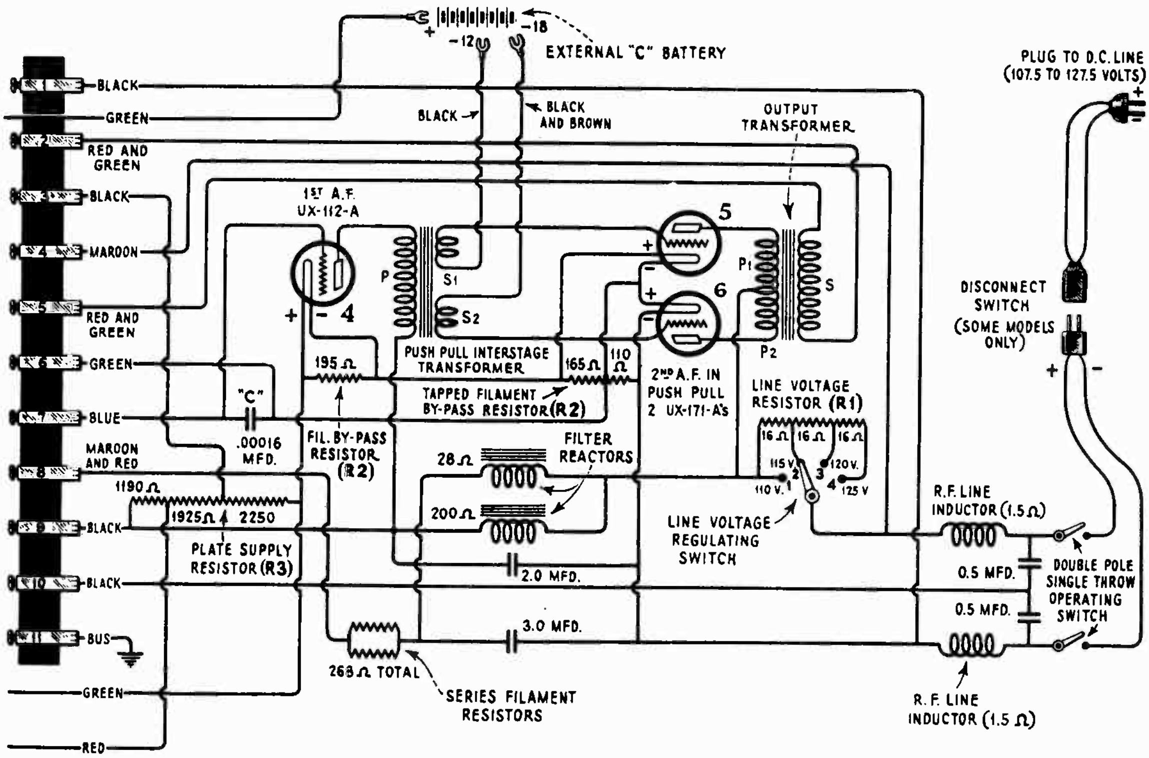

diagram of Radiola 46 (*D. C.*)

SOCKET VOLTAGES RADIOLA 46 (D. C.)

Volume Control at Minimum Position—D. C. Line Volts, 120.

Line Switch at No. 3 Position.

Socket No.	Control Grid to Filament Volts	Plate to Filament Volts	Plate Current Milliamperes	Filament Volts
1	—	85	0	3.2
2	—	85	0	3.2
3	0	25	1.5	4.9
4	5.0	85	3.0	4.8
5	16.5	100	15.0	4.8
6	18.0	105	15.0	4.8

Volume Control at Maximum Position—D. C. Line Volts, 120.

Line Switch at No. 3 Position.

Socket No.	Control Grid to Filament Volts	Plate to Filament Volts	Plate Current Milliamperes	Filament Volts
1	—	80	3.0	3.2
2	—	80	3.0	3.2
3	0	25	1.5	4.9
4	5.0	80	3.0	5.0
5	16.5	100	12.0	4.9
6	18.0	105	12.0	4.9

TERMINAL STRIP VOLTAGES

The following voltages taken at the S.P.U. terminal strip with the receiver operating and all tubes and shields in place are correct when the line voltage is within the limits for the switch tap being used.

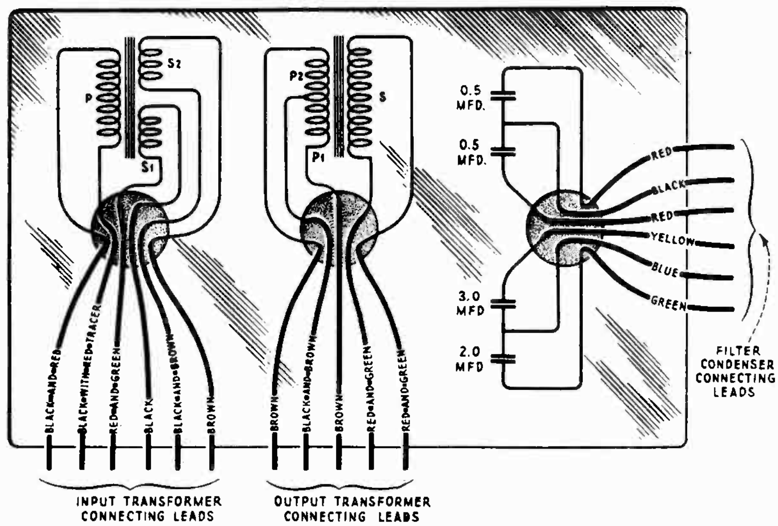

Figure 7—Internal connections of the A. F. coupling unit and filter condensers

VOLUME CONTROL AT MINIMUM OR MAXIMUM

Line voltage at 120 volts—Switch Tap at No. 3

Terminals	Voltage	Voltage Measured
1 to 4	120	Reproducer field voltage and plate voltage (approximately) of Radiotrons No. 5 and No. 6
8 to green Volume Control lead	18	Filament and R.F. control grid bias voltage for Radiotrons No. 1, No. 2, filament voltage for Radiotron No. 3, and filament voltage for pilot lamp
1 to 3	50	Plate voltage for Radiotron No. 3
1 to 9	105	Plate voltage for Radiotrons Nos. 1, 2 and 4
Across volume control	68	Screen grid voltage for Radiotrons Nos. 1 and 2

PART IV—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 46 (D.C.) are readily accessible and replacements can be made easily.

Since the D.C. model of Radiola 46 is very similar to the A.C. Model full information as to correct methods for removing assemblies in order to replace component parts if necessary, may be found in the Radiola 44-46 Service Notes as follows:

Removing Receiver Assembly from Cabinet—See R-44-46 Service Notes, p. 33.
Removing S.P.U. from Cabinet—See R-44-46 Service Notes, p. 34.
Removing Reproducer Assembly—See R-44-46 Service Notes, p. 34.
Replacing R.F. Line-up Condensers—See R-44-46 Service Notes, p. 35.

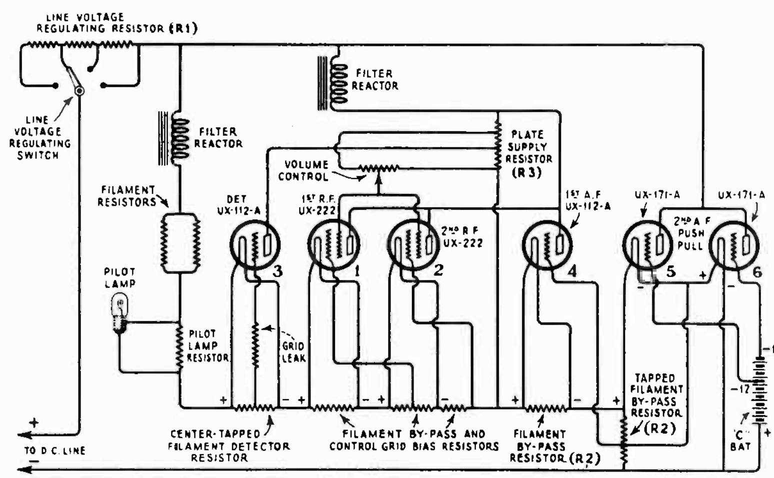

Figure 8—Schematic circuit diagram of the voltage system

PART V—CONTINUITY TESTS

RADIOLA 46 (D. C.) CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly of Radiola 46 (D.C.) Disconnect the antenna and ground leads, the cable connections to the "C" battery and terminal strip and unscrew the pilot lamp.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient battery to give a good deflection when connected across the battery terminals should be used in making these tests.

The approximate D.C. resistances of the various circuits are also shown in the column titled, "Correct Effect." Checking the resistance of the circuits adds an additional check on their correct functioning. This may be done by means of a direct reading "Ohmmeter," a resistance bridge, or any of the methods shown in previous issues of RCA Service Notes.

The Radiotron contacts and socket numbers, the cable connections and color scheme are shown in Figure 9, and should be referred to when making these tests. Figure 7 illustrates the internal connections of the A.F. coupling unit and filter condensers. Figures 10 and 11 illustrate the wiring diagram of the receiver assembly and socket power unit respectively. Figure 8 is a voltage schematic circuit diagram for the Radiola 46 (D.C.)

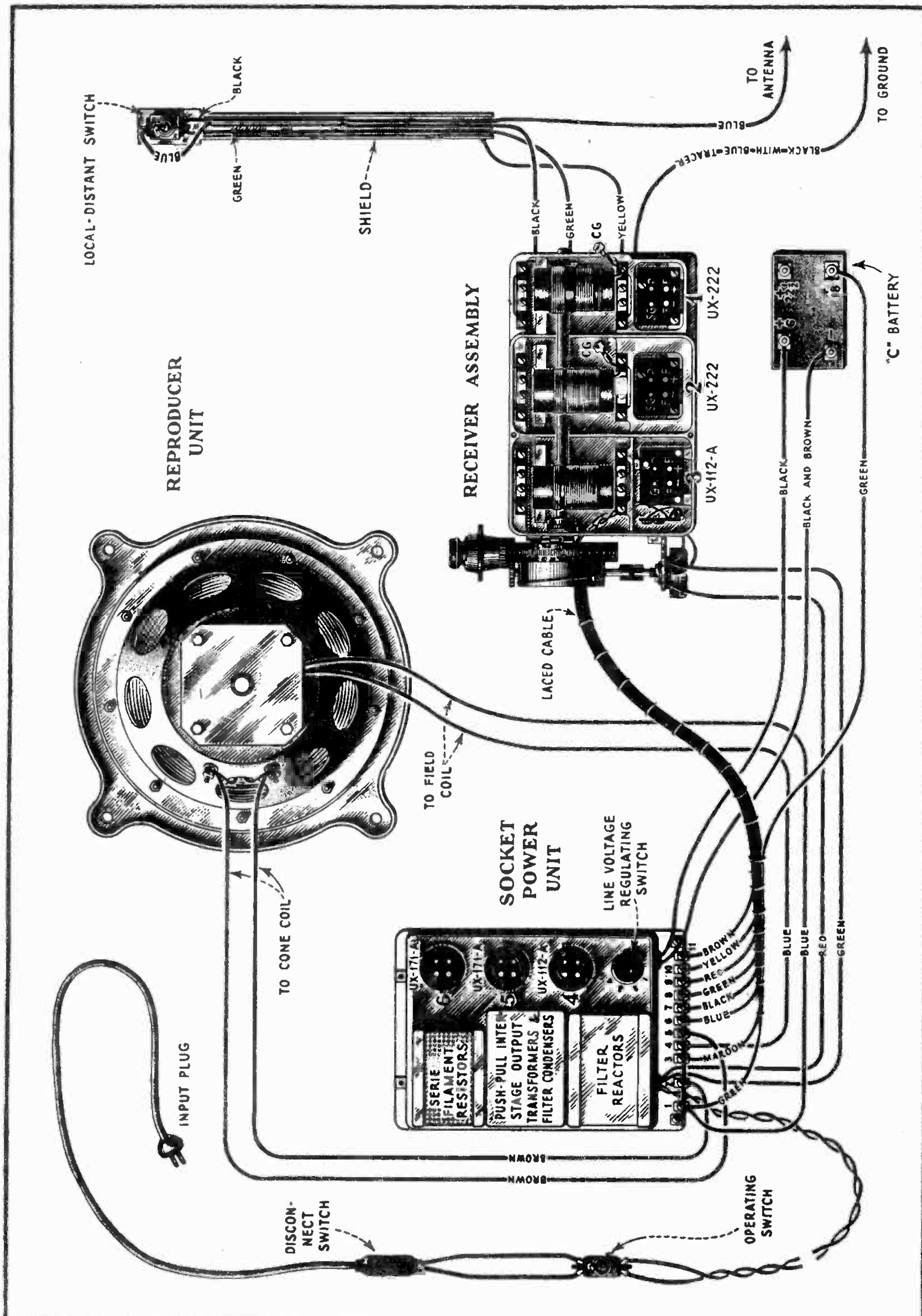

Figure 9—Complete layout and cable connections

RECEIVER ASSEMBLY CONTINUITY TEST CHART

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
Condenser Tests	CG1 to Ground	Open	Closed	Shorted or grounded 0.2 mfd. condenser
	—F1 to Ground	Open	Closed	Shorted or grounded 0.1 mfd. condenser
	—F1 to SG1 (Unsolder center connection to volume control)	Open	Closed	Shorted 0.1 mfd. condenser
	—F1 to P1	Open	Closed	Shorted 0.1 mfd. condenser
	CG2 to Ground	Open	Closed	Shorted or grounded 0.2 mfd. condenser
	—F2 to Ground	Open	Closed	Shorted or grounded 0.1 mfd. condenser
	—F2 to SG2 (Unsolder center connection to volume control)	Open	Closed	Shorted 0.1 mfd. condenser
	—F2 to P2	Open	Closed	Shorted 0.1 mfd. condenser
	F3 to Ground	Open	Closed	Shorted or grounded 1.0 mfd. condenser
	G3 to Ground	Open	Closed	Shorted or grounded 0.00016 mfd. condenser
	—F3 to P3	Open	Closed	Shorted 0.0012 mfd. condenser

Local-Distant Switch in "Distant" Position

Circuit	Test Terminals	Correct Effect	Indication	Caused by
Antenna and Ground	Antenna lead to ground lead	Closed (24 ohms)	Open	Open primary 1st R.F. transformer, antenna loading coil, or connection
	Ground lead to lug No. 10 (Yellow)	Closed	Open	Open connection
Control Grid	CG1 to —F2	Closed (17 ohms)	Open	Open secondary 1st R.F. transformer or filament and bias resistor
	CG2 to +F1	Closed (59.5 ohms)	Open	Open secondary 2nd R.F. transformer or filament and bias resistor
	G3 to +F3	Closed (2-4 meg)	Open	Open grid leak, center tapped resistor, or connection

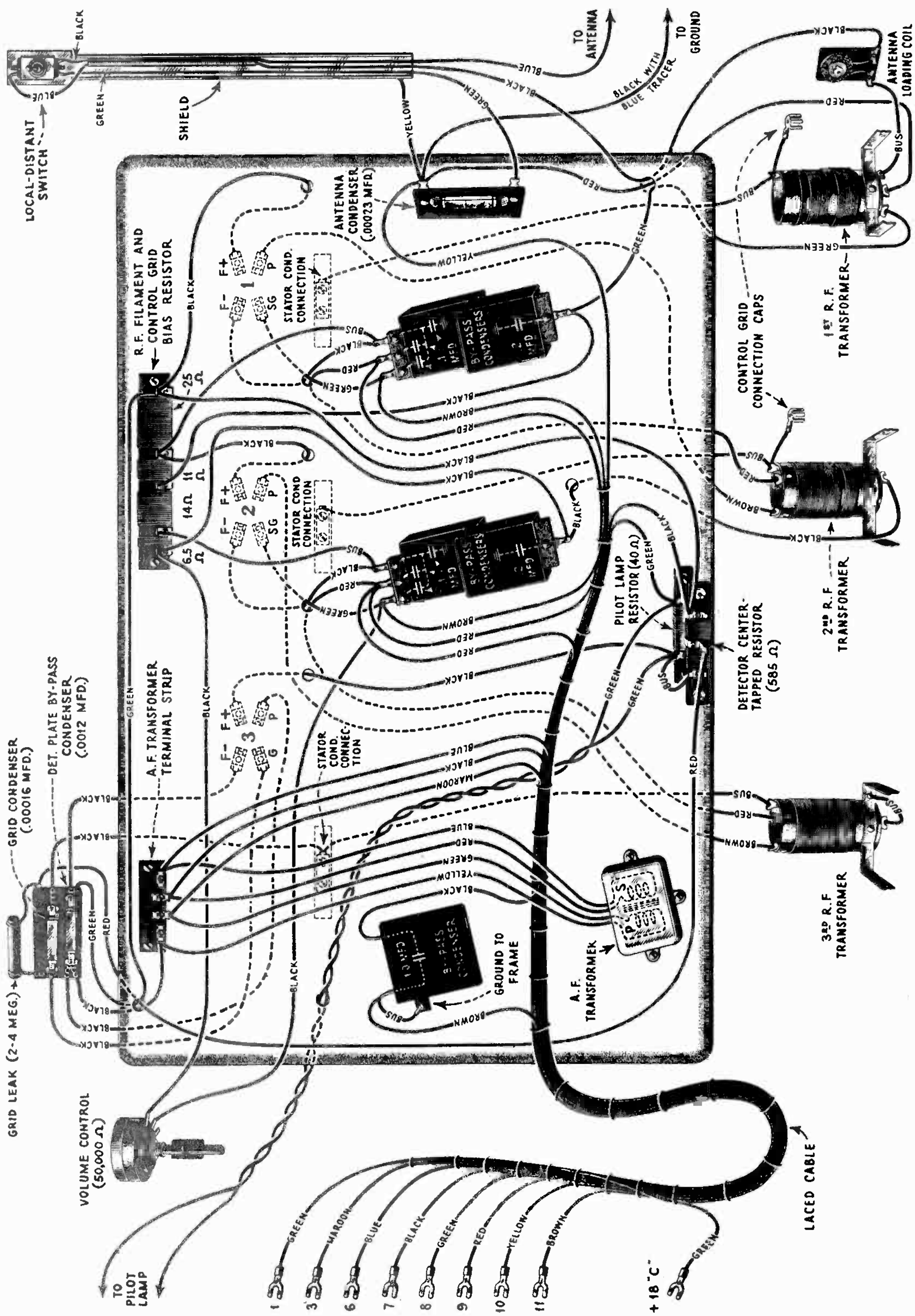

Figure 10—Wiring diagram of the receiver assembly

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
Screen Grid	SG1 to center arm of volume control	Closed	Open	Open connection
	SG2 to center arm of volume control	Closed	Open	Open connection
Plate	P1 to Lug No. 9 (Red)	Closed (60 ohms)	Open	Open primary 1st R.F. transformer or connection
	P2 to Lug No. 9 (Red)	Closed (60 ohms)	Open	Open primary 2nd R.F. transformer or connection
	P3 to Lug No. 3 (Maroon)	Closed (1050 ohms)	Open	Open primary 1st A.F. transformer or connection
Miscel-laneous and Filament	Lug No. 6 (Blue) to Lug No. 7 (Black)	Closed (5700 ohms)	Open	Open secondary 1st A.F. transformer or connection
	Stationary contact (closest to casting) of volume control to —F2	Closed (6.5 ohms)	Open	Open section of filament and bias resistor or connection
	—F1 to +F1	Closed (25 ohms)	Open	Open section of filament and bias resistor or connection
	+F2 to —F2	Closed (25 ohms)	Open	Open section of filament and bias resistor or connection
	+F1 to —F3	Closed	Open	Open connection
	—F3 to +F3	Closed (585 ohms)	Open	Open center tapped detector filament resistor
	Remove Pilot Lamp			
	+F3 to Lug 8 (Green)	Closed (40 ohms)	Open	Open pilot lamp resistor

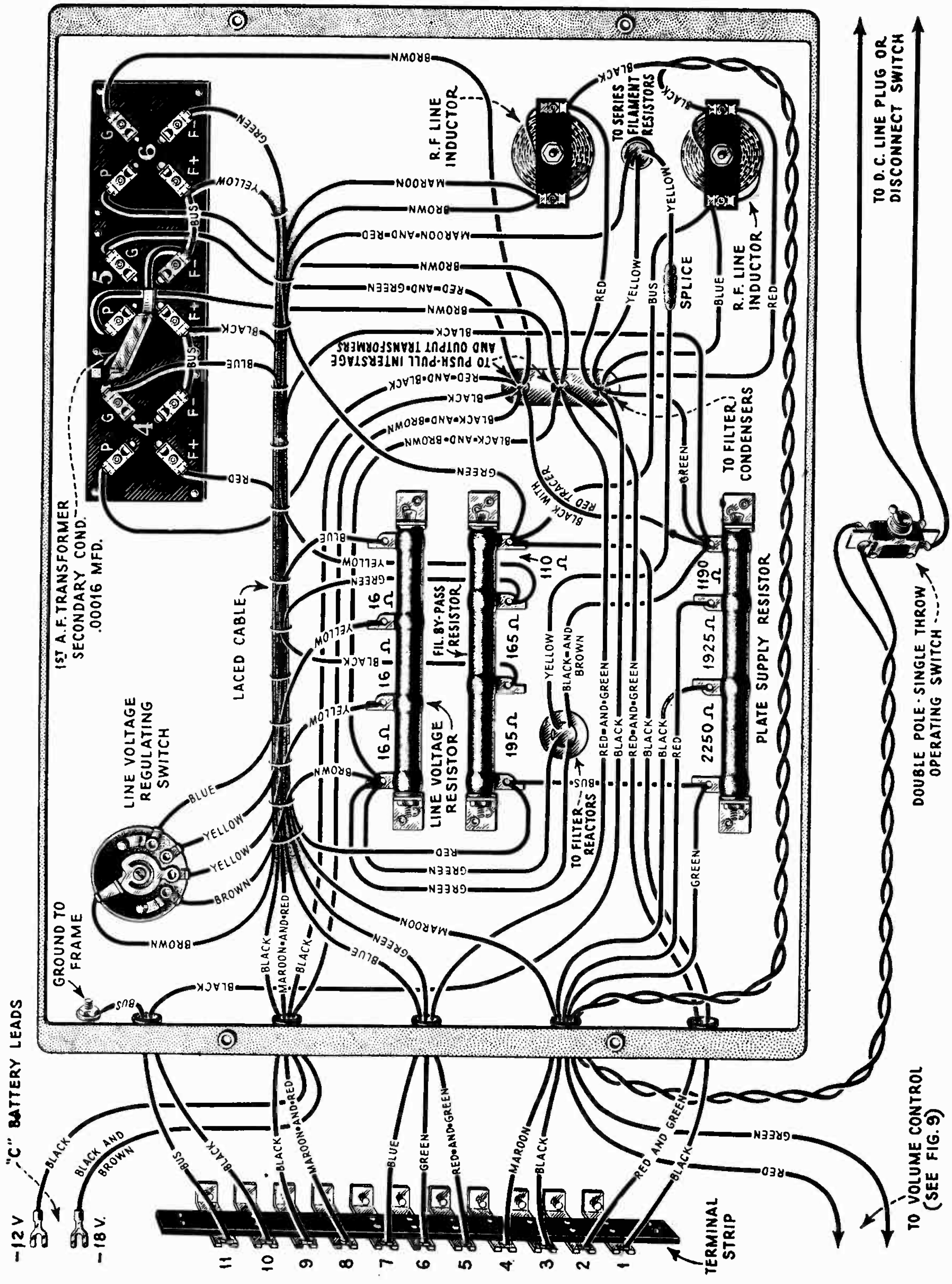

Figure 11—Wiring diagram of the socket power unit

SOCKET POWER UNIT CONTINUITY TEST CHART

Line voltage switch at No. 4—Operating Switch "On"

Test Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused by
G4 to Lug No. 7	Closed	Open	Open connections
P4 to Lug No. 9	Closed (1500 ohms)	Open	Open primary of push-pull interstage transformer
P5 to P6	Closed (380 ohms)	Open	Open primary of output transformer
P4 to P5	Closed (1880 ohms)	Open	Open primary of output transformer, primary (P1) of push-pull transformer or choke
Lug No. 2 to Lug No. 5	Closed (1 ohm approx.)	Open	Open secondary of output transformer, or connections
G5 to —12 v. "C" Battery Lug	Closed (5450 ohms)	Open	Open secondary (S1) of push-pull transformer
G6 to —18 v. "C" Battery Lug	Closed (3650 ohms)	Open	Open secondary (S2) of push-pull transformer
Green volume control lead to Lug No. 1	Closed (470 ohms)	Open	Open section of R2, or connections
Green volume control lead to Lug No. 9	Closed (5365 ohms)	Open	Open section of R3, or connections
Lug No. 8 to Lug No. 4	Closed (344 ohms)	Open	Open series filament resistors, open choke, open section of R1, or open connections
Lug No. 1 to Lug No. 8 (Disconnect R3 from R2)	Open	Closed (268 ohms)	Shorted 3 mfd. condenser
Lug No. 1 to Lug No. 9 (Disconnect R3 from R2)	Open	Closed (Short)	Shorted 2 mfd. condenser
Lug No. 1 to Lug No. 10	Open	Closed	Shorted 0.5 mfd. condenser
Lug No. 4 to Lug No. 10	Open	Closed	Shorted 0.5 mfd. condenser
Lug No. 1 to —blade of D.C. plug, or disconnect switch	Closed (1.5 ohms)	Open	Open R.F. line choke, switch, or connections
Lug No. 4 to +blade of D.C. plug, or disconnect switch	Closed (1.5 ohms)	Open	Open R.F. line choke, switch, or connections
Lug No. 6 to Lug No. 7	Open	Closed	Shorted 1st A.F. secondary condenser
+F5 to —F5	Closed (165 ohms)	Open	Open filament resistor section of R2, or connections
+F5 to —F6	Closed (275 ohms)	Open	Open tapped filament resistor section of R2, or connection
—F5 to +F6	Closed	Open	Open connection
—F4 to +F4	Closed (195 ohms)	Open	Open filament resistor section of R2, or connection

R46 (DC)

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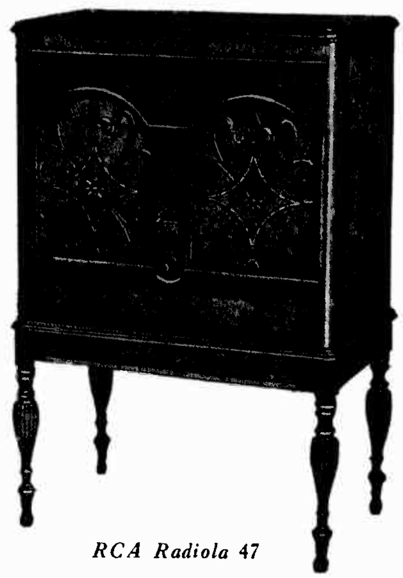

RCA Radiola 47

First Edition—30M

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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 Department 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 Department 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

PART I—SERVICE DATA ON RECEIVER

PART II—ASSEMBLY REMOVALS

PART III—SERVICE DATA ON MAGNETIC PICK-UP

PART IV—SERVICE DATA ON PHONOGRAPH MOTOR AND AUTOMATIC STOP

PART V—SERVICE DATA ON AUTOMATIC STOP

ILLUSTRATIONS

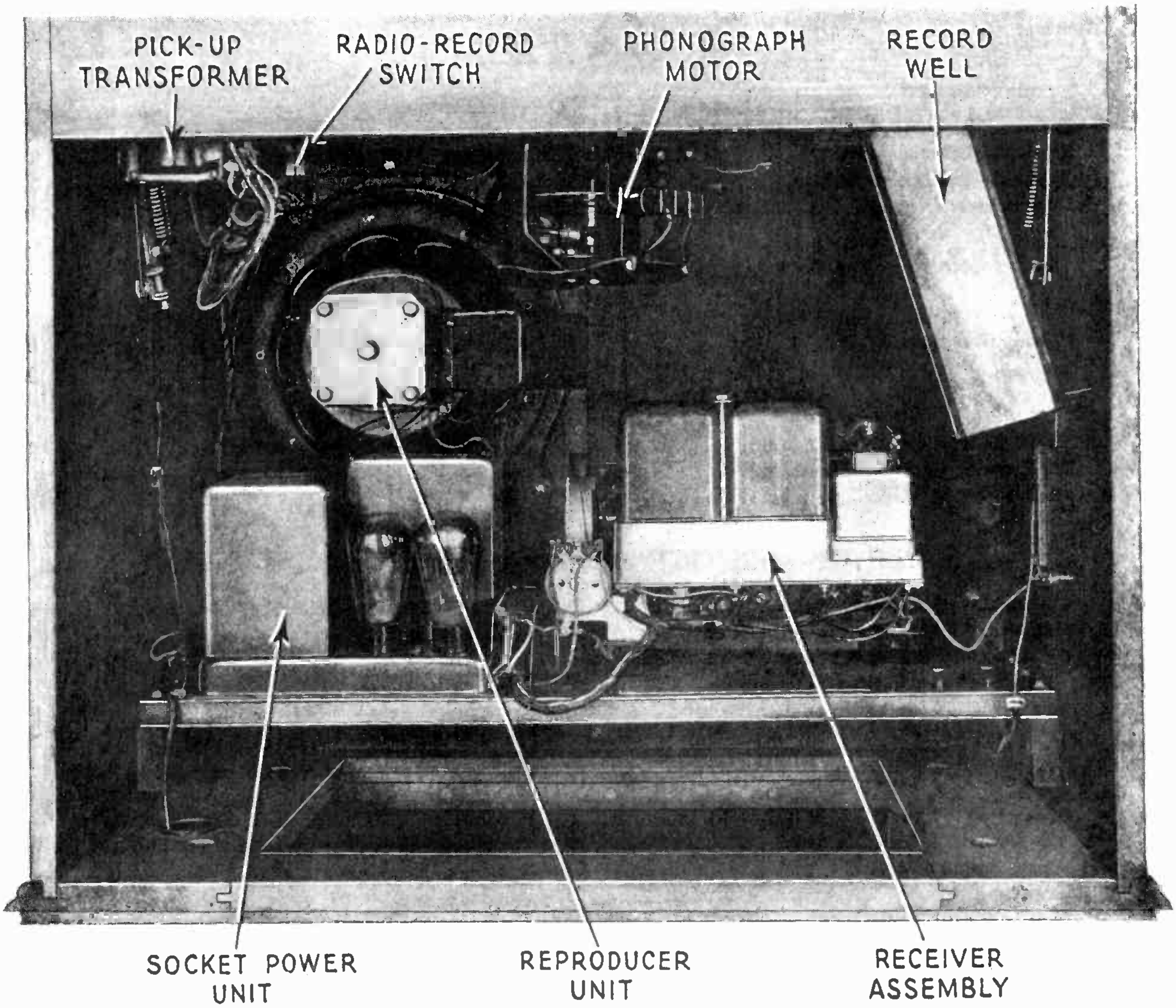

Figure 1—Rear interior cabinet view showing main assemblies

ADJUSTMENT OF LID MECHANISM

A spring mechanism is provided on each lid stop that balances the lid at any opening position. (See Figure 1). Failure of proper operation is indicated by the lid either continuing to open or close after the hand is removed. If this condition is present adjust as follows:

(a) Remove the rear panel of Radiola 47 to gain access to the adjusting screws for the balancing springs.

(b) If the lid continues to open after being released, too much tension is on the springs. Reduce the tension by turning the adjusting screws counter-clockwise gradually until normal operation is secured.

(c) If the lid closes upon release of the hand insufficient tension exists at the springs. Increase the tension gradually by turning the adjusting screws clockwise until normal operation is secured.

If the springs have lost their tension they must be replaced. If a replacement spring is not available, try removing a turn from the old spring.

RCA RADIOLA 47

SERVICE NOTES

Prepared by RCA Service Department

ELECTRICAL SPECIFICATIONS

Voltage Rating	105-125 Volts
Frequency Rating	50-60 Cycles or 25-40 Cycles
Power Consumption (Radio)	100 Watts
Power Consumption (Phonograph)	135 Watts
Recommended Antenna Length	25-60 Feet
Type of Circuit	Screen Grid Tuned R.F.
Number and Types of Tubes	3 UY-224, 1 UX-245 and 1 UX-280—Total 5
Number of R. F. Stages	2
Type of Detector	Bias Power
Number of A. F. Stages (Radio)	1
Number of A. F. Stages (Phonograph)	2
Type of Rectifier	Full Wave—UX-280
Type of Loudspeaker	Dynamic 300-330 V, 40-45 M. A. Field
Type of Pick-up	Low Impedance Flexible Armature
Type of Phonograph Motor	Induction

PHYSICAL SPECIFICATIONS

Height (Lid Open)	57 inches
Height (Lid Closed)	45 inches
Width	29¾ inches
Depth	18½ inches
Weight, Net	125 lbs.
Weight, Packed in Standard Packing Case	200 lbs.
Packing Case Dimensions	22½x35x49 inches

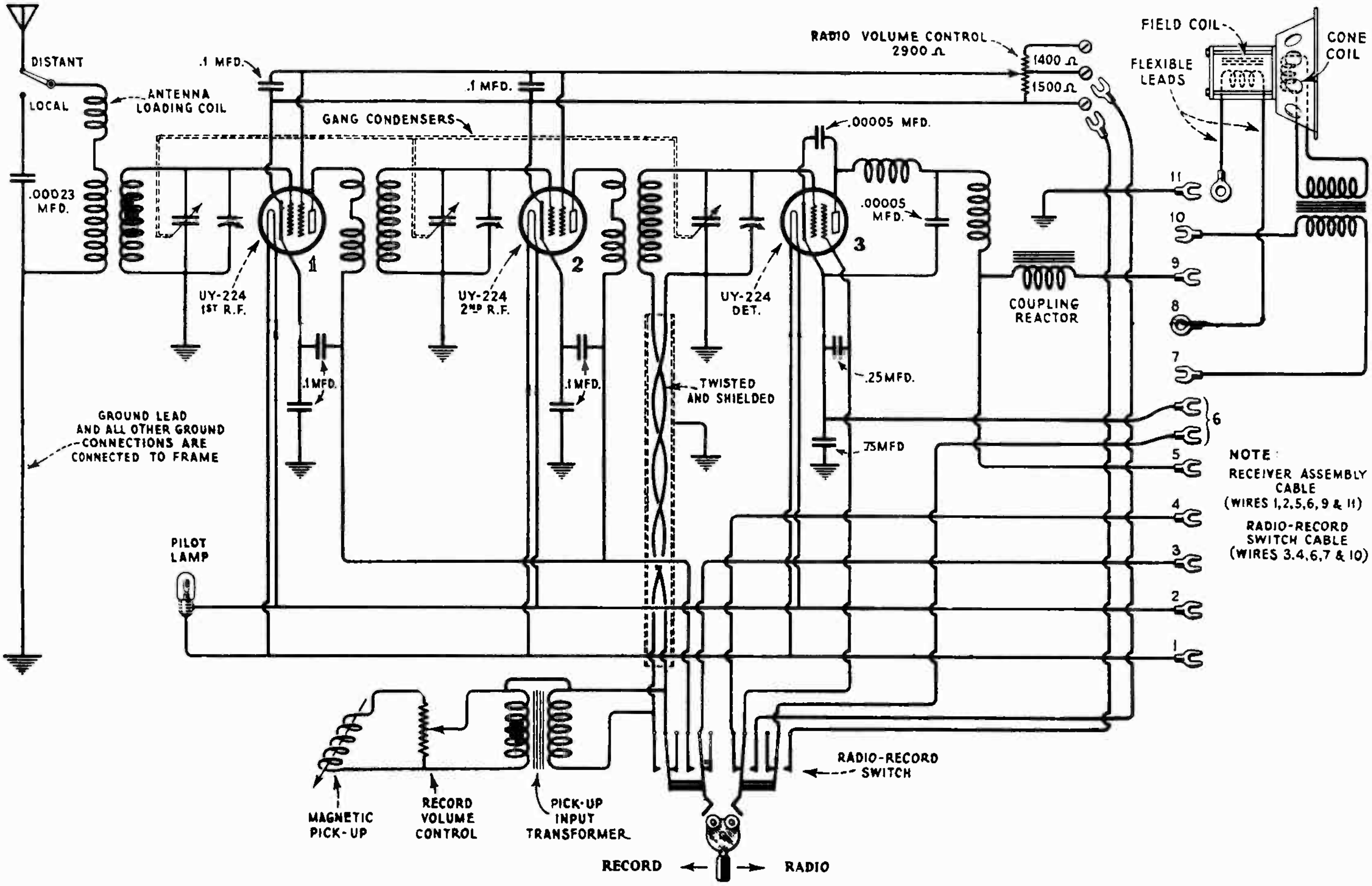

Figure 2—Schematic circuit diagram of receiver, phonograph pick-up and reproducer

INTRODUCTION

RCA Radiola 47 is a combination A.C. operated screen grid type radio receiver and an electrically operated phonograph. Excellent quality of output reproduction is secured from both the radio and phonograph due to correct design and use of Radiotron UX-245 power amplifier. All the mechanism is housed in a console cabinet of pleasing proportions. Figure 1 illustrates a rear interior cabinet view, Figure 2 a schematic circuit of the receiver and Figure 3 a schematic circuit of the socket power unit. Figure 4 illustrates a top view of the receiver assembly.

The radio receiver consists of two tuned R.F. stages and a tuned power detector using Radiotrons UY-224, and an impedance coupled power amplifier using Radiotron UX-245. Radiotron UX-280 is used as a full wave rectifier for converting alternating current into pulsating direct current which, after suitable filtering, is used as the plate and grid supply to all other Radiotrons and field supply to the dynamic loudspeaker.

The phonograph uses the RCA low impedance, flexible armature type pick-up and a two-stage power amplifier. The power amplifier of both the receiver and S. P. U. consists of a Radiotron UX-245. The output of both the radio receiver and the phonograph is fed into a dynamic type loudspeaker similar to that used in Radiolas 46 and 66. The motor used to turn the phonograph turntable is of a special induction type that gives excellent service with a minimum amount of wear and tear. It is noiseless in operation.

PART I—SERVICE DATA ON RADIO RECEIVER

The receiver assembly and S. P. U. used in Radiola 47 are very similar in both mechanical and electrical characteristics to that used in Radiola 46. For service information on these units other than that contained herein, the reader is referred to the RCA Radiolas 44 and 46 Service Notes. This includes:

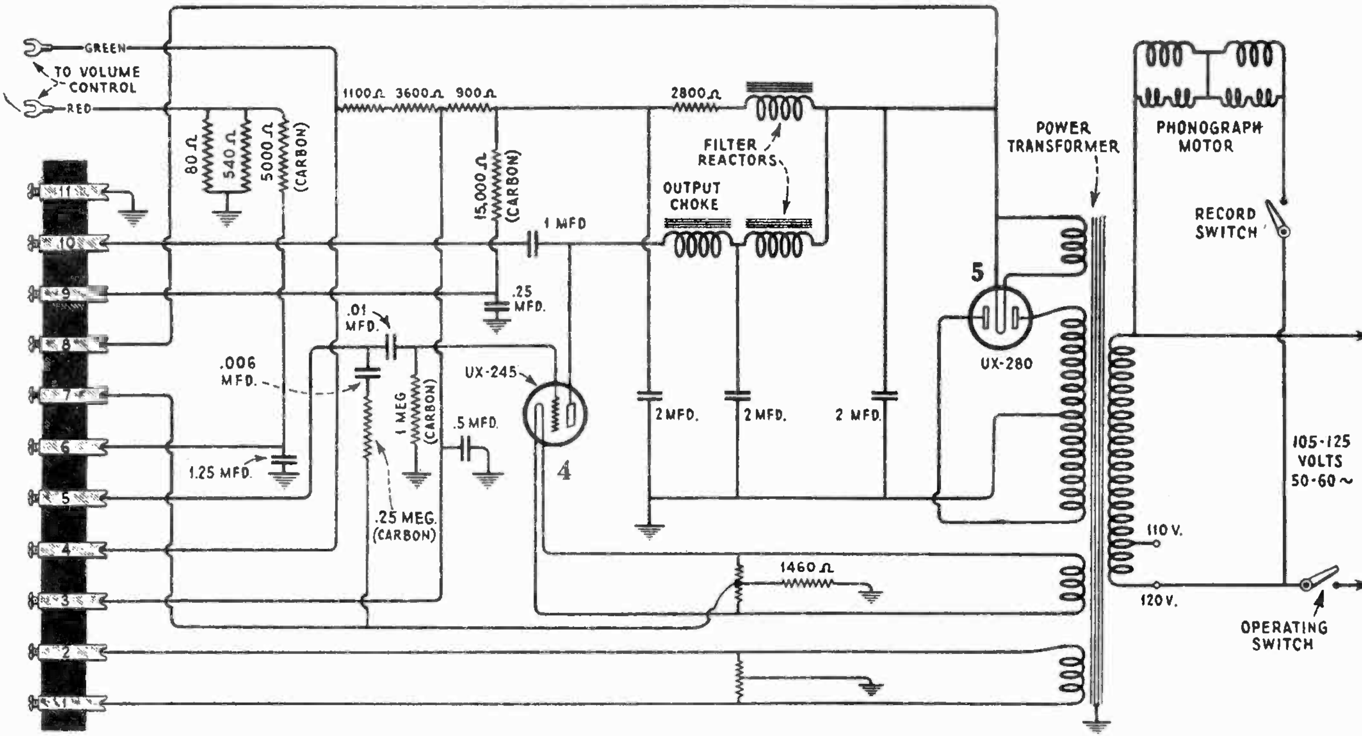

Figure 3—Schematic circuit diagram of socket power unit

Theory of Operation of A.C. Screen Grid Radiotron.
Antenna.
Antenna (Indoor Type).
Ground.
Special antenna installation for noisy locations.
Radiotrons.
Adjustments for low line voltage.
Jerky action of station selector.
Use of local-distant switch.
Installation of pilot lamp.
Shields.
Antenna system failures.
Radiotron sockets and prongs.
Improperly operating volume control.
Broken condenser drive cord.
Adjusting line-up condensers.
Excessive hum.
Acoustic howl.
Low volume.
Distorted or noisy reproduction.
Audio howl.
Uncontrolled oscillations.
Voltage supply system.
Testing filter condensers and output condenser and choke.
Checking resistance values.

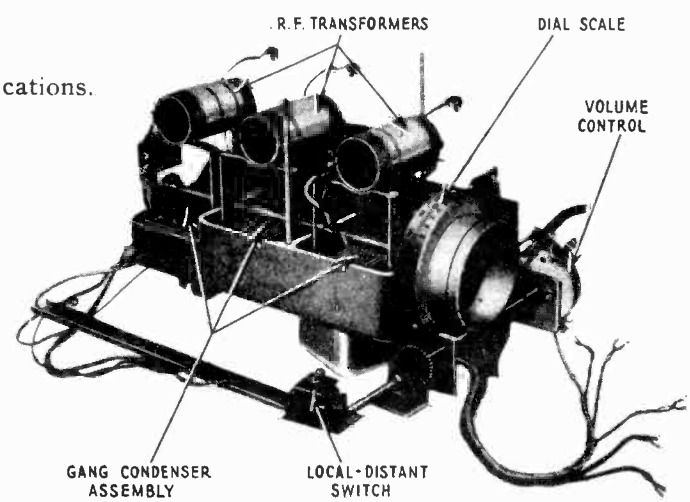

Figure 4—Top view of receiver assembly showing parts

(1) VOLTAGE READINGS

The following readings are taken with a Weston Model 537, Type 2, or other test set giving similar readings. These voltages are approximate only, due to the oscillating condition of the circuits. However, they enable the service man to obtain a satisfactory check on the continuity of the circuits to the various sockets. The screen grid voltages are not readable, due to the reversal of the polarity at the contact points.

When making tests remove only the shield and control and control grid connection of the tube whose voltage is under measurement. Do not tie the control grid connection to the control grid cap of the tube in the test set. It is not practical to test the control grid voltage directly at the sockets.

SOCKET VOLTAGES—RADIOLA 47

Volume Control at Minimum—Radio-Record Switch at "Radio"

Socket No.	Cathode to Heater Volts	Fil. to Control grid Volts	Cathode or fil. to plate Volts	Plate Current Millamperes	Filament or Heater Volts
1	2.1	—	190	0	2.35
2	2.1	—	185	0	2.35
3	18	—	120	3.0	2.35
4	—	6.0	225	29.0	2.35

Volume Control at Maximum—Radio-Record Switch at "Radio"

Socket No.	Cathode to Heater Volts	Fil. to control grid Volts	Cathode or fil. to plate Volts	Plate Current Millamperes	Filament or Heater Volts
1	2.1	—	165	3.5	2.35
2	2.1	—	165	3.0	2.35
3	16	—	115	2.0	2.35
4	—	6.0	225	29.0	2.35

TERMINAL STRIP VOLTAGES

The following voltages taken at the S. P. U. terminal strip with the receiver operating and all tubes and shields in place are correct when the line voltage is within the limits for the transformer tap being used.

Radiola 47

Terminals	Volume Control at		Voltage Measured
	Minimum	Maximum	
1 to 2	2.5 A.C.	2.5 A.C.	Heater voltage of Radiotrons UY-224
3 to red V. C. lead	185 D.C.	170 D.C.	Plate voltage of Radiotrons Nos. 1 and 2
4 to 6	70 D.C.	65 D.C.	Screen grid voltage of Radiotron No. 3
6 to 9	195 D.C.	180 D.C.	Plate voltage of Radiotron No. 3
6 to 11	5.0 D.C.	5 D.C.*	Control grid voltage of Radiotron No. 3
8 to 11	320 D.C.	320 D.C.	Total D. C. output from rectifier
Red V.C. lead to 11	2.1 D.C.	2.1 D.C.	Control grid voltage of Radiotrons Nos. 1 and 2
Arm of V.C. to red V. C. lead	0	70 D.C.	Screen grid voltage of Radiotrons Nos. 1 and 2

*Be sure no signal is tuned in.

(2) RCA RADIOLA 47 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly and socket power unit of Radiola 47. Disconnect the antenna and ground leads, the cable connections at the terminal strip of the S.P.U., and the A.C. supply cord at its outlet. Refer to Figures 5, 6 and 7. All resistance values noted are D.C.

CONTINUITY TEST CHART

Receiver Assembly and Adjacent Circuits

Circuit	*Test Terminals*	*Correct Effect*	*Incorrect Effect*	
			Indication	*Caused by*
Radio-Record Switch at Radio Position				
Grid and Plate	P1 to Lug No. 3 (Green lead from Radio-Record Switch Cable)	Closed (60 Ohms)	Open	Open primary of 1st R.F. transformer, or defective Radio-Record Cable or switch
	P2 to Lug No. 3 (Green lead from Radio-Record Switch Cable)	Closed (60 Ohms)	Open	Open primary of 2nd R.F. transformer, or defective Radio-Record Cable or switch
	CG3 to Ground	Closed (3 Ohms)	Open Short	Open secondary of 3rd R.F. transformer, or connections Shorted tuning, or trimming condenser
Radio-Record Switch in Center Position				
Grid and Plate	CG1 to Ground	Closed (3 Ohms)	Open Short	Open secondary of 1st R.F. transformer Shorted tuning or trimming condenser
	SG1 to arm of volume control	Closed (Short)	Open	Open connections
	CG2 to Ground	Closed (3 Ohms)	Open Short	Open secondary of 2nd R.F. transformer Shorted tuning or trimming condenser
	SG2 to arm of volume control	Closed (Short)	Open	Open connections
	CG3 to Ground	Closed (1,200 Ohms)	Open	Open secondary of 3d R.F. transformer, open secondary of pick-up transformer, or connections
	SG3 to Lug No. 4 (Red lead from Radio-Record Switch cable)	Closed (Short)	Open	Open connections, or defective Radio-Record Cable or switch
	Across volume control	Closed (2,900 Ohms)	Open	Open volume control
	P3 to Lug No. 9 (Black lead from receiver cable)	Closed (6,000 Ohms)	Open	Open R.F. filter coils, or coupling reactor

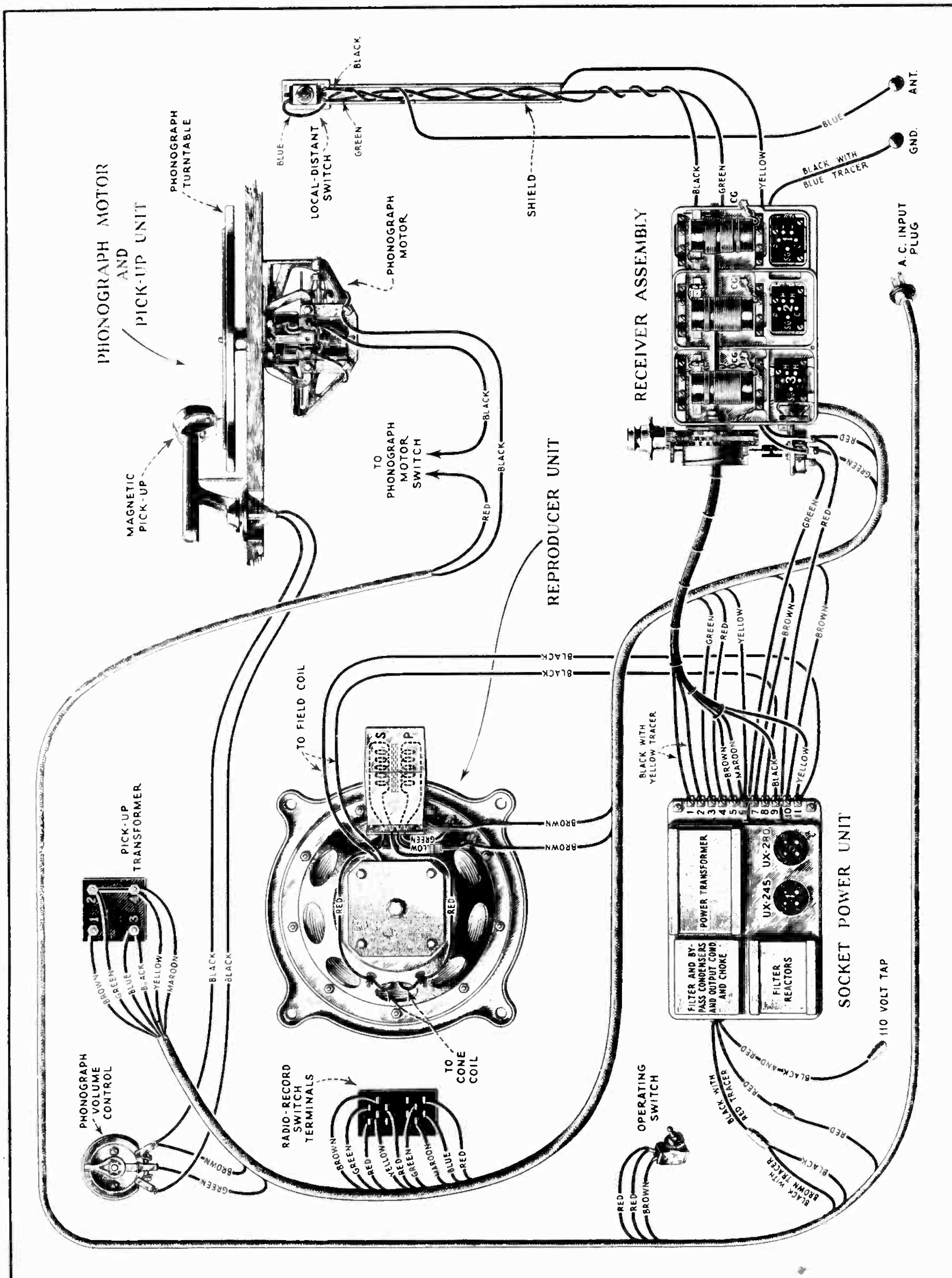

Figure 5—Complete layout of main assemblies showing cable connections

CONTINUITY TEST CHART—Continued

Circuit	*Test Terminals*	*Correct Effect*	*Incorrect Effect*	
			Indication	*Caused by*
Grid and Plate	P3 to Lug No. 5 (Brown lead from Receiver Cable)	Closed (400 Ohms)	Open	Open R.F. filter coils
			Closed (200 Ohms)	Both 0.00005 mfd. condensers shorted
	Unscrew Pilot Lamp From Socket			
Heater	One heater contact of sockets Nos. 1, 2 and 3 to Lugs 1 or 2	Closed (Short)	Open	Open connections
	Other heater contact of sockets Nos. 1, 2 and 3 to Lugs 1 or 2	Closed	Open	Open connections
	Ant. to Ground (Switch at distant position)	Closed (30 Ohms)	Open	Open antenna loading coil or primary of 1st R.F. transformer
Miscellaneous	C1 to Ground	Open	Closed	Shorted .1 mfd. condenser
	C1 to P1	Open	Closed	Shorted .1 mfd. condenser
	C2 to Ground	Open	Closed	Shorted .1 mfd. condenser
	C2 to P2	Open	Closed	Shorted .1 mfd. condenser
	C3 to Ground	Open	Closed	Shorted .75 mfd. condenser
	C3 to SG3	Open	Closed	Shorted .25 mfd. condenser
	C3 to P3	Open	Closed	Either .00005 mfd. condenser in R.F. filter shorted
	C3 to Lug No. 6 (Maroon lead from Receiver Cable)	Closed (Short)	Open	Open connection
	Red Vol. Cont. lead from Radio-Record cable to Lug No. 6 (Yellow lead from Radio-Record Switch Cable)	Open	Closed	Defective Radio-Record Cable or switch

Replacements of volume control—See NOTE, Part II, Section 2, p. 16.

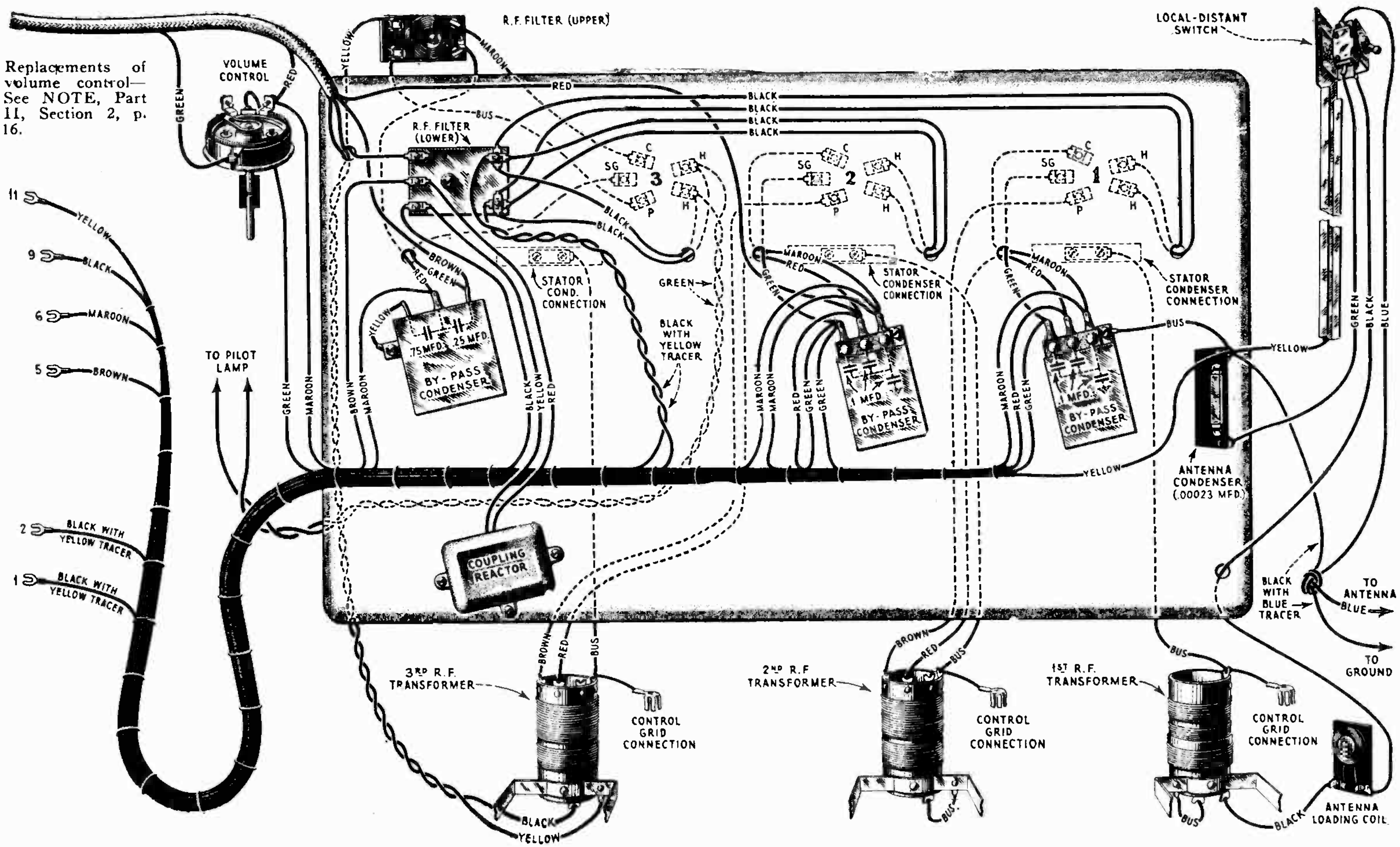

Figure 6—Receiver wiring diagram

NOTE—Volume control replacements should be made with the center terminal inserted as illustrated, or at the electrical position indicated in Figure 2. Volume control replacements are furnished complete with the center terminal as a separate piece.

CONTINUITY TEST CHART—Continued

Circuit	Test Terminals	Correct Effect	Incorrect Effect — Indication	Incorrect Effect — Caused by
Insulate Movable Arm on Volume Control With Bit of Paper				
Miscellaneous	C1 to SG1	Open	Closed	Shorted .1 mfd. condenser
	C2 to SG2	Open	Closed	Shorted .1 mfd. condenser
Radio-Record Switch at Record Position				
Miscellaneous	P1 to Lug No. 3 (Green lead from Radio-Record Switch Cable)	Open	Closed	Defective Radio-Record Cable, switch or connections
	P2 to Lug No. 3 (Green lead from Radio-Record Switch Cable)	Open	Closed	Defective Radio-Record Cable, switch or connections
	SG3 to Lug No. 4 (Red lead from Radio-Record Switch Cable)	Open	Closed	Defective Radio-Record Cable, switch or connections
	SG3 to Green Vol. Cont. lead from Radio-Record Switch Cable	Closed (Short)	Open	Defective Radio-Record Cable, switch or connections
	Red Vol. Cont. lead from Radio-Record Switch Cable to Lug No. 6 (Yellow lead from Radio-Record Switch Cable)	Closed (Short)	Open	Defective Radio-Record Cable or switch

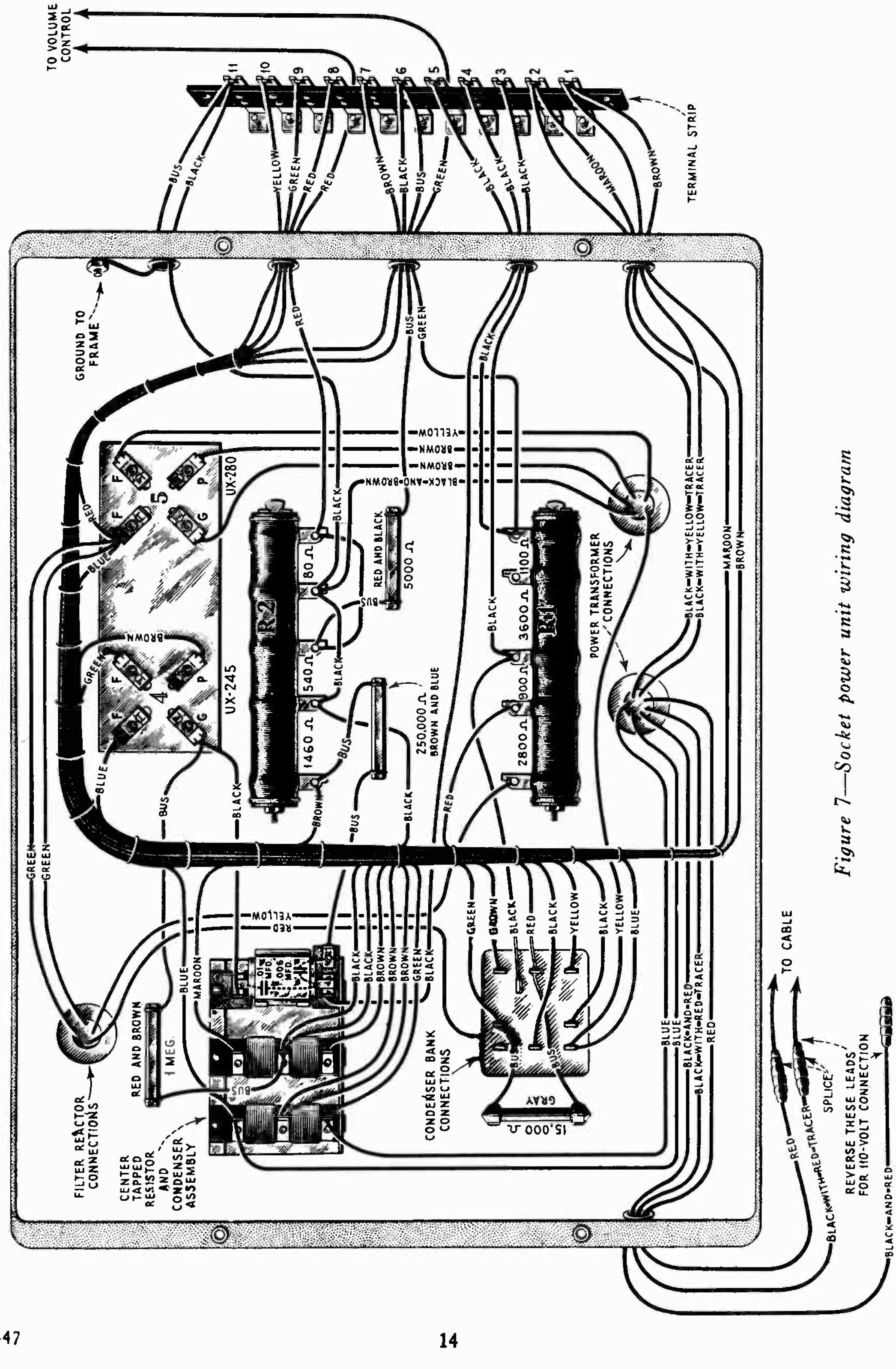

Figure 7—Socket power unit wiring diagram

CONTINUITY TESTS

Radiola 47 S. P. U.

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
	1 to 2	Closed (Short)	Open 50 Ohms	Open UY-224 heater winding and center tapped resistance unit Open UY-224 heater winding
	3 to 4	Closed (4,700 Ohms)	Open	Open 3,600 and 1,100-ohm section of R-1
	3 to 8	Closed (5,400 Ohms)	Open	Open 2,800 or 900-ohm section of R-1 or filter reactor
	3 to 9	Closed (15,900 Ohms)	Open	Open 15,000-ohm resistor or 900-ohm section of R-1
	5 to G4	Open	Closed	Shorted .01 mfd. condenser
	5 to 11	Open	Closed (weak) Short	Shorted .006 mfd. condenser Grounded .006 mfd. condenser or connections
	6 to 11	Closed (5,070 or 5,420 Ohms)	Open	Open 5,000-ohm resistor or 540 and 80-ohm section of R-2 (in some receivers the 5,000-ohm resistor is replaced by two, one being 2,000 ohms and one 3,350 ohms connected in series)
	7 to 11	Closed (1,460 Ohms)	Open	Open 1,460-ohm section of R-2
	10 to P4	Open	Closed	Shorted 1 mfd. output condenser
Miscellaneous	11 to Ground	Closed (Short)	Open	Open connection
	G4 to 11	Closed (weak) (1 meg.)	Open Short	Open 1 meg. resistor Shorted or grounded 1 meg. resistor or connections
	P4 to 8	Closed (1,400 Ohms)	Open	Open filter reactor or output choke
	P5 to G5	Closed (250 Ohms)	Open	Open high voltage winding of power transformer
	Red. V.C. lead to 11	Closed (70 Ohms)	Open	Open 80 and 540-ohm section of R-2
	Across fil. contacts of socket No. 4	Closed (Short)	Open 50 Ohms	Open UX-245 filament winding and center tapped resistor Open UX-245 filament winding
	Across fil. contacts of socket No. 5	Closed (Short)	Open	Open UX-280 filament winding
	Across A.C. input plug (Op. Sw. "On"	Closed (4 Ohms)	Open	Open primary of power transformer or defective operating switch
	8 to 11	Open	Closed	One or more 2 mfd. filter condensers shorted, shorted .25 mfd. condenser, or shorted .5 mfd. condenser

PART II—ASSEMBLY REMOVALS

(1) TO REMOVE MOTOR

(a) Place the pick-up swivel arm clear of the turntable. Remove needle from the pick-up and remove turntable.
(b) Release external connections to the motor.
(c) Release speed adjusting arm from adjusting screw cam.
(d) Remove cap screws with felt washers holding motor to the top panel and remove motor to a convenient place for further work. *Be sure to properly replace felt washers when replacing the motor.*

(2) TO REMOVE RECEIVER ASSEMBLY

(a) Remove station selector and volume control knobs.
(b) Open back and remove the three machine screws holding the receiver to the shelf.
(c) Remove all connections of the "Radio-Record" switch, and receiver cables from the S.P.U. terminal strip. Remove also the two brown leads from the "Radio-Record" switch cable to the loudspeaker input terminals.
(d) Remove the record well by releasing the five screws holding the supporting strips to the cabinet.
(e) Release "Local-Distant" escutcheon plate to enable easy removal of the "Local-Distant" switch and shield.
(f) The receiver chassis may now be pulled free from the cabinet and placed at any location within radius of the "Radio-Record" switch cable for any further work.

NOTE—Volume control replacements are furnished complete with the center terminal as a separate piece. It should be inserted at the electrical position indicated in Figure 2 when replacement is made.

(3) TO REMOVE S. P. U.

(a) Using a short screw driver the four machine screws may be removed from the under side of the shelf. Releasing the shelf by removing the wood screws at each end will facilitate the removal of the S.P.U.
(b) Remove all connections from the terminal strip and volume control.
(c) Remove tape from S.P.U. connections to the A.C. supply line and unsolder to permit removal of S.P.U.
(d) To replace make sure proper connections are made from S.P.U. to the A.C. supply line. The connections should be carefully resoldered, and first, wrapped with a covering of rubber tape. Then cover the rubber tape with friction tape to complete the joint.

(4) TO REMOVE TONE ARM AND PICK-UP

(a) Remove needle from the pick-up.
(b) Remove three screws holding pivot of the tone arm to the top panel.
(c) Release the two black leads that go to the phonograph volume control.
(d) The tone arm and pick-up may now be easily removed.

(5) TO REMOVE DYNAMIC LOUDSPEAKER UNIT

In order to replace a cone, field coil, or make any cone adjustment it will be necessary to remove the loudspeaker unit as follows:

(a) Remove S.P.U. as described above.
(b) Remove all connections to loudspeaker unit.
(c) Remove the four large machine screws holding the loudspeaker frame to the cabinet and lift clear from the cabinet.

PART III—SERVICE DATA ON MAGNETIC PICK-UP

Service work on the magnetic pick-up may be divided into the following classes:

1. Adjustment of the armature
2. Replacing rubber pivot supports and clamping block
3. Replacing coil
4. Replacing armature.

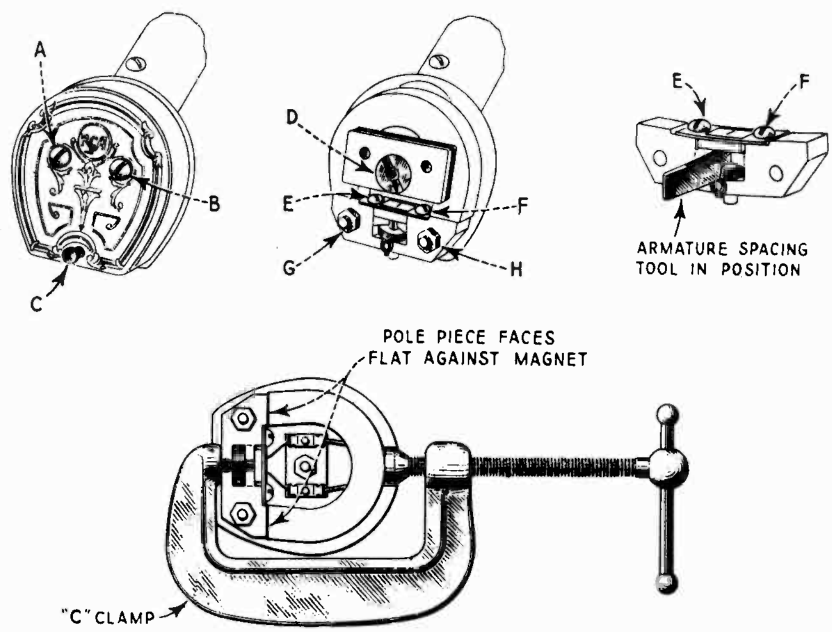

Figure 8—Phonograph pick-up showing various adjustments

(1) ADJUSTMENT OF ARMATURE

Adjustment of the armature consists essentially of having it in its electrical center between the two pole pieces. Need for this adjustment is usually evidenced by distortion during phonograph reproduction with blasting, especially on the low notes. The following procedure should be adopted when making this adjustment.

(a) Remove screws A, B and C (See Figure 8) from the pick-up, and remove the cover thereby released.

(b) Remove the nut "D" (See Figure 8) that holds the magnet bracket and fibre spacers. Mark the magnet poles and the pole pieces so that when they are replaced they will be in their original position. The magnet is now free to be released. Place a keeper such as a large nail across the magnet poles and remove it from the pole pieces.

(c) With a small screw driver loosen screws E and F. The small piece of metal that holds the clamping block may now be moved either way until the armature is approximately between the two pole pieces. Judging the center by the eye is sufficiently accurate for this adjustment.

(d) After the center has been located the two screws, E and F should be tightened. The magnet may now be replaced, the keeper removed and the pick-up re-assembled in the reverse manner of that used to remove it. While re-assembling be sure that all dirt is completely removed from any part of the magnet armature or other parts of the pick-up.

MAGNETIC PICK-UP SERVICE DATA CHART

Indication	Cause	Remedy
No Reproduction	Poor volume control contact between arm and resistance	Clean volume control resistance with a pipe cleaner and any of the various cigarette lighter fluid
	Open pick-up coil or connections	Repair any loose connections by resoldering or replace an open coil as described in Part III, Section 3
Weak or Distorted Reproduction	Loose needle	Tighten needle in socket with needle set screw
	Dirty contact in volume control	Clean volume control resistance and contact arm
	Armature out of adjustment	Center armature as described in Part III, Section 1
	Defective rubber damping block or pivot supports	Replace rubber damping block and pivot supports as described in Part III, Section 2
	Dirt in armature air gap	Clean all dirt from air gap by means of a blower or disassemble pick-up and clean. Remove rust from armature if necessary.
	Weak magnet	Remagnetize magnet by taking to magneto repair shop. Place keeper across pole faces until magnet is again in place in the pick-up. Making repairs without placing a keeper on the magnet is the easiest way of having the magnet lose its magnetism.
	Needle holder rattle	If the needle hole of the pick-up cover touches the set screw that holds the needle, a rattle will result. Relocate the cover by shifting the magnet clamp

(2) REPLACING RUBBER PIVOT SUPPORTS AND DAMPING BLOCK

After considerable time, or due to climatic conditions, the rubber pivot supports and the rubber damping block may become hardened and require replacement. Such hardening is usually evidenced by the armature being set to one side and not moving easily. As with other rubber articles, these parts give best life when used frequently. Also the pick-up should not be supported by the needle resting against the record or turntable as such use will tend to set the armature to one side. The pick-up should hang free.

Usually the rubber pivot supports and damping block will require replacement at the same time and are therefore supplied in sets of three. When a replacement is necessary such a set should be procured. If such a set is not available and a repair is urgently needed the damping block may be cut from a piece of automobile inner tube. The pivot supports may be small strips cut from the thin portion of a baby's rubber nipple making sure it is the best quality obtainable.

Use the following procedure when making these replacements:—

(a) Procure an RCA magnetic pick-up feeler tool. This is RCA Part No. 2677, or it may be easily constructed by referring to Figure 9.

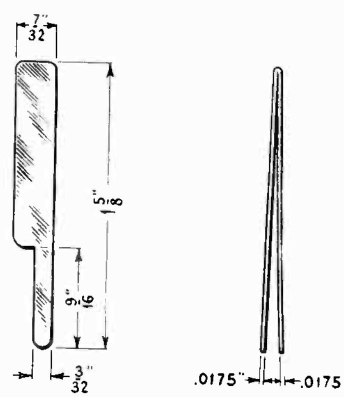

Figure 9—Magnetic pick-up armature spacing tool

(b) Remove the pick-up case and the magnet from the pole pieces as described in Part III, Section 1.

(c) Unsolder the leads to the coil at the terminal strip inside of the pick-up case. Remove nuts G and H, Figure 8, and release the pole pieces from the back support. Now remove screws E and F and disassemble the pole pieces, armature and coil. The old rubber should be completely removed from all parts and the parts should be scraped clean with a knife.

(d) Place the new rubber pivot supports in their proper place. This may be either tubing or strips. Re-assemble the pole pieces and coil and new rubber damping block in place with feeler gauge in place as shown in Figure 8. Hold together as tight as possible. Tighten screws E and F. Now remove tool. Be sure the cambric cover is in place between the coil and pole pieces.

(e) Place the assembled mechanism against the magnet, making sure the poles are against the proper pole pieces, and replace assembly on tone arm correctly. Put on the nuts G and H, but do not tighten. Place the magnet bracket and fibre spacers in place and tighten in their correct position. Now with 2-inch "C" clamp tighten the pole pieces as shown in Figure 8 until the faces of the pole pieces are flat against the magnet pole. Now tighten nuts G and H. The pick-up is now re-assembled and the cover may be replaced and the Radiola returned to normal operation. If the cover does not fit properly it may be necessary to relocate the position of the magnet clamp.

(3) REPLACING PICK-UP COIL

The pick-up coil may be replaced in the same manner as the rubber supports and damping blocks, the difference being that the coil is replaced instead of the rubber pieces. The cambric cover between the coil and pole pieces should be removed from the old coil and placed around the new one. All adjustments are the same.

(4) REPLACING PICK-UP ARMATURE

The pick-up armature may be replaced in the same manner as the rubber supports or coil, the difference being that the armature is the part replaced. All adjustments are the same. In some cases replacement of the armature is made necessary due to rust. If a new armature is not available, the old one may be temporarily repaired by removing all rust with sandpaper. This is not a permanent repair due to the fact that the sandpapered surface will quickly rust, so therefore a new armature should be installed as soon as available.

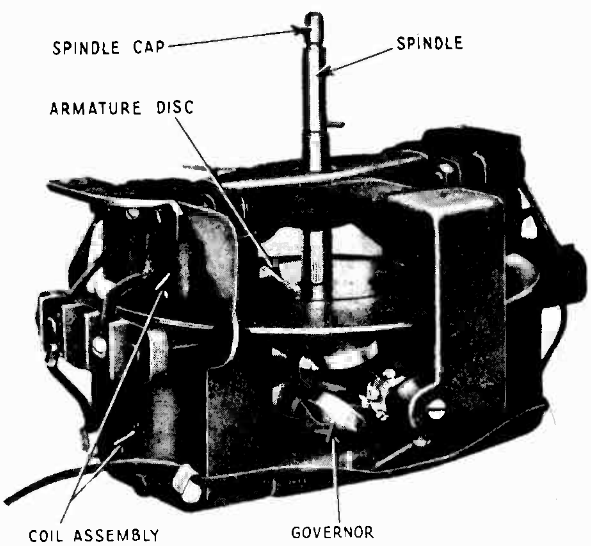

Figure 10—Phonograph motor mechanism

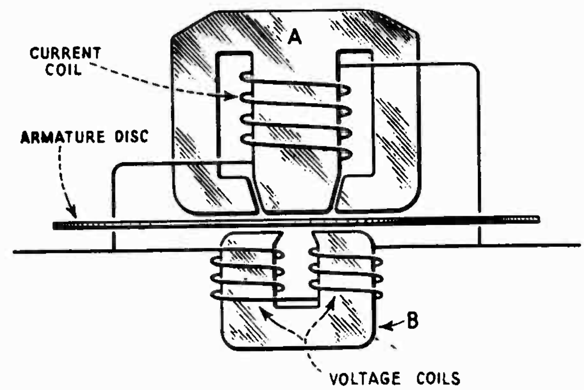

Figure 11—Phonograph motor coil connections

PART IV—SERVICE DATA ON PHONOGRAPH MOTOR AND AUTOMATIC STOP

(1) THEORY OF OPERATION OF RCA PHONOGRAPH MOTOR

This motor operates on the same motor principles as the induction type watt hour meter which may be practically stated as follows:—

By referring to Figure 11 the essential elements of the motor can be seen. On the laminated core A is the current coil with few turns, and on the laminated core B are the voltage coils of many turns, or having much more inductance than the current coil. This causes the magnetic flux from core B to lag behind that of core A. Without going into further technical description, this condition with the design and position of the cores and correct connections of the coils causes the total magnetic flux to "glide" laterally through the air gap in the direction of the armature disc's motion. This action is continuous as long as alternating current is flowing correctly through the coils of the motor.

This "gliding" flux in cutting the armature disc sets up eddy currents in such a direction that the magnetic flux of the eddy currents reacting with the "gliding" flux from cores A and B causes a torque to be developed in the direction of the "gliding" flux. (This torque is due to attraction of unlike magnetic poles and repulsion of like magnetic poles). Since the motion of the "gliding" field is continuous and in one direction, continuous rotation of the disc and drive of the motor is produced.

(2) SPEED REGULATION

In order to insure proper phonograph operation and reproduction the speed may be checked as follows:

(a) Place a record on the turntable and insert a small piece of paper under the edge of the record to serve as an indicator.

(b) Play the record in the normal manner and count the number of revolutions made by the turntable for one minute. The speed should be 78 revolutions per minute.

(c) Turning the speed regulating screw (Figure 10) clock-wise allows the motor to run faster and vice versa. Adjust by trial until the speed is 78 revolutions per minute as determined from a full minute's count.

NOTE:—The speed of the machine should be checked at least four or five times a year. Improper speed will cause distortion.

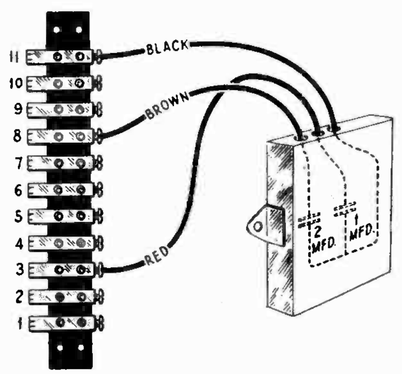

Figure 12—25-cycle condenser connections. This condenser is an additional part in all 25-cycle models.

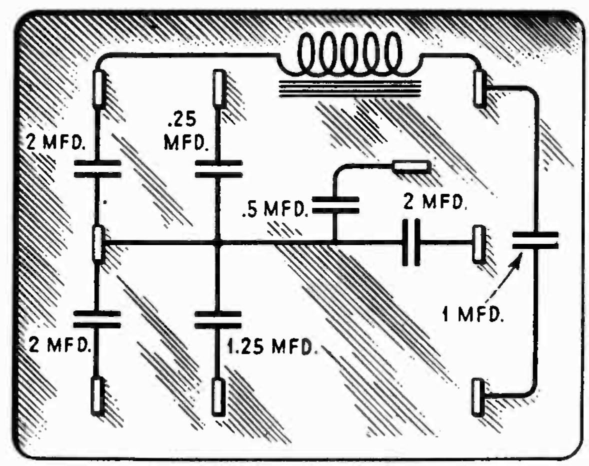

Figure 13—Internal connections of the condenser bank

(3) GOVERNOR

The governor will maintain a constant speed of the motor within a range of sudden voltage changes of 20 volts, providing all the parts are correctly adjusted. Any adjustment made on the motor (including lubrication), will have a certain effect on the regulation of speed and the speed adjustment should be checked as described in Part IV, Section 2 before the unit is again placed in service.

(4) LUBRICATION OF MOTOR

The various bearings and gears of the motor should be kept clean and should be lubricated at least once every six months. RCA Motor Oil and RCA Electric Motor Grease should be used and applied to the points indicated in the Radiola 47 Instruction Book. Before lubricating it is desirable that the parts first be cleaned with carbon tetra-chloride (Carbona) and all dirt and old grease removed. In addition to the regular lubrication all bright metallic parts except the motor disc should be covered with a light film of oil to prevent rusting.

Should RCA Motor Oil and Grease not be available any high grade light engine oil may be substituted for the oil and vaseline for the grease.

(5) SERVICE DATA ON PHONOGRAPH MOTOR

The following Service Data Chart indicates the cause and remedy for any difficulties which may be encountered in the operation of the phonograph motor. These are listed according to their indications:—

PHONOGRAPH MOTOR SERVICE DATA CHART

Indication	Cause	Remedy
Failure to run	Operating switch or record switch "off" or defective	Turn switches "On" or repair any defective switches
	No A. C. power at socket outlet	Check with a O-150-V. A. C. voltmeter
	Loose or open connection in the connector cord or plug	Repair any defective connections
	Wrong or open connections of motor coils	Check wiring and make any repairs necessary
	Jammed motor	Rotate turntable by hand with power on. If jammed examine motor and replace or repair part causing jamming
	Shipping blocks not removed	Remove paper blocks between disc and coils use to hold motor during shipment
Motor fails to maintain correct speed	Low line voltage	Check line voltage with a O-150 Volt A. C. voltmeter while motor is running and phonograph is in operation. The voltage must be between 105-125 for proper operation. See Part IV, Sec. 3
	Improper lubrication	Examine moving parts, bearings and gears. If oil and grease is gummy clean and lubricate as described in Part III. Section 4
	Motor improperly mounted or jarred in shipping	Loosen the three motor mounting screws and tighten alternately while motor is running. Do not tighten any screw sufficiently to cause binding or slowing down of the motor.
	Worn motor spindle ball bearing	Replace a worn ball bearing
	Weak motor coils	After checking all the above causes and the motor still fails to maintain speed replace one or both of the motor coils as described in Part IV, Section 9. It is possible for them to test electrically O. K. but be weak in operation.
Noisy operation	See Part IV, Section 6 for the cause and remedy of defects or improper adjustments that may cause noisy operation	
Hum	Loose coils or coil laminations	Tighten screws that hold coil cores together. If this does not correct the hum place a small wooden wedge between inside of coil and core.
	Cabinet hum	Tighten motor mounting screws or replace felt washers between motor and cabinet.

(6) NOISY OPERATION

There are several causes of motor noise other than hum, which is discussed in the Phonograph Service Data Chart (p. 22).

(a) Governor Springs.—A noise or rattle may sometimes be caused by loose or broken governor springs. Tighten all the governor spring screws. If this does not stop the noise, loosen the screws on the gear end of the governor springs and allow the motor to run for a minute or two to allow the springs to assume their correct position. Stop the motor and retighten the screws. If any of the springs are broken or badly out of balance, they should be replaced.

(b) Governor Bearings.—The thrust bearing at the gear end of the governor, may cause noise while the motor is running. Hold one finger over the end of the bearing and loosen the set screw which holds the bearing in position. Adjust the bearing to the most quiet running position and re-tighten the set screw.

If this procedure is not successful the position of the governor spiral relative to that of the governor drive gear should be shifted slightly until a condition of minimum spiral to gear noise is obtained.

To do this the set screw holding the thrust bearing at the gear end of the governor spindle is loosened and the bearing shifted slightly and re-clamped (loosening the bearing on the opposite end of the shaft first if necessary). Now, with the bearing at the disc end of the spindle loosened and one finger against it to prevent it from slipping out, start the motor. While the motor is running, press lightly against this bearing and clamp the set screw to hold it in place. The center of the worm should be approximately opposite the center of the worm gear. If this is not the case for the position of minimum noise a defective or poorly lubricated worm or worm gear is indicated. A bent governor spindle may also be the cause.

(c) Governor spindle.—A bent governor spindle will cause binding in the gears and bearings as well as noise. The bent spindle should be replaced with a new one. Removal of the governor can be accomplished by loosening the two governor bearing screws, one at each end of the governor shaft, and lifting the governor from the frame.

(d) Governor driving gear.—Remove the motor spindle as described in Part IV, Section 11, and examine the gear for wear. If the wear on the teeth is uneven on opposite sides of the gear the turntable spindle is bent and both gear and spindle should be replaced.

(e) Turntable spindle and disc.—A bent turntable spindle or a bent or improperly adjusted disc will cause noise. The bent spindle may cause the disc to rub against the iron core of one of the coils. A bent spindle can be detected by placing a pencil flat on the motor board with the point against the spindle if the pencil point touches the spindle on one side only while the motor is running, the spindle is bent and should be replaced. If the disc is bent and rubs against the cores of the motor coils the lower spindle bearing should be adjusted as described in Part IV, Section 12, or the disc should be replaced, depending upon the extent of the damage.

(f) If the motor "bumps" (turntable jumps up and down), it may be due to a faulty or worn gear or worm; insufficient grease or poor grease on the worms; or not enough turns on one of the upper motor coils.

(7) HEATING

Normal operation of the motor will produce more heat than can comfortably be tolerated while touching any of the coil units. This is mentioned in order that the service man will not misconstrue this heating as an indication of a defect.

(8) CONTINUITY OF MOTOR CIRCUITS

Due to the absence of motor terminal boards it is best to disconnect the motor and test for continuity of circuit directly at the motor coils. This may be done by any of the methods used for regular continuity tests. Associated circuits should be checked by referring to the diagram, Figure 5. Figure 14 shows a top cabinet view of the phonograph compartment.

MAKING PHONOGRAPH MOTOR REPLACEMENTS

(9) REPLACING THE MOTOR COILS

Should the necessity arise for replacing the coils of the induction disc phonograph motor proceed as follows:—

(a) Remove the motor as outlined in Part II, Section 1.
(b) Open the lugs holding the black power leads to the motor frame and remove these leads to one side.
(c) Release the round head machine screw and the two hexagon head machine screws holding the coil unit, which is to be replaced, to the motor frame. (See Figure 10).
(d) Put the new coil unit in place and replace the coil unit mounting screws, tightening them carefully.
(e) Replace the black power leads under the lugs and reconnect the power leads to the proper points on the terminal board as shown in Figure 5. Lubricate motor if necessary.
(f) Replace motor and turntable and test for operation and speed.

(10) REPLACING THE MOTOR GOVERNOR PARTS

If it becomes necessary to remove the governor, to replace the governor spindle or springs use the following procedure:— Part II, Section 1.

(a) Remove the motor as outlined in to release the governor bearing that may
(b) Unscrew governor bearing screwvernor in Figure 10.
be seen just to the right of the go
(c) Push the governor spindle against this bearing so as to start it out of its socket, and remove this bearing.
(d) Remove the governor spindle with its associated parts.
(e) All governor parts are now readily accessible and it may be disassembled. The governor spring holding collar is fastened to the governor spindle by means of a small set screw, and the spindle is "spotted" to facilitate proper replacement
(f) Replace the governor spindle and its assembled parts by placing the outer tip of the spindle in the outer thrust bearing socket first, and then inserting the inner tip into its bearing, after which the outer bearing is replaced, and its set-screw tightened, being careful to leave a little play in the bearings.
(g) It is usually a good plan to re-lubricate the unit whenever service work is done.
(h) Replace motor and turntable and test for operation and speed.

(11) REPLACING THE MOTOR SPINDLE, DISC OR GOVERNOR DRIVING GEAR

(a) Open the lugs holding the power leads to the motor frame and move these leads to one side.

(b) Remove the three mounting screws from the coil unit on the opposite side of the motor from the governor, and remove this coil unit.

(c) Press down on the speed regulating arm so as to release the pressure on the governor friction disc, and turn the motor disc so that the set screws in the hub of the motor disc and the governor driving gear are readily accessible.

(d) Loosen both set screws far enough to back them out of the recesses provided for them in the motor spindle, and draw out the spindle.

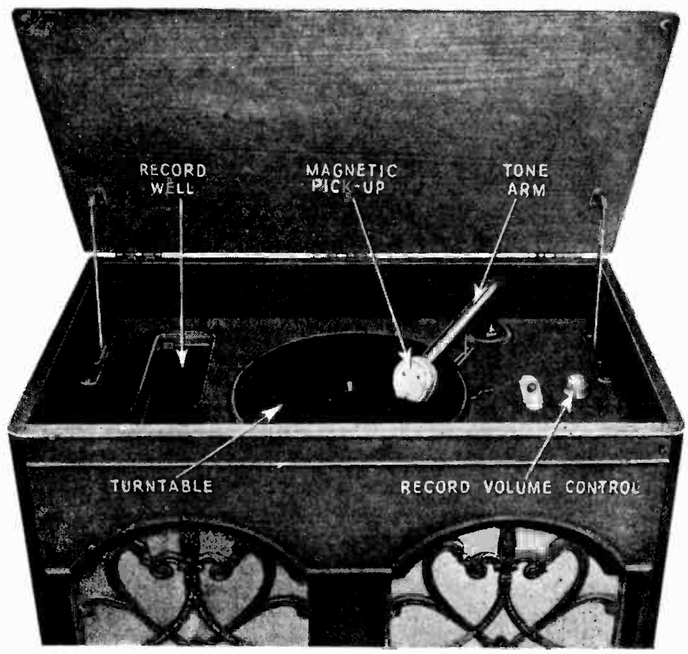

Figure 14—Top cabinet view showing phonograph parts

(e) The motor should now be reassembled in the reverse of the above procedure, making any necessary replacements.

NOTE:—Care should be taken to see that the ball bearing under the lower end of the motor spindle is not lost

(f) After assembling the motor the lock nuts around the spindle adjusting screw, Figure 10, should be loosened and the spindle adjusting screw should be adjusted until the motor disc turns freely in the center of the air gap of the coil units.

(g) Tighten the spindle adjusting screw lock nut.

(h) Replace the motor and turntable.

(i) Lubricate the motor (Refer to Part IV, Section 4).

(j) Re-connect, following the wiring diagram, Figure 5, and test operation and speed (Refer to Part IV, Section 2).

(12) REPLACING THE MOTOR SPINDLE BALL BEARING

A worn motor spindle ball bearing will cause slow or varying speed and should be replaced as follows:—

(a) Place the pick-up swivel arm clear of turntable, remove any needle which may be in the pick-up and remove the turntable.

(b) Loosen the spindle adjusting screw lock nut and remove the motor spindle adjusting screw. The ball bearing may now be removed.

(c) Place the unit in its normal operating position. The motor disc will now rest on the pole faces of the lower or current coil.

(d) Lay a card across the motor mounting top panel, against the motor spindle and mark the spindle lightly at the point of contact.

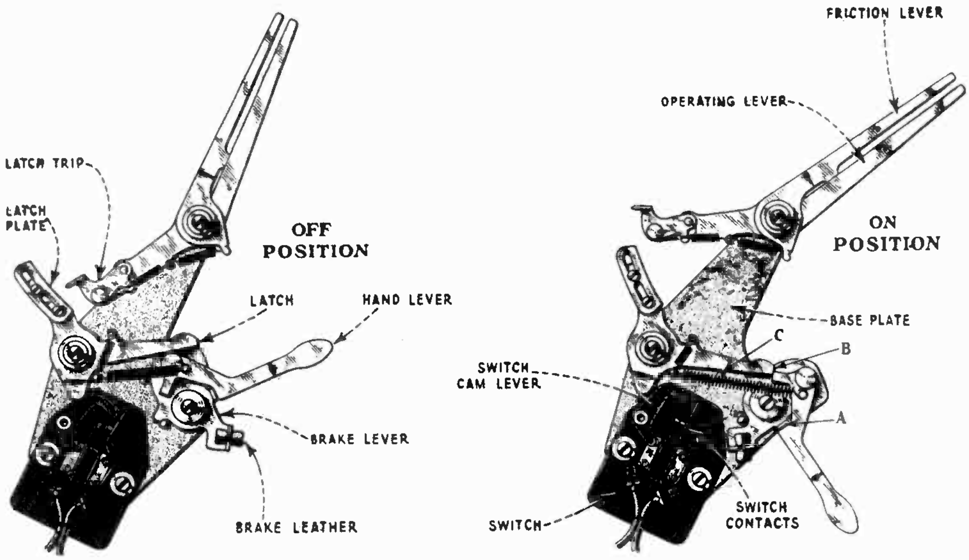

Figure 15—*Automatic stop mechanism*

(e) Lift the spindle until the motor disc touches the pole faces of the upper or voltage coils and again mark the spindle.

(f) Put the new ball bearing in place and replace the motor spindle adjusting screw, adjusting it so that the card placed across the motor board will make contact against the spindle just half-way between the two marks previously made. This should place the motor disc in the center of the air gaps. If the disc is slightly warped an additional adjustment one way or the other may be necessary to prevent it from rubbing against the pole pieces in operation.

(g) Lubricate as described in Part IV, Section 4, replace turntable and test for operation and speed. (Refer to Part IV, Section 2).

PART V—SERVICE DATA ON AUTOMATIC STOP

The automatic stop is purely a mechanical device, ruggedly constructed, and will require very little service work.

AUTOMATIC STOP SERVICE DATA CHART

Indication	Cause	Remedy
Failure to trip	Loose latch plate	Tighten latch plate screws with plate in correct position. (See Fig. 15)
	Latch trip does not engage latch plate properly	Increase tension on latch trip by cutting off one or more of tension spring coils
	Defective latch plate. If the friction lever swings with the eccentric record groove, but the operating lever fails to swing or swings slightly, the latch plate is probably caught in a burr on one of the teeth of the latch plate	Remove all burrs from the latch plate with a piece of emery cloth or a fine file. Also make sure no burrs are on the edge of the latch trip
	If failure to trip is not due to the above causes, bend the lug "A," Figure 15, on the brake lever away from the brake lever pivot so that there will be a smaller bite between the hand lever and the latch at point "B."	
Premature Tripping	Worn surface	Examine the contact surfaces between the hand lever and the latch (point "B," Figure 15). These two surfaces must be square. If they have become worn round, they should be squared with a fine file.
	Insufficient tension	If the latch does not strike the latch stop pin "C" (Figure 15), when the hand lever is pulled to the "On" position, increase the tension of the latch spring or decrease the tension of the latch trip spring
	If the mechanism still trips prematurely after checking the springs and contact surfaces as suggested in the foregoing, bend the lug "A" toward the brake lever pivot so that there will be a larger bite of the hand lever at the point "B" (Figure 15).	
Brake fails to stop turntable	Worn friction leather, sticky brake	See Part V, Section 1
Switch Failure	Mal-adjustment of switch	See Part V, Section 2

(1) BRAKE FAILURE

If the brake does not stop the turntable soon enough:

(a) Examine the friction leather to see that it is not worn down too far to make proper contact with the inside rim of the turntable. If necessary, bend open the lugs holding the leather in position and slip the leather farther out, so as to make a firmer contact against the turntable rim.

It may become necessary, after a long period of use and several adjustments, to replace the brake leather. The old brake leather should be removed by bending open the lugs holding it and then should be replaced with a 3/8 in. length of 1/4 in. round leather belting such as is used on sewing machines, etc. Use the softest grade of belting obtainable.

(b) Place a drop of oil in the bearing surfaces between the brake lever and the base plate if the brake appears to stick.

(c) Increase the tension of the brake and hand lever spring by cutting off one or more coils and replacing the end of the spring over the lug.

(2) SWITCH FAILURE

If the record lamp lights, but the motor fails to start when the hand lever is in the "On" position the switch should be examined to see that it is operating properly. See Figure 15.

The left hand screw holding the switch to the base plate passes through an oversize round hole in the switch body and the right hand screw passes through an elongated hole in the switch body. This permits of a considerable adjustment of the switch on the base plate.

(a) Remove the single small screw holding the switch cover in place.

(b) Set the hand lever to the "On" position and examine the switch contacts to see that they close.

(c) If the switch does not close and the switch cam lever may be moved away from the switch contact, leaving a gap between the contacts, the movable contact spring should be bent so as to increase its tension.

(d) If the switch cam lever does not have a sufficiently free movement to permit the contacts to close, both switch mounting screws should be loosened, and the switch should be adjusted on the base plate (with the hand lever in the "On" position), so that there is a space of 1/32 in. between the switch cam lever and the latch cam and about 1/16 in. between the switch cam lever and the spring anchor pin. When this adjustment has been made tighten the switch mounting screws.

(e) Clean the switch contacts occasionally with 00 sandpaper to remove any corrosion that may be present.

(f) Replace the switch cover plate.

(g) Replace the turntable with the hand-lever in the "On" position so as to clear the brake lever arm of the inside rim of the turntable, and rotate the table by hand for several revolutions to permit the slot in the turntable hub to slip over the pin in the motor spindle.

RCA
Radiola 48
SERVICE NOTES

Second Edition—2M
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RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

CONTENTS

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

ILLUSTRATIONS

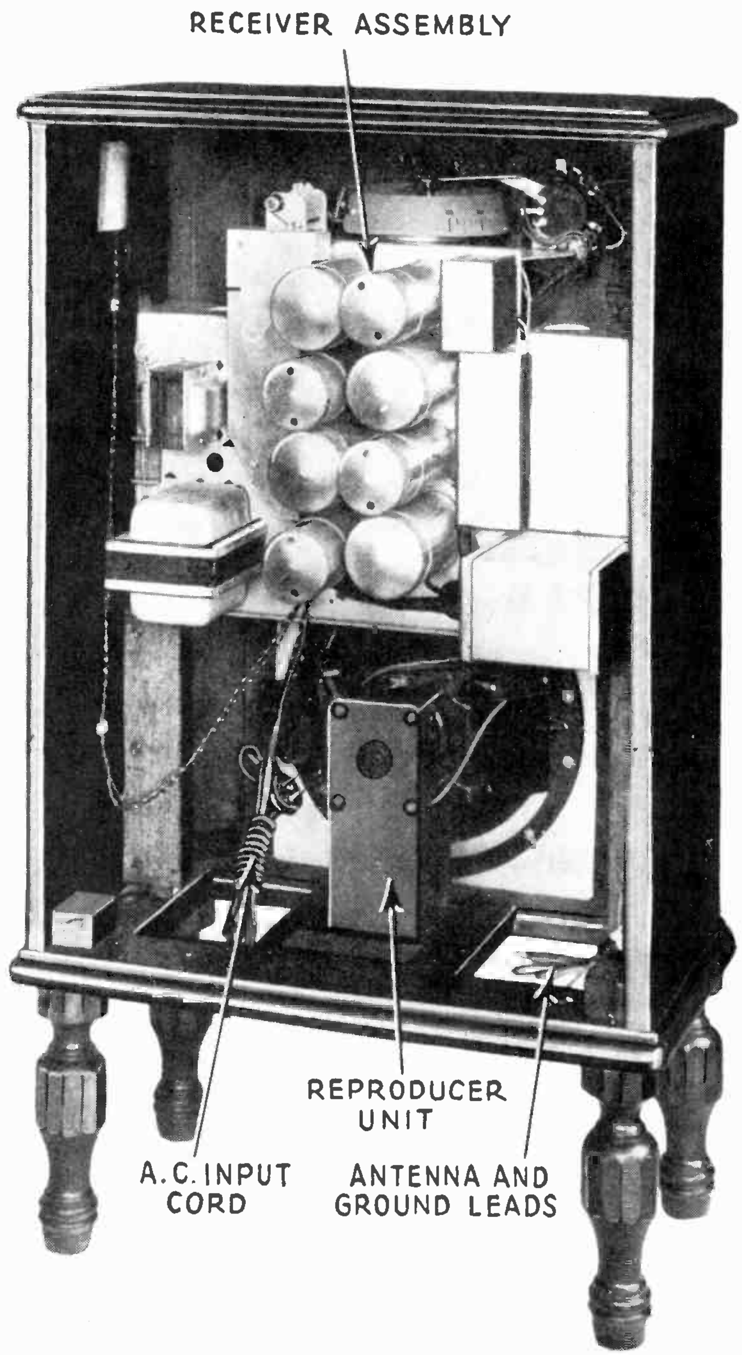


Figure 1—Rear interior cabinet view

RCA RADIOLA 48

SERVICE NOTES

ELECTRICAL SPECIFICATIONS

Voltage Rating	105—125 Volts
Frequency Rating	25-40 and 50-60 Cycles
Power Consumption	115 Watts
Recommended Antenna Length	25-75 Feet
Type of Circuit	A.C. Screen Grid T.R.F.
Type and Number of Radiotrons	4 UY-224, 2 UX-245, 1 UX-280
Number of R. F. Stages	3
Type of Detector	Power Grid Bias
Number of Audio Stages	1 (Push-Pull)
Type of Volume Control	Compound type (Changes input R.F. voltage to first tube and screen grid voltage to R.F. amplifiers simultaneously)
Type of Rectifier	Full Wave, UX-280
Type of Loudspeaker	Electro-Dynamic
Wattage Dissipation in L.S. Field	10 Watts (110 V. 85 M. A.)
Undistorted Output	2.5 Watts

PHYSICAL SPECIFICATIONS

Height	35 Inches
Depth	13 Inches
Width	20½ Inches
Weight (Packed for Snipment)	95 Lbs.
Packing Case Dimensions	17½" x 26" x 40"

INTRODUCTION

RCA Radiola 48 is a seven-tube A.C. operated screen grid type tuned radio frequency receiver. Excellent and uniform selectivity, sensitivity and fidelity are secured throughout the broadcast band. Included in the same cabinet is an improved electrodynamic type loudspeaker which, together with the receiver, gives a very excellent quality of reproduction.

A feature of Radiola 48 is the calibrated kilocycle dial. This dial is very accurate and greatly facilitates the location of stations of known frequency, even though not previously received. Another unique feature is the compound type volume control. This performs the function of two types of volume control operating simultaneously and gives a positive control of volume without distortion on signals of any intensity.

The receiver uses four Radiotrons UY-224, three as R.F. amplifiers and one as a detector; two Radiotrons UX-245 as a push-pull audio stage; and one Radiotron UX-280 as a full wave rectifier for converting the alternating current into direct current which, after suitable filtering, is used as a plate and grid supply to all Radiotrons.

Figure 1 shows a rear interior cabinet view and Figure 2 the schematic circuit diagram.

ELECTRICAL DESCRIPTION OF CIRCUIT

A unit type of construction is used; that is, the receiver and power parts are all built into a single unit, see Figures 3 and 4. Numerous advantages are present in this type of construction. The gang condenser is mounted on one side of a center plate in a vertical position. The coils and Radiotron sockets are directly opposite on the other side of the center plate. This makes the leads from the sockets to the coils and to the gang condenser very short. Individual shields are placed over each Radiotron and coil and individual compartments over each unit of the gang condenser so that a very complete system of shielding is present. The heater type tubes are mounted in a horizontal position and the filament type in a vertical position. Mounting the heater type

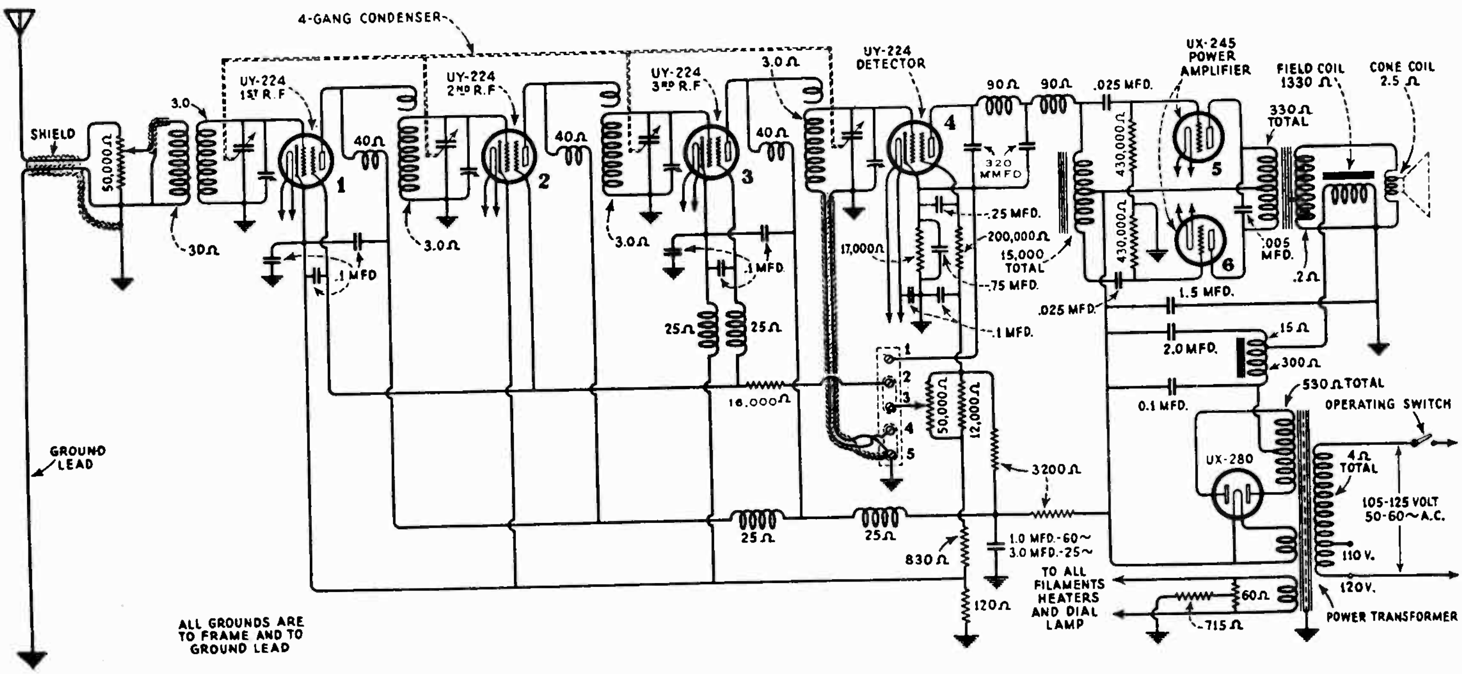


Figure 2—Schematic circuit diagram.

tubes in a horizontal position has no detrimental effect on their life, as the elements are rigid and held in place. However, it is important to mount the filament type tubes in a vertical position, as the elements may sag and short if mounted horizontally.

Examining the circuits we find the following functions taking place. See Figure 2.

The antenna and ground are connected to each side of a 50,000-ohm potentiometer. The moving contact of the potentiometer is connected to one side of the primary of the first R.F. transformer, the other side being connected to ground. The action of this potentiometer constitutes one-half the action of the volume control, the other half being discussed later. The secondary of the R.F. transformer is connected to the grid circuit of the first R.F. Radiotron UY-224, which is tuned by the first unit of the gang condenser. The plate circuit of this tube contains a high impedance coil located inside the grid coil of the second R.F. transformer. This plate coil is of the correct impedance to match the UY-224 and is at right angles to the grid coil in which it is located. This is done so that the inductive coupling between these circuits is at a minimum. A single turn at one end of the grid coil is connected to the plate of the UY-224 and provides capacitive coupling between the circuits.

The reason for using capacitive instead of inductive coupling is due to the fact that the primaries of the R.F. transformer resonate at about 350 K.C. with receiver capacitance and tend to increase the sensitivity at the low end of the range. Capacitive coupling has less reactance to high frequencies than to low frequencies, thereby increasing the effective coupling at the high frequency end. A combination of the two gives about an equal gain throughout the tuning range.

The following two R.F. circuits function in the same manner as the one already described. The screen grid voltage of these three Radiotrons is varied by means of the second section of the volume control. This action occurring simultaneously with the variation of input voltage to the first tube gives a positive control of volume without distortion.

The detector circuit functions as a biased-grid, power detector operating at a high plate voltage so that an output sufficient to swing the two Radiotrons UX-245 to maximum output is obtained. The detector tube is operated at 250 volts plate potential and 10 volts negative grid bias.

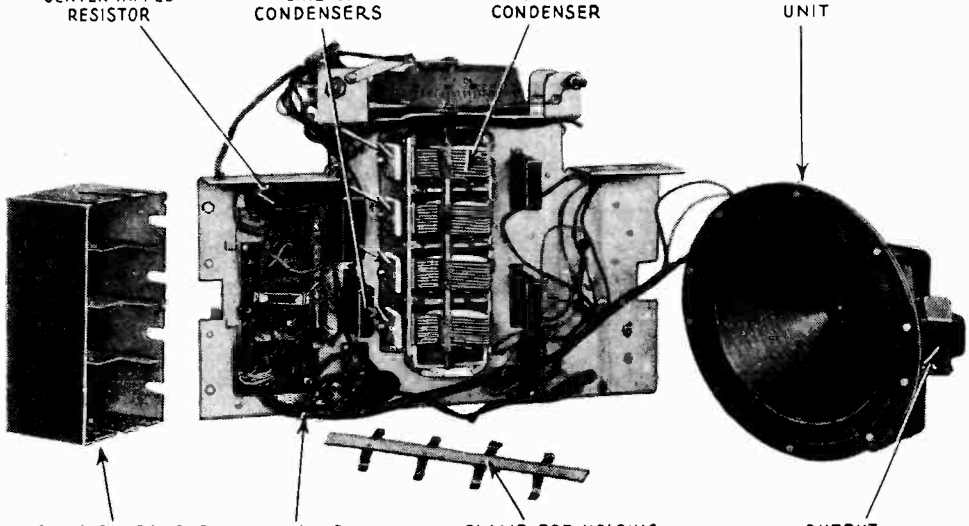


Figure 3—Front view of chassis and reproducer, showing parts.

As the detector is a Radiotron UY-224 and must therefore work into a high impedance, a transformer would not be suitable for coupling it to the grid circuit of two Radiotrons UX-245. Impedance coupling is therefore used, one-half of a tapped reactor being in the plate circuit of the detector. This reactor is of quite high impedance and functions as an auto transformer. Two coupling condensers are used to pass the A.C. component of the detector output to the grid of the Radiotrons UX-245. Two high resistance units are used so that the proper grid bias may also be impressed on these tubes.

The output of the Radiotrons UX-245 is coupled to the cone coil of the electro-dynamic speaker through a center-tapped primary, step-down transformer.

A full wave rectifying circuit employing Radiotron UX-280 is used to provide the direct current voltages necessary for plate and grid supply to all Radiotrons and also for field current supply to the electro-dynamic loudspeaker. The filter circuit is of the type employed in the Super-Heterodyne models with the exception that a .1 mfd. condenser is used to by-pass any high frequency ripple that may be present in the rectified output. An explanation of the action of this filter is contained in the Radiola 80 Service Notes.

PART I—INSTALLATION

(1) ANTENNA AND GROUND

Instructions for erecting a good antenna and ground system, together with hints for special installations in noisy locations, are contained in the Radiola 80 Service Notes. The reader is therefore referred to Part I, Sections 1, 2, 3 and 4 of that booklet.

(2) RADIOTRONS

This receiver uses a total of seven Radiotrons, four Radiotrons UY-224, two Radiotrons UX-245 and one Radiotron UX-280. The Radiotrons should be placed in their correct sockets as indicated on the instruction card accompanying each set. The proper

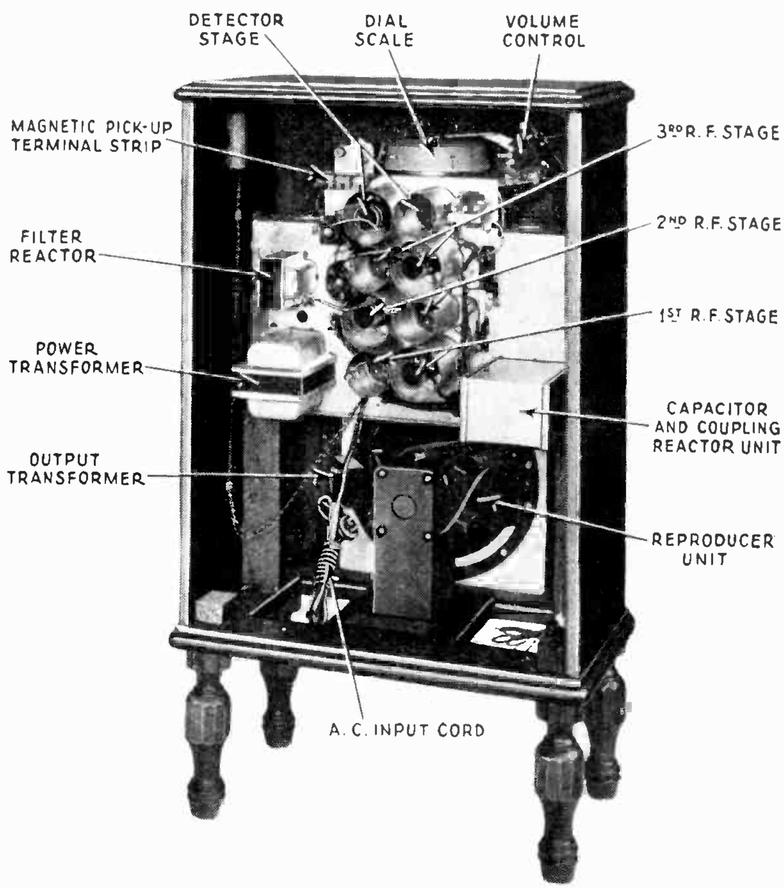


Figure 4—Rear interior cabinet view with shields removed.

location for the Radiotrons UY-224 is shown on the top of the shields which covers them after being inserted in the sockets. These four tubes are mounted horizontally. The Radiotrons UX-280 and UX-245 are mounted vertically, the proper marking being placed adjacent to each socket.

The detector Radiotron should be chosen from the other Radiotrons UY-224 for the tube that will give the greatest output with the volume control advanced to its maximum undistorted position. Then interchange the remaining Radiotrons UY-224 until best results are obtained.

(3) LOCATION

This receiver should be tried in various locations in the room in which it is to be operated and the location giving the best acoustical results used. However, the eight-foot A.C. cord may prove a limiting factor if an A.C. outlet is not within its radius. An extension cord may be used in cases of this kind, as the better results usually justify its small cost.

The antenna and ground leads should be separated as much as possible until they connect to the receiver, otherwise a reduction in signal strength will result, due to the capacity between leads.

(4) JERKY ACTION OF STATION SELECTOR

Should operation of the station selector be stiff or jerky, a little oil dropped on each condenser bearing will effectively remedy this condition. When experiencing this trouble it is also well to check the cable tension spring to make sure that suitable tension is being applied to the condenser drive cable.

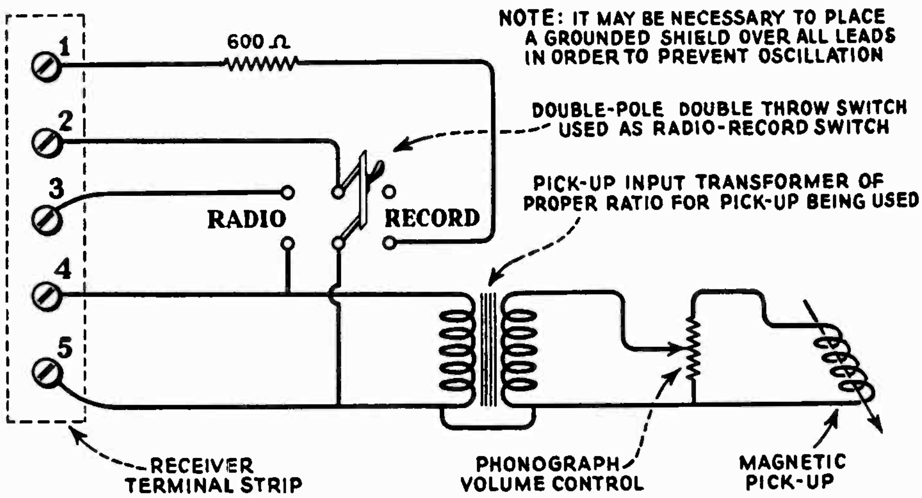


Figure 5—Connections for attaching a magnetic pick-up.

(5) ADJUSTMENT FOR LOW LINE VOLTAGES

An extra tap is connected to the primary of the power transformer for use when line voltages do not exceed 115 volts. Figure 13A shows the terminal board with its normal connections. The change in connection to be made for 110-volt lines is indicated by a dotted line.

(6) REMOVAL OF SHIPPING BLOCKS AND SCREWS

Four metal clamps are placed between the chassis and its cabinet mounting strips to hold the chassis securely during shipment. After unpacking the set, remove the four red screws and withdraw the clamps. Do not replace the screws.

(7) MAGNETIC PICK-UP CONNECTIONS

Figure 5 shows the correct connections for attaching a magnetic pick-up.

When connecting a magnetic pick-up to Radiola 48, if the distance from the set to the phonograph is more than several feet, certain precautions to prevent oscillation must be taken other than shielding the leads. These precautions are to mount the "Radio-Record" switch and the input transformer inside the cabinet. The volume control may or may not be located on the phonograph, any place being satisfactory. Two additional contacts should be provided on the switch so that when the switch is in the "radio" position, both sides of the pick-up input line to the transformer will be open. Unless this is done serious oscillation will occur which will be very difficult to remedy. The leads from the switch and transformer should be shielded and the shield grounded.

With certain input transformers, a slight hum may be obtained during record reproduction. Shunting a 5,000-ohm resistor across the secondary of the transformer will remedy this trouble.

PART II—SERVICE DATA

(1) ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna, or the antenna touching some metallic surface such as the edge of a tin roof, drain pipe, etc. By disconnecting and shorting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

(2) RADIOTRON SOCKETS AND PRONGS

The tube sockets used in this set are of an improved type having a large contact surface and should require a minimum of service work. In order to get best results, however, the tube prongs should be periodically cleaned, as dirty Radiotron prongs may cause noisy operation. Fine sandpaper may be used to clean them so as to insure a good contact surface. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and bases carefully to make certain that all particles of sand are removed.

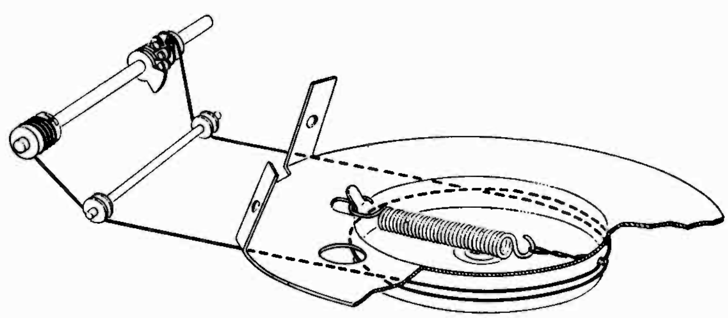


Figure 6—Drive cord arrangement.

(3) BROKEN CONDENSER DRIVE CORD

The gang condenser is driven from the station selector knob by means of a cord arrangement that also functions as a vernier control. This cord is of rugged construction and a spring is used to maintain an even tension at all times. Should the cord become disengaged from the drum or a new cord be required, follow the arrangement indicated in Figure 6 for the correct position of the cord on the drum, otherwise the cord length will be incorrect or the stops on the shaft will engage at the wrong time.

(4) ADJUSTMENT OF R.F. LINE-UP CONDENSERS

Four small adjustable condensers, connected in parallel to the main tuning condensers, are provided to line-up the circuits at the high frequency end of the scale and also to allow a line-up that will cause the dial to read accurately. A need for readjustment of these condensers is indicated by insensitivity of the receiver not due to other causes. Also if the dial scale reads incorrectly and cannot be adjusted for correct reading by slipping it, an adjustment of these condensers is necessary. A step by step procedure for making such adjustment follows:

1. Procure the following material:
   An end wrench that will fit the hex heads of the line-up condensers. A special wrench listed in the Replacement Parts Catalog is designed for this purpose.

A modulated R.F. oscillator giving a signal at 600 K.C. and 1400 K.C. It is important that these points be accurately known within 10 K.C., otherwise the dial of the receiver will not read accurately after the set is aligned.
An output meter. This may be any of the usual devices such as a 0-5 milli-ammeter placed in the plate circuit of the detector, a thermo galvanometer substituted for the cone coil or a disc rectifier meter used across the cone coil leads.

2. Turn the dial scale to 600 K.C. and mark the position of the pin that holds the drive cord to the drum so that this position may be checked after the chassis is removed from the cabinet. See Figure 7.

3. Remove the chassis and loudspeaker from the cabinet. This can be done by removing the four chassis mounting screws, the two reproducer mounting bolts, the staples holding the switch, antenna and ground leads, the operating switch and the control knobs. The chassis and reproducer unit may now be lifted clear of the cabinet and placed in a position convenient for work.

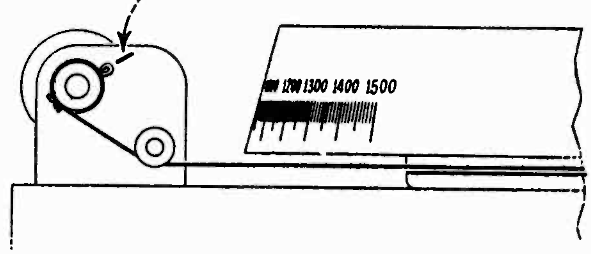


Figure 7—View showing method of checking position of dial.

4. Take a small piece of metal about 2½" long by ⅜" wide and point one end of it. Bend as indicated in Figure 8 and then slip it under the gang condenser shield clamp so that it will act as an indicator for the dial. With the pencil mark and the pin coinciding as before removal of the chassis from the cabinet, set the indicator so that it will read 600 K.C. on the scale. From now on be careful not to disturb the indicator and recheck its position if in doubt as to its accuracy.

5. Set the scale so that an equal amount of adjustment will be possible in either direction by loosening its clamping screws.

6. Place the receiver in operation and couple the output of the oscillator to the antenna lead. Place the oscillator in operation at 1400 K.C. Connect the output meter in the circuit.

7. Turn the station selector until the dial reads exactly 1400 K.C. Now adjust the detector, 3rd R.F., 2nd R.F. and 1st R.F., line-up condensers until a maximum deflection is obtained in the output meter. Adjust the volume control so that overloading does not occur and the output meter needle does not go beyond its scale.

8. Set the oscillator at exactly 600 K.C. Tune in the signal on the receiver. It should read within one division of 600 K.C. If it does not read within one unit of 600 K.C. shift the scale to the opposite side of 600 K.C. ½ the difference between the scale reading and 600 K.C. For example, if the scale reads 610 K.C. at maximum output, set the scale at 595 K.C. Or if the scale reads 590 K.C., set it at 605 K.C.

9. Shift the oscillator frequency to 1400 K.C. and set the selector at the point where the dial reads exactly 1400 K.C. Now adjust the four line-up condensers in the order given until maximum output is obtained. The receiver calibration should now read quite accurately at all frequencies through the broadcast range.

10. Remove the temporary dial indicator and return the chassis to the cabinet in the reverse manner of that used to remove it.

(5) LINE-UP ADJUSTMENT OF GANG CONDENSER

The gang condenser is mounted in an inaccessible position when the chassis is mounted in the cabinet. Unless tampered with adjustments will not be needed. However, if tampering has occurred, the following procedure may be used for realigning it.

1. Procure the following material:

   Modulated R.F. Oscillator, the output of which is continuously variable throughout the broadcast band.

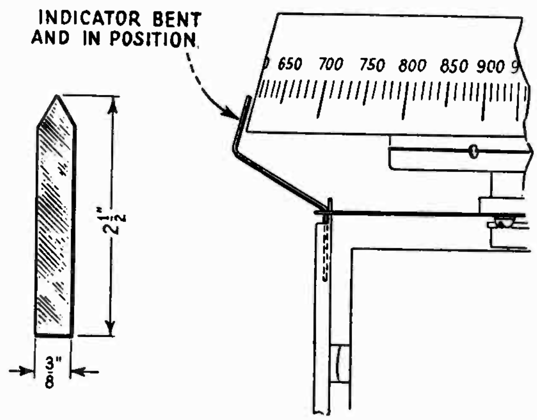


Figure 8—Dial indicator.

   Output meter. This may be a thermo-galvanometer, or a disc type A.C. voltmeter having about a 0-5 volt range.

   A Small End Wrench for adjusting the condenser vane screws. A wrench listed in the Replacement Parts Catalog is especially designed for this purpose.

2. Remove the receiver from the cabinet as described in Part II, Section 4. Place the receiver in operation and make the R.F. line-up condenser adjustments as described in Part II, Section 4. Then remove the gang condenser shield clamp and shield. Shift the black with yellow tracer wire connected to the arm of the antenna potentiometer to the black antenna lead connected to one side of this potentiometer. Couple the oscillator output to the antenna (black) lead of the receiver. Adjust the selector knob until the first vanes of the gang condenser fully mesh with the stator plates and the next set is free. This is shown in Figure 9A.

3. Adjust the oscillator until a deflection is obtained in the output meter. This will be at about 1120 K.C. Adjust the volume control so that oscillation will not occur. Now adjust the four vanes that are engaged with the stator until a maximum deflection is obtained. If the variation is not sufficiently great to permit this, make a slight readjustment of the line-up condenser in the circuit under test. After adjusting the first group of vanes, if the line-up condensers have been altered, return to them and readjust as described in Part II, Section 4, making sure the shields are in place.

4. After adjusting the line-up condensers if necessary, shift the gang condenser so that the first and second sections of the end rotor plates are meshed with the stator plates.

   Shift the oscillator frequency and adjust the second group of vanes until a maximum deflection is obtained and the adjustable vanes still make a satisfactory clearance of the stator plates. Due to slight inaccuracies of the coils it may not be possible to exactly peak each vane, as a sufficient capacity variation is not present. However, adjusting for a maximum output reading while still maintaining clearance will give as good, or better, an adjustment as was originally present in the receiver.

5. Follow the same procedure as that used with the second for each of the various groups of vanes. After all adjustments are made it is good practice to realign the line-up condensers, also checking the dial scale as given in Part II, Section 4.

(6) REPLACING REPRODUCER CONE

Should replacement of the reproducer cone be necessary, proceed as follows:

1. Remove the reproducer assembly as described in Part II, Section 4.

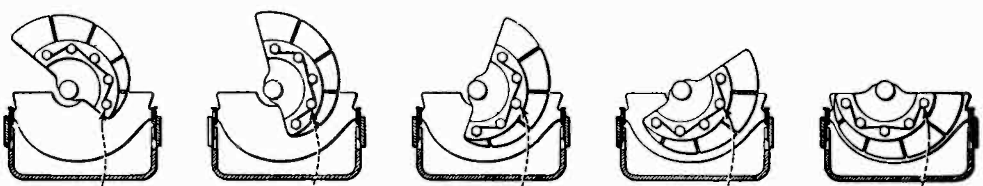


Figure 9—Gang condenser adjustment positions.

2. Remove the ten nuts, screws and lock washers that hold the metal ring and cone edge in place. Remove the cone centering screw. The cone coil is connected by means of two soldered terminals located adjacent to the cone bracket. Unsolder these leads. The cone may now be removed.
3. Place the new cone in the position occupied by the old one, and replace cone ring, the ten screws, nuts and the lock washers. Do not tighten the screws.
4. Place three pieces of cardboard the thickness of a visiting card and approximately 1½" x ¼" in size in the space between the inside of the cone coil and the pole piece.
5. Now replace the cone centering screw and tighten.
6. Tighten the ten screws that hold the cone edge and replace the felt ring.
7. Remove the pieces of cardboard and solder the cone coil leads in place.

(7) SERVICE DATA CHART

The following Service Data Chart gives the cause and remedy of the most common indications of a defective receiver. If following the suggestions in this chart does not remedy any trouble that occurs, then the Voltage Reading Service Data Chart should be used to isolate the trouble. See Part III, Section 3.

Before making any tests or repairs, check the condition of all the Radiotrons. A defective tube can be the cause of practically any indication that might be observed.

SERVICE DATA CHART

Indication	Cause	Remedy
No Reception	No current at Outlet	Turn line current "On"
	Defective Operating Switch	Repair or replace operating switch
	Open cone or field coil in reproducer	Repair or replace defective part in reproducer unit
	Defective parts in chassis	Test by means of voltage readings or continuity tests and repair or replace any defective parts
Low Volume	Poor antenna system	Install antenna system as suggested on instruction card
	Shorted field coil in reproducer unit	Repair any defect in reproducer
	R.F. stages not properly aligned	Realign circuits as suggested in Part II, Sections 4 and 5
	Defective parts in chassis	Test by means of voltage readings or continuity test and repair or replace any defective parts
Poor Quality	Receiver not properly tuned	Tune in station properly
	Receiver improperly aligned	Align receiver properly as given in Part II, Sections 4 and 5
	Defective coupling reactor	Replace coupling reactor unit
	Defective coupling condenser	Replace coupling condenser
	Defective output transformer	Repair or replace output transformer
Audio Howl	Shipping blocks not removed	Remove shipping blocks
	Defective cushion supports	Replace any defective support. The receiver assembly should not be rigidly mounted to the cabinet
	Oscillation	R.F. oscillation will cause a whistle or howl when a signal is tuned in. Remove the cause of oscillation
	By-pass condenser not properly mounted causing poor connection to frame	Check all by-pass condensers and make sure they are mounted securely to chassis frame
	Open by-pass condenser	Repair or replace any open by-pass condenser
	Broadcasting station heterodyne	This is caused by transmitting stations and is no fault of the receiver
Oscillation	Poor ground	Connect set to good ground
	Shields not in place	Make sure all shields are tightly in their proper positions
	Shield clips broken or bent	The gang condenser shield has a number of small clips for maintaining contact between the shield and the condenser shaft. Make sure they are all making good, clean contact to the shaft. Replace any that might be broken
	Open or shorted by-pass condenser	Replace any defective condenser or repair any poor connections
	Radiotron	A defective Radiotron UY-224 may cause oscillation and should be replaced by one known to be in good operating condition
	Screen grid resistor	Make sure screen grid resistor is 16,000 ohms
Hum	Defective Radiotron UX-280	Replace defective Radiotron
	Shorted field coil	Repair or replace field coil
	Grounded heater lead	Remove the cause of any grounds
	Loose laminations in filter reactor	Tighten filter reactor clamping screw
	Shorted by-pass condenser from C4 to ground.	Replace defective condenser
Noisy Volume Control	Poor contact of arm	Work contact arm back and forth several times If trouble does not clear up, replace volume control
Dial Scale Reads Incorrectly	Scale shifted	Adjust scale by loosening clamping screws and setting correctly. Then tighten clamping screws
	Set not properly aligned	Realign receiver as described in Part II, Section 4.

PART III—ELECTRICAL TESTS

(1) VOLTAGE SUPPLY SYSTEM

Figure 10 illustrates the schematic diagram of the voltage supply system together with the values of the various resistors. Figure 11 shows the wiring cable.

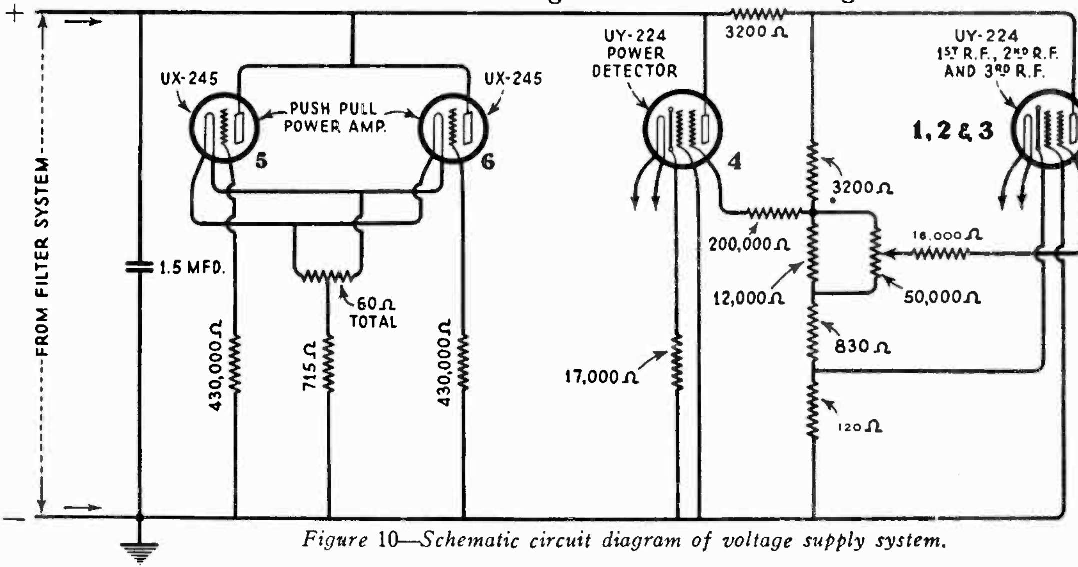


Figure 10—Schematic circuit diagram of voltage supply system.

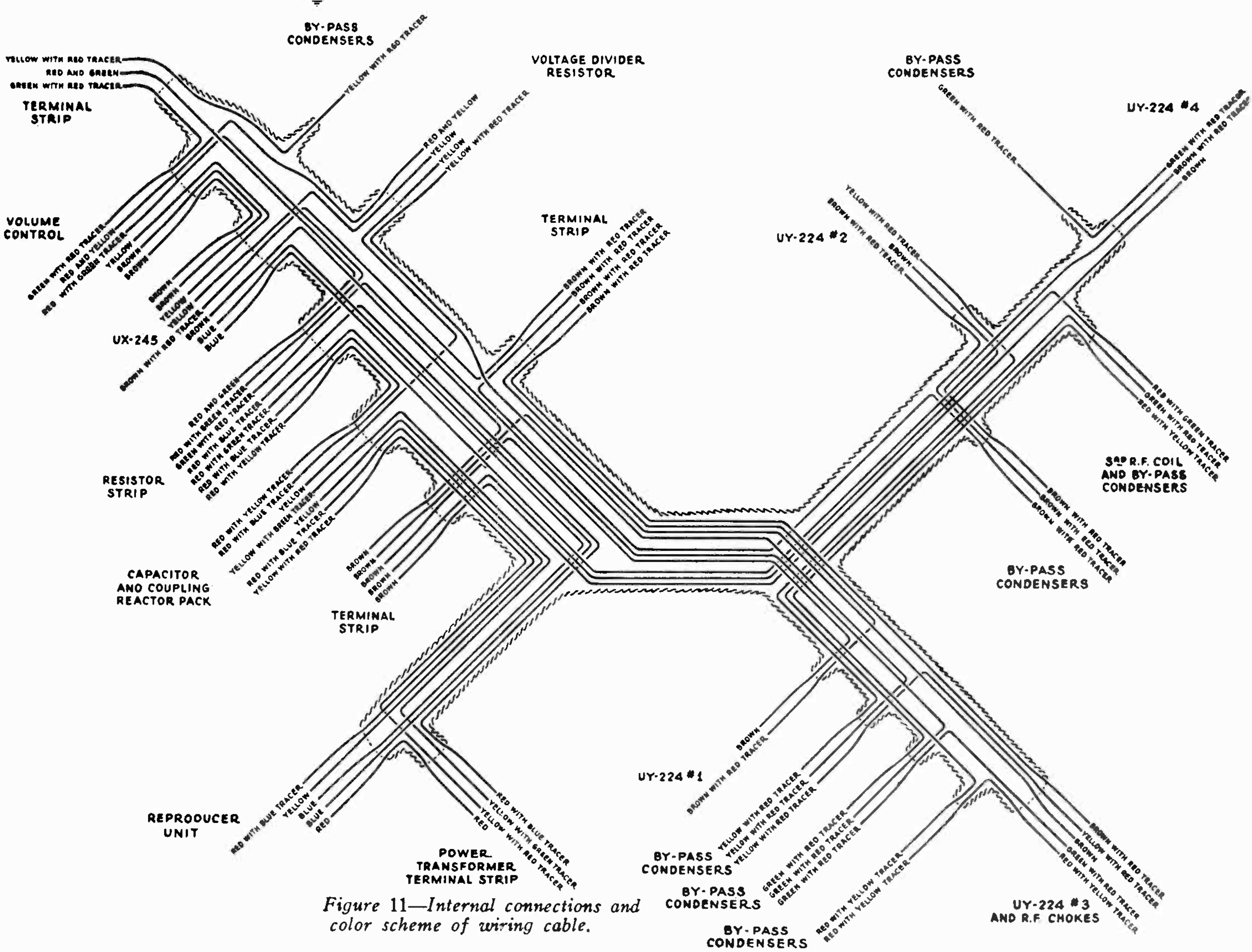


Figure 11—Internal connections and color scheme of wiring cable.

VOLTAGE READING SERVICE DATA CHART

Volume Control at Maximum

VOLTAGE CHARACTERISTIC	TUBE 1 1st R. F.				TUBE 2 2nd R. F.				TUBE 3 3rd R. F.				TUBE 4 DETECTOR				TUBE 5 POWER A. F.			TUBE 6 POWER A. F			Cause of Incorrect Reading
	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	Grid Volts	Plate Volts	Plate M.A.	Grid Volts	Plate Volts	Plate M.A.	
Normal	2.5	85	160	3.0	2.5	85	155	3.5	2.5	75	156	3.5	7.5	55	225	0.5	1.0	200	25	1.0	200	25	
No C.G. Voltage on Tube No. 1	0	80	150	6.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Open Secondary of 1st R.F. Transformer
No C.G. Voltage on Tube No. 2	...	...	...	...	0	80	150	6.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Open Secondary of 2nd R.F. Transformer
No C.G. Voltage on Tube No. 3	...	...	...	...	...	...	...	...	0	75	150	5.5	...	...	...	...	...	...	...	...	...	...	Open Secondary of 3rd R.F. Transformer
No C.G. Voltage on Tube No. 4	...	...	...	...	...	...	...	...	...	...	...	...	0	15	190	1.5	...	...	...	...	...	...	Open Secondary of 4th R.F. Transformer or Link on Term. Strip
No Plate Voltage on Tube No. 1	2.5	80	0	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Open Primary of 2nd R.F. Transformer
No Plate Voltage on Tube No. 2	...	...	...	...	2.5	80	0	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Open Primary of 3rd R.F. Transformer
No Plate Voltage on Tube No. 3	...	...	...	...	...	...	...	...	2.5	75	0	0	...	...	...	...	...	...	...	...	...	...	Open Primary of 4th R.F. Transformer
No Plate Voltage on Tube No. 4	...	...	...	...	...	...	...	...	...	...	...	...	3.5*	18*	0	0	...	...	...	...	...	...	Open Coupling Reactor or Detector R.F. Choke
No Plate Voltage on Tube No. 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.0	0	0	5.0	210	45	Open Primary of Output Transformer
No Plate Voltage on Tube No. 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5.0	210	45	2.0	0	0	Open Primary of Output Transformer
No Plate Voltage on Tubes Nos. 1 and 2	2.3	60	0	0	2.0	60	0	0	2.0	60	175	1.5	6.0	12	175	1.5	...	...	...	...	...	...	Open R.F. Plate Supply Choke
No S.G. Voltage on Tube No. 3	2.5	100	155	4.5	2.5	100	155	4.5	2.5	0	165	0	6.5	60	210	1.0	...	...	...	...	...	...	Open S.G. R.F. Choke
No Voltages on Tube No. 3	2.5	80	170	3.0	2.5	100	165	5.0	18*	0	0	0	6.5	60	220	0.5	...	...	...	...	...	...	Open R.F. Choke Connected to Cathode of Tube No. 3
No Plate Voltages on Plates Nos. 1, 2 and 3	2.1	60	0	0	2.1	60	0	0	2.1	60	0	0	10	60	220	0 5	...	...	...	...	...	...	Open R.F. Plate Supply Choke
No C.G. Voltages on Tubes Nos. 1, 2 and 3	0	80	150	4.5	0	65	160	3.5	0	75	150	4.5	30	8.0	195	1.5	...	...	...	...	...	...	Shorted 0.1 Mfd. Condenser from Cathode No. 1 to Ground
No C.G. Voltages on Tubes Nos. 1, 2 and 3	0.4	75	150	3.5	0.4	70	160	3.0	0	80	155	4.5	30	2.0	185	1.5	...	...	...	...	...	...	Shorted 0.1 Mfd. Condenser from Cathode No. 3 to Ground
No S.G. Voltages on Tubes Nos. 1, 2 and 3	2.5	0	180	0	2.5	0	180	0	2.5	0	180	0	...	...	...	...	...	...	...	...	...	...	Shorted 0.1 Mfd. Condenser from S.G. No. 1 or 3 to Cathode
No Plate Voltages on Tubes Nos. 1, 2 and 3	7.0	1.0	0	0	7.5	1.0	0	0	8.0	0	0	0	0	1 0	175	0	...	...	...	...	...	...	Shorted 0.1 Mfd. Condenser from Plate No. 3 to Cathode
No Plate Voltages on Tubes Nos. 1, 2 and 3	7.0	1.0	0	0	7.0	1 0	0	0	7.0	1 0	0	0	0	1.0	175	0	...	...	...	...	...	...	Shorted 0.1 Mfd. Condenser from Plate No. 1 to Cathode
No C.G. Voltage on Tube No. 4	...	...	...	...	...	...	...	...	...	...	...	...	0	8.0	220	2.0	...	...	...	...	...	...	Shorted 0.75 Mfd. Condenser across Detector Bias Resistor
No S.G. Voltage on Tube No. 4	...	...	...	...	...	...	...	...	...	...	...	...	12	0	220	0.5	...	...	...	...	...	...	Shorted 0.25 Mfd. Condenser from S.G. to Cathode Tube No. 4
No C.G. or S.G. Voltages on Tubes Nos. 1, 2 and 3	0	0	110	0	0	0	110	0	0	0	110	0	0	0	200	0	...	...	...	...	...	...	Shorted 0.1 Mfd. Condenser from Ground to Volume Control
Low Plate and S.G. Voltages on Tubes Nos. 1, 2, 3 and 4	1.2	38	80	0.8	1.5	38	82	.8	1.4	30	80	1.5	4.5	9	105	0.5	0	115	58	0	115	58	Shorted 0.1 Mfd. Condenser from Ground to No. 4 Heater
No Voltages on Tube No. 4	2.8	60	170	0.75	3.0	50	160	1.4	2.8	60	165	3.8	20*	0	0	0	...	...	...	...	...	...	Open 17,000-Ohm Resistor
No S.G. Voltage or Plate M.A. on Tube No. 4	2.5	80	165	2.0	2.8	90	165	2.5	3.0	60	165	3.8	5.5	0	220	0	...	...	...	...	...	...	Open 200,000-Ohm Resistor
High C.G. and Low S.G. Volts on Tube No. 4	...	...	...	...	...	...	...	...	...	...	...	...	19	24	210	1.25	...	...	...	...	...	...	Open 12,000-Ohm Resistor Across Volume Control
No Voltages on Tubes Nos. 1, 2 and 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	260	0	...	...	...	...	...	...	Open 3,200-Ohm Section of Voltage Dividing Resistor
No C.G. or S.G. Voltages on Tubes Nos. 1, 2, 3 and 4	0	0	265	0	0	0	265	0	0	0	265	0	0	0	260	0	...	...	...	...	...	...	Open 3,200-Ohm S.G. Supply Resistor
High C.G. Voltage on Tube No. 4	2.6	65	170	1.1	2.6	83	165	2.5	2.8	60	165	4.0	16	50	210	1.2	...	...	...	...	...	...	Open S.G. Voltage Section of Volume Control
High C.G. Voltage on Tube No. 4	2.0	80	190	2.2	2.2	100	183	4.0	2.6	75	180	5.8	20	70	205	1.3	...	...	...	...	...	...	Open 830-Ohm Section of Voltage Dividing Resistor
Very High C.G. Voltage on Tubes Nos. 1, 2 and 3	255*	0	0	0	255*	0	0	0	255*	0	0	0	16	145	245	1.0	...	...	...	...	...	...	Open 120-Ohm Section of Voltage Dividing Resistor
No S.G. Voltage on Tubes Nos. 1, 2 and 3	1.8	0	195	0	1.8	0	195	0	1.8	0	195	0	7.4	85	230	0.5	...	...	...	...	...	...	Open Volume Control Arm or 12,000-Ohm Resistor
High Plate Current on Tube No. 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0	150	70	6.0	150	0	Open 430,000-Ohm Resistor
High Plate Current on Tube No. 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6.0	150	0	0	150	70	Open 430,000-Ohm Resistor
High Plate Current on Tube No. 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+43	70	85	−8.0	80	0	Shorted .025 Mfd. Condenser
High Plate Current on Tube No. 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	−8	80	0	+43	70	85	Shorted .025 Mfd. Condenser

*Caused by meter connection. No voltage present in operation.

(2) VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron socket with the receiver in operating condition should prove of value when checking with test sets such as a Weston Model 547, Type 3, or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the circuits will oscillate. Small variations of voltages will be caused by different tubes and line voltages. Therefore, the following values must be taken as approximately those that will be found under varying conditions. Figure 12 shows a simplified schematic circuit diagram. The numbers in Column 1 indicate the tube socket numbers shown in Figures 13A and 13B.

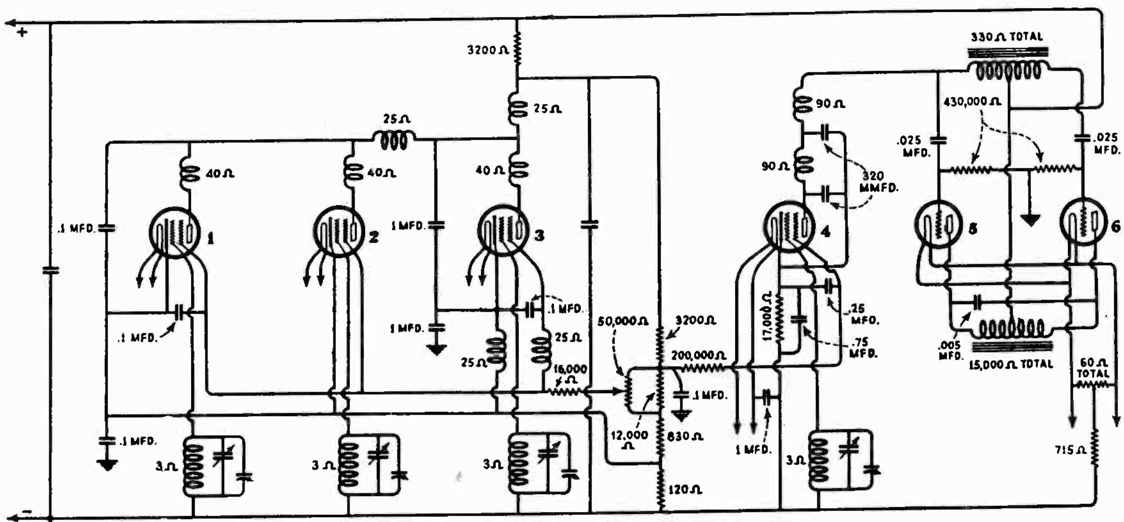


Figure 12—Simplified schematic circuit diagram.

RADIOTRON SOCKET VOLTAGES—120-VOLT LINE

Tube No.	Cathode to Heater Volts D.C.	Cathode or Filament to Control Grid-Volts D.C.	Cathode to Screen Grid Volts D.C.	Cathode or Filament to Plate Volts D.C.	Plate Current M. A.	Screen Grid Current M. A.	Heater or Filament Volts
			Volume Control at Maximum				
1	—40	—2.5	+85	160	3.0	0.2	2.3
2	—36	—2.5	+85	155	3.5	0.15	2.3
3	—36	—2.5	+75	155	3.5	0.15	2.3
4	—28	—7.5	+55	225	0.5	0.1	2.3
5	—	*—1.0	—	200	25.0	—	2.3
6	—	*—1.0	—	200	25.0	—	2.3
			Volume Control at Minimum				
1	—40	—1.0	+ 6	200	0	0	2.3
2	—40	—1.4	+ 6	200	0	0	2.3
3	—40	—0.8	+ 6	200	0	0	2.3
4	—28	—8.4	+75	230	.6	0	2.3
5	—	*—1.0	—	205	25.0	—	2.3
6	—	*—1.0	—	205	25.0	—	2.3

*Not true reading due to resistor in circuit.

(3) VOLTAGE READING SERVICE DATA CHART

The service data chart on page 16 provides a means of diagnosing trouble from socket voltage readings taken with any of the usual set analyzers.

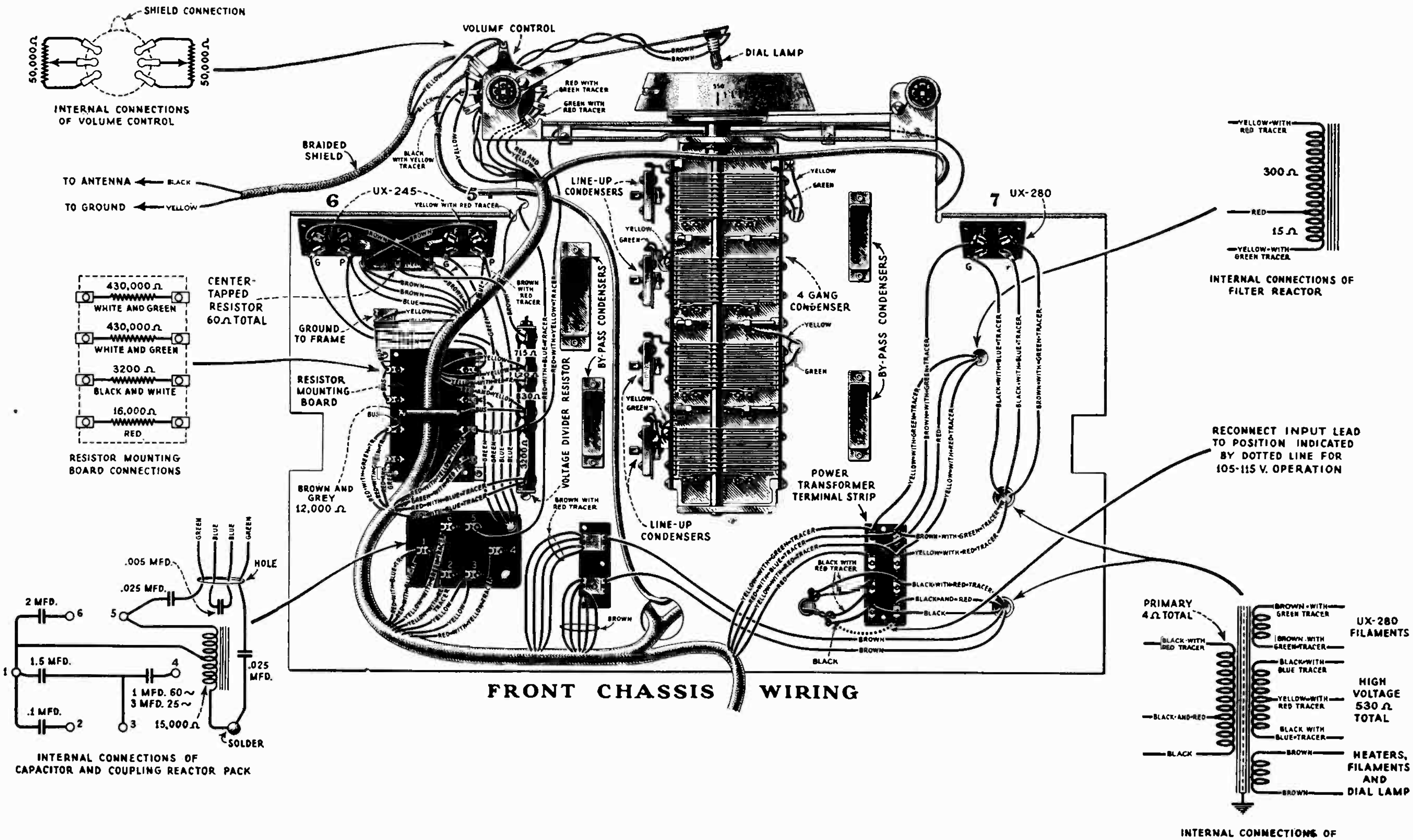


Figure 13A—Layout and wiring diagram of the chassis (front)

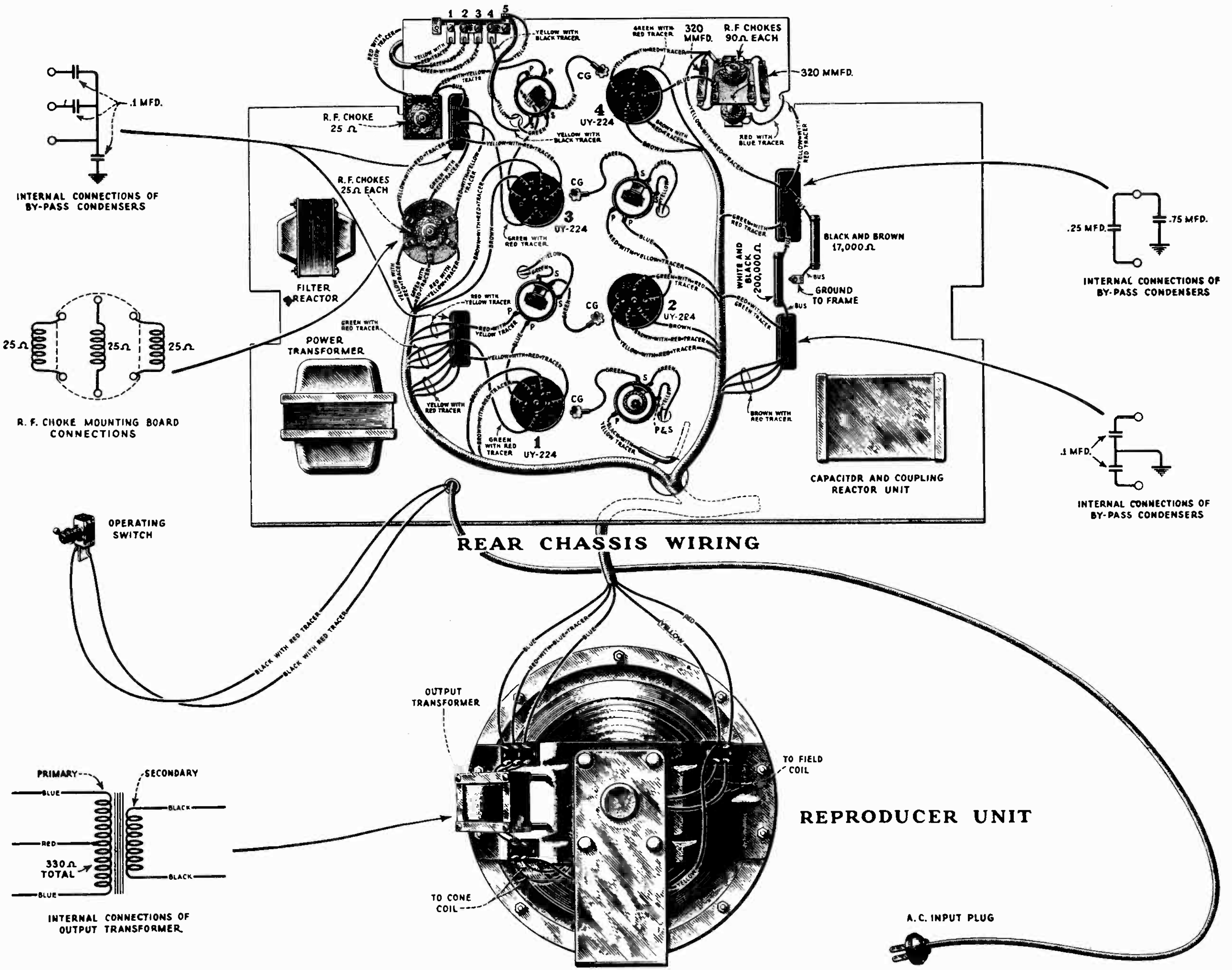


Figure 13B—Complete layout and wiring diagram of the chassis (rear) and reproducer unit

(4) CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly of this instrument. Disconnect the antenna and ground leads, and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series, or a voltmeter with sufficient battery to give a good deflection when connected across the battery terminals, should be used in making these tests.

The resistance of the various circuits are shown in the column titled "Correct Effect." Checking the resistance of the circuits adds an additional check on their correct functioning. This may be done by means of a direct reading "Ohmmeter," a resistance bridge, the voltmeter-ammeter method or the method suggested in the Radiola 80 Service Notes.

Radiotron socket numbers used in making these tests are shown in Figures 13A and 13B. The schematic diagram, Figure 2, gives the values of the parts of the various circuits. Figure 12, the simplified schematic circuit diagram, is useful when making these tests.

Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused By
Ant. lead to Ground lead (Vol. Cont. at "Min")	Closed (50,000 ohms)	Open	Open section of volume control
Ant. lead to Ground lead (Vol. Cont. at "Max")	Closed (30 ohms)*	Closed (50,000 ohms)	Open primary of 1st R.F. transformer
C1 to Ground	Closed (120 ohms)	Open Short Closed (21 ohms)	Open 120-ohm section of voltage divider resistor Shorted 0.1 mfd. condenser from C1 to Ground Shorted 0.1 mfd. condenser from C3 to Ground
CG1 to Ground	Closed (3 ohms)	Open Short	Open secondary of 1st R.F. transformer Shorted 1st tuning or line-up condenser
SG1 to C1, (Vol. Cont. at "Min")	Closed (16,830 ohms)	Open Short Closed (50 ohms)	Open 16,000-ohm resistor or 830-ohm section of voltage divider resistor Shorted 0.1 mfd. condenser from SG1 to C1 Short 0.1 mfd. condenser from SG3 to C3
SG1 to SG2	Closed	Open	Open connection
C1 to C2	Closed	Open	Open connection

* This may be higher on some sets due to the volume control arm not covering the full range of the resistance unit.

CONTINUITY TESTS—*Continued*

Terminals	Correct Effect	Incorrect Effect: Indication	Incorrect Effect: Caused By
P1 to P2	Closed (80 ohms)	Open	Open primary of 2d or 3d R.F. transformers or connections
P1 to Ground	Closed (14,000 ohms)	Open	Open primary of 2d R.F. transformer R.F. choke, 3,200-ohm resistor, 12,000-ohm resistor and volume control, 830-ohm or 120-ohm section of voltage divider.
		Closed (160 ohms)	Shorted 0.1 mfd. condenser from C1 to plate supply
		Closed (210 ohms)	Shorted 0.1 mfd. condenser from C3 to plate supply
		Closed (54,240 ohms)	Open 12,000-ohm resistor across volume control
		Closed (16,240 ohms)	Open volume control
		Closed (90 ohms)	Shorted 1.0 mfd. condenser
C2 to Ground	Closed (120 ohms)	Open	Open 120-ohm section of voltage divider resistor
		Short	Shorted 0.1 mfd. condenser from C1 to Ground
		Closed (21 ohms)	Shorted 0.1 mfd. condenser from C3 to Ground
CG2 to Ground	Closed (3 ohms)	Open	Open secondary of 2d R.F. transformer
		Short	Shorted 2d tuning or line-up Cond.
SG2 to C2 (Vol. Cont. at "Min")	Closed (16,830 ohms)	Open	Open 16,000-ohm resistor or 830-ohm section of voltage divider resistor
		Short	Shorted 0.1 mfd. condenser from SG1 to C1
		Closed (50 ohms)	Shorted 0.1 mfd. condenser from SG3 to C3
SG2 to SG3	Closed (25 ohms)	Open	Open R.F. Choke
C2 to C3	Closed (25 ohms)	Open	Open R.F. Choke
P2 to P3	Closed (105 ohms)	Open	Open primary of 3d or 4th R.F. transformer or R.F. Choke

CONTINUITY TESTS—*Continued*

Terminals	Correct Effect	Incorrect Effect — Indication	Incorrect Effect — Caused By
P2 to Ground	Closed (14,000 ohms)	Open	Open primary of 3d R.F. transformer, R.F. Choke, 3,200-ohm resistor, 12,000-ohm resistor and volume control, 830-ohm or 120-ohm section of voltage divider
		Closed (160 ohms)	Shorted 0.1 mfd. condenser from C1 to plate supply
		Closed (210 ohms)	Shorted 0.1 mfd. condenser from C3 to plate supply
		Closed (54,240 ohms)	Open 12,000-ohm resistor across volume control
		Closed (16,240 ohms)	Open volume control
		Closed (90 ohms)	Shorted 1.0 mfd. condenser
C3 to Ground	Closed (155 ohms)	Open	Open R.F. choke or 120-ohm section of voltage divider
		Short	Short 0.1 mfd. condenser from C3 to ground
		Closed (21 ohms)	Short 0.1 mfd. condenser from C1 to Ground
CG3 to Ground	Closed (3 ohms)	Open	Open secondary of 3d R.F. transformer
		Short	Shorted 3d tuning or line-up condenser
SG3 to C3 (Vol. Cont. at "Min")	Closed (16,880 ohms)	Open	Open cathode or S.G. choke, 16,000-ohm resistor or 830-ohm section of voltage divider resistor
		Short	Shorted 0.1 mfd. condenser from C3 to SG3
		Closed (50 ohms)	Shorted 0.1 mfd. condenser from C1 to SG1
SG3 to Terminal No. 2	Closed (16,025 ohms)	Open	Open R.F. choke or 16,000-ohm resistor
P3 to Ground	Closed (13,940 ohms)	Open	Open primary of 4th R.F. transformer, R.F. choke, 3,200-ohm resistor and volume control, 830-ohm or 120-ohm section of voltage divider
		Closed (185 ohms)	Shorted 0.1 mfd. condenser from C3 to plate supply or from C1 to plate supply
		Closed (54,215 ohms)	Open 12,000-ohm resistor across volume control
		Closed (16,215 ohms)	Open volume control
		Closed (65 ohms)	Shorted 1.0 mfd. condenser

CONTINUITY TESTS—*Continued*

Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused By
C4 to Ground	Closed (17,000 ohms)	Open Short	Open 17,000-ohm resistor Shorted 0.75 mfd. condenser across 17,000-ohm resistor
CG4 to Ground	Closed (3 ohms)	Open Short	Open secondary of 4th R.F. transformer or open link at terminal strip Shorted 4th tuning or line-up condenser
SG4 to Terminal 3 (Vol. Cont. at "Max")	Closed (200,000 ohms)	Open	Open 200,000-ohm resistor
C4 to P4	Closed (41,707 ohms)	Short	Shorted 320 mmfd. condenser
Terminal 3 to P4 (Vol. Cont. at "Max")	Closed (14,080 ohms)	Open	Open R.F. choke, coupling reactor or either 3,200-ohm resistor
P4 to either F7	Closed (7,680 ohms)	Open	Open R.F. choke, or one-half of coupling reactor
P4 to G5	Open	Closed (180 ohms)	Shorted .025 mfd. coupling condenser
P4 to G6	Open	Closed (15,180 ohms)	Shorted .025 mfd. condenser
G5 to Ground	Closed (430,000 ohms)	Open	Open 430,000-ohm resistor
G6 to Ground	Closed (430,000 ohms)	Open	Open 430,000-ohm resistor
P5 to P6	Closed (330 ohms)	Open Short	Open primary of output transformer Shorted .005 mfd. condenser
Across secondary of output transformer (cone coil disconnected)	Closed (.2 ohms)	Open	Open secondary of output transformer
Across cone Coil (Output transformer disconnected)	Closed (2.5 ohms)	Open	Open cone coil

CONTINUITY TESTS—*Continued*

Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused By
G7 to P7	Closed (530 ohms)	Open	Open high voltage winding of power transformer
G7 or P7 to Ground	Closed (1,895 ohms)	Open	Open high voltage winding of power transformer, filter reactor or reproducer field coil
Across F7 contacts	Closed (Short)	Open	Open UX-280 filament winding
Either side of filament contacts of Sockets 1, 2, 3, 4, 5 or 6	Closed (745 ohms)	Open	Open 60-ohm center tapped resistor or 715-ohm bias resistor
		Short	Shorted 0.1 mfd. condenser from heater to ground of Socket No. 4
Across A.C. input plug	Closed (4 ohms)	Open	Open primary of power transformer
Either F7 to Ground	Closed (17,350 ohms)	Open	Open either 3,200-ohm resistor, 12,000-ohm resistor and volume control, 830-or 120-ohm section of voltage divider
		Closed (57,350 ohms)	Open 12,000-ohm resistor across volume control
		Closed (19,350 ohms)	Open volume control
		Closed (3,200 ohms)	Shorted 1.0 mfd. condenser
		Closed (1,345 ohms)	Shorted 2.0 mfd. condenser
		Closed (1,630 ohms)	Shorted .1 mfd. condenser
		Short	Shorted 1.5 mfd. filter condenser
Terminal No. 2 to F7 (Vol. Cont. in Max. Position)	Closed (6,400 ohms)	Open	Open 3,200-ohm resistor

RCA

Radiola 60

SERVICE NOTES

PREPARED ESPECIALLY FOR
RCA AUTHORIZED DEALERS

RCA Radiola 60

Third Edition—2M—Jan. 1931

RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

A WORD OR TWO ABOUT SERVICE

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 the RCA Distributors, and the RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributor.

Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer. To assist in promoting this phase of the Dealer's 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 RCA Loudspeakers and 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, and it is suggested they be preserved for ready reference by the RCA Authorized Dealer.

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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—MAKING REPLACEMENTS

ILLUSTRATIONS

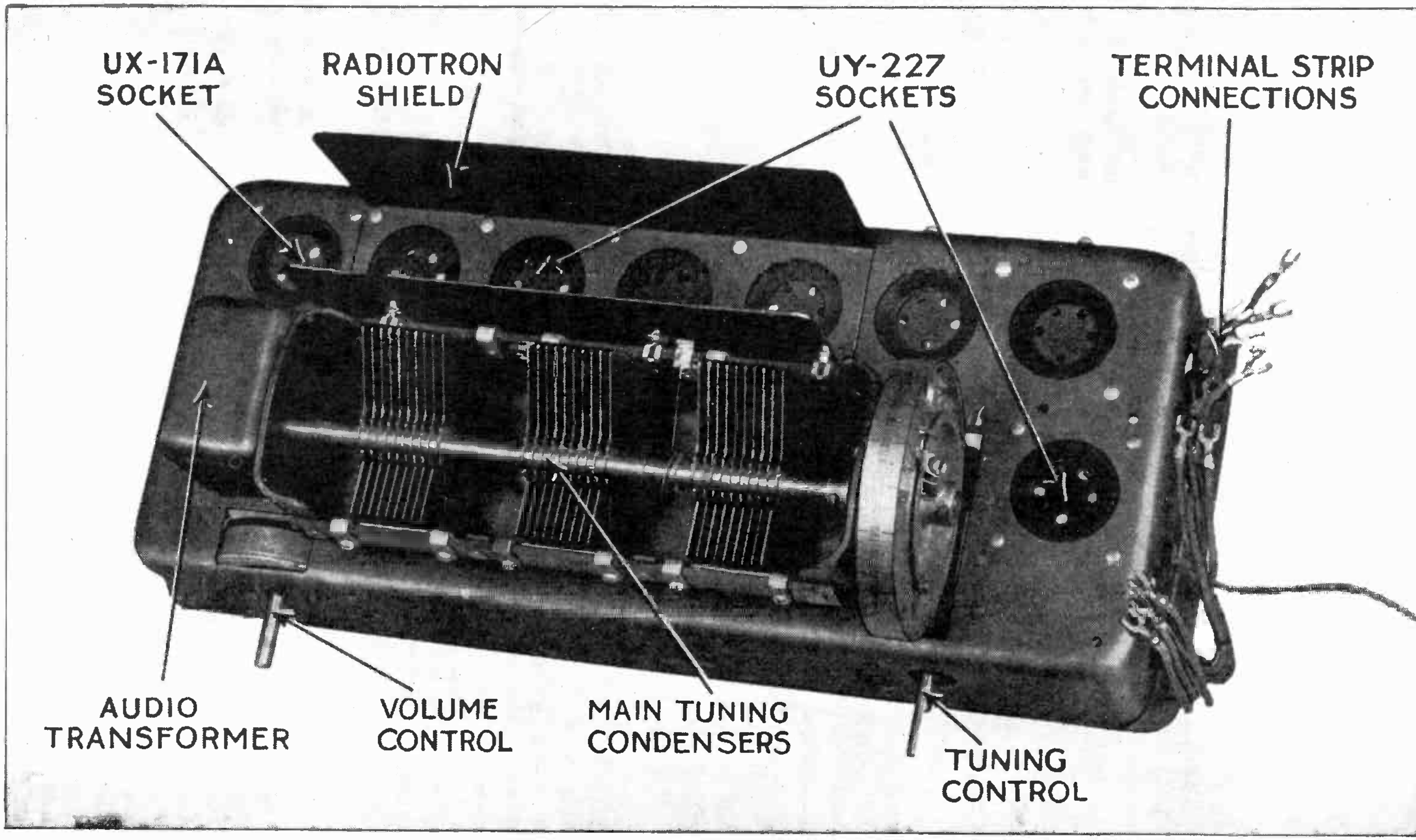


Figure 1—Top view of Receiver Assembly

RCA RADIOLA 60

(105-125 Volts. 50-60 Cycle A. C.)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 60 is a socket powered radio receiver employing an eight-tube fundamental super-heterodyne circuit and a full-wave rectifying circuit. Figure 1 is a top view of the receiver chassis. Seven Radiotrons UY-227, one Radiotron UX-171A, and one Radiotron UX-280 are used. Excellent sensitivity and tone quality are obtained. The socket power unit (Figure 2) provides all plate, grid and filament voltages used in the receiver assembly.

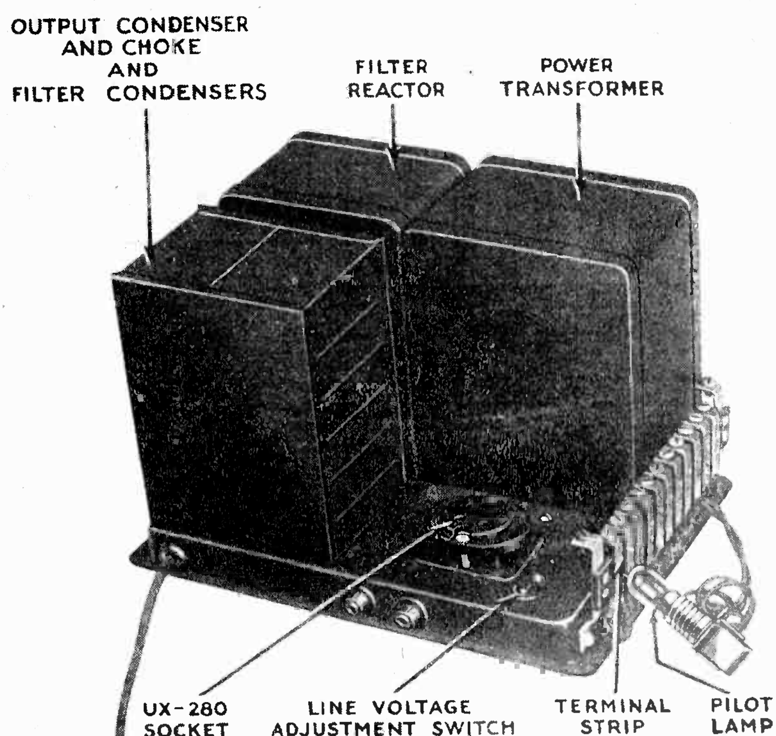


Figure 2—Top view of socket power unit

Radiola 60 is designed to operate on alternating current of 105 to 125 volts, 50 to 60 cycles, such as is used for house lighting. Connection to D.C. lines or to A.C. lines of different rating may damage the Radiola or the Radiotrons.

Radiola 60 is also made up in models designed for 105-125 volt, 25-40 cycle A.C. operation, The difference between this and the 50-60 cycle instrument is the power transformer. Should it be desirable to change a 50-60 cycle Radiola 60 for operation on 25-40 cycles, or vice versa, a change of the power transformer is all that is necessary. These transformers may be obtained through the regular RCA channels as a replacement part.

The following circuit characteristics are incorporated in the design of Radiola 60. See Figure 3.

(a) It has an eight-tube super-heterodyne circuit using seven Radiotrons UY-227 and one UX-171A in the receiver unit. Radiotron UX-280 is used as a full-wave rectifier in the socket power unit.

(b) The circuit consists of one untuned coupling stage; one tuned R.F. stage; a tuned heterodyne detector circuit; two intermediate R.F. stages; an oscillator; a second detector; and a power amplifier. (Figure 4.)

(c) The second detector, operated at 160 volts plate potential with grid bias, changes the radio frequency current of the intermediate stages into audio frequency current.

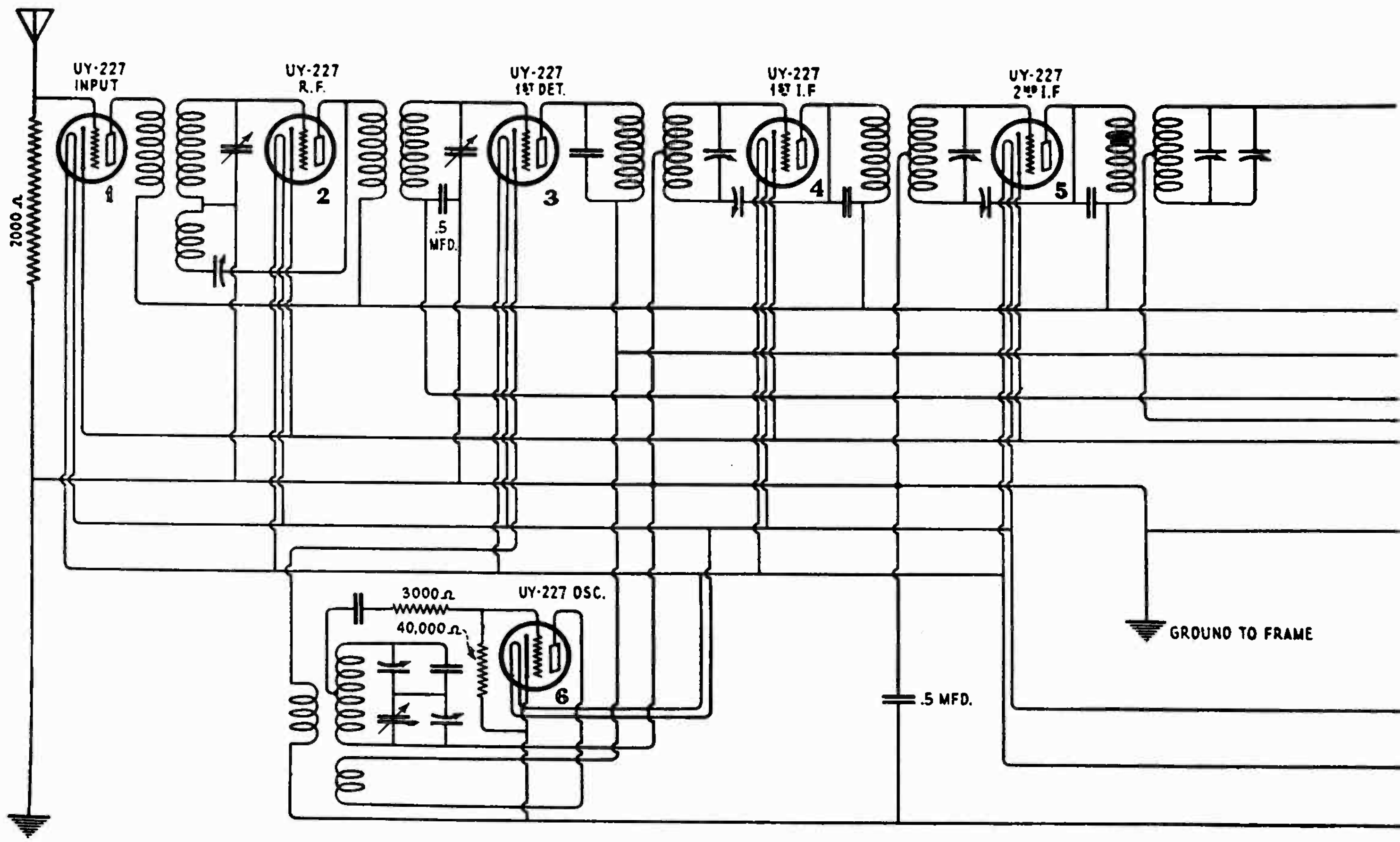


Figure 3—Schematic circuit diagram of

This gives improved quality and sufficient output to operate the power tube directly from the second detector, thus eliminating any distortion that might be present if an intermediate audio stage were used.

(d) The volume control regulates the grid bias on all radio and intermediate frequency amplifying stages, giving a positive control of volume, even on nearby local stations, without distortion.

(e) The use of the indirect heater type of Radiotron permits the connection of power amplifiers, such as Loudspeakers 104 and 105, to the detector without developing excessive hum.

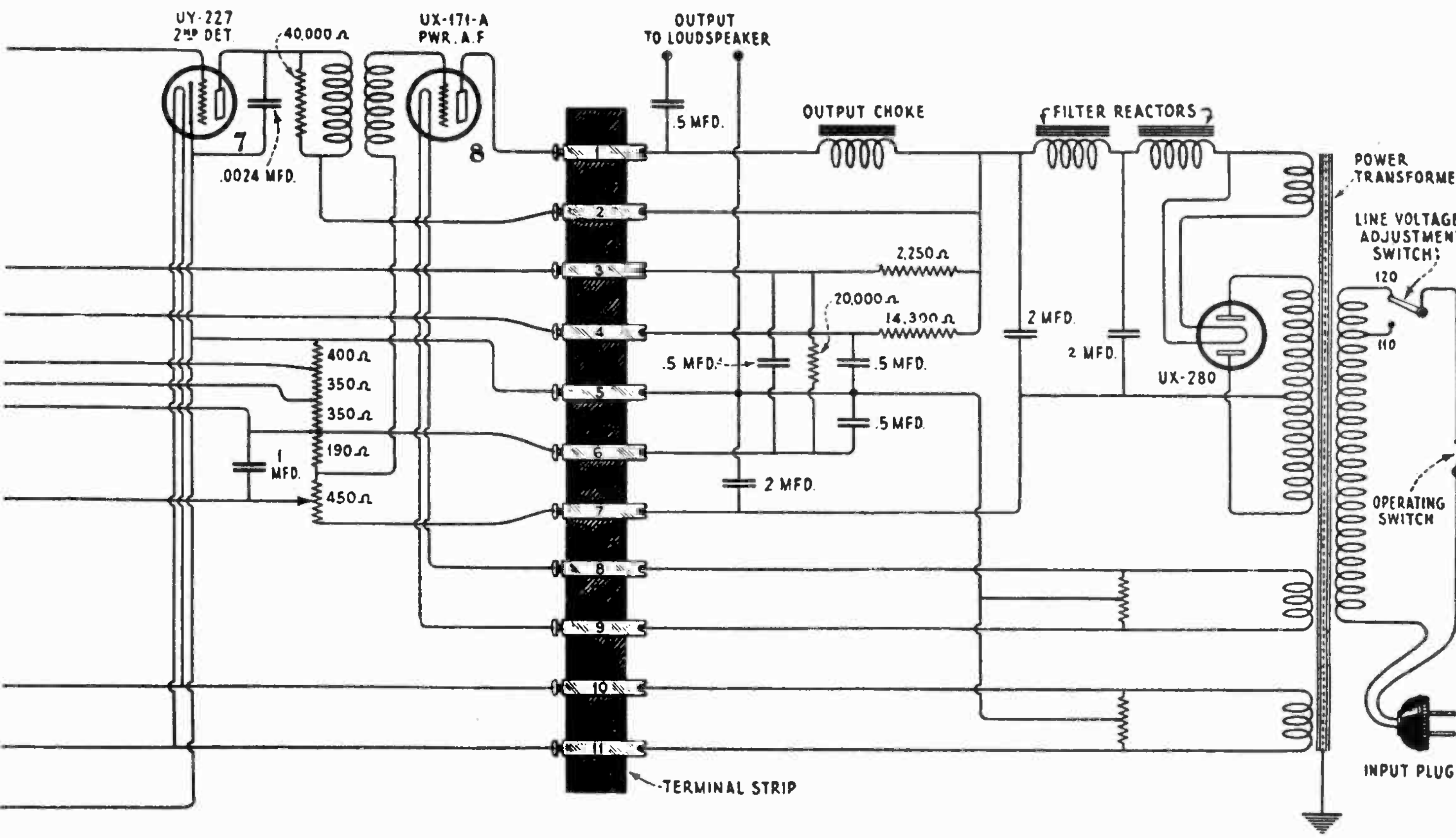
Figure 4 illustrates the sequence of the Radiotrons in the receiver, omitting Radiotron UX-280 in the socket power unit. From right to left, when facing the front of the Radiola, the Radiotron sequence is as follows:

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground across a resistance and functions as a coupling tube to the antenna system.

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

Radiotron No. 3 is the tuned heterodyne detector. It is tuned by the center of the gang condensers.

Radiotrons No. 4 and No. 5 are the first and second intermediate frequency stages. These stages are tuned to a frequency of 180 K.C., giving ample distance between the two peaks of



receiver assembly and socket power unit

the oscillator to eliminate any possibility of stations coming in at more than one point on the tuning dial.

Radiotron No. 6 is the oscillator. It is tuned by the third of the gang condensers. Two trimming condensers are provided at the rear of the receiver assembly for adjusting the oscillator circuit to keep the resultant beat note at the correct frequency for the intermediate stages.

Radiotron No. 7 is the second detector. It operates at a plate potential of 160 volts with the proper grid bias and does not use a grid leak or condenser. Its output is sufficient to drive the power amplifier.

Radiotron No. 8 is the power amplifier stage. An output filter is provided for keeping the D.C. used with this tube out of the loudspeaker windings.

These various principles incorporated in Radiola 60 provides a radio receiver of advanced design, excellent performance and good tone quality

PART I—INSTALLATION

{1} ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiola 60 the antenna length need only be approximately 25 feet. 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 abolutely 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. Bring the lead-in wire from the outside through a porcelain tube insulator to the inside of the house for connection to the receiver.

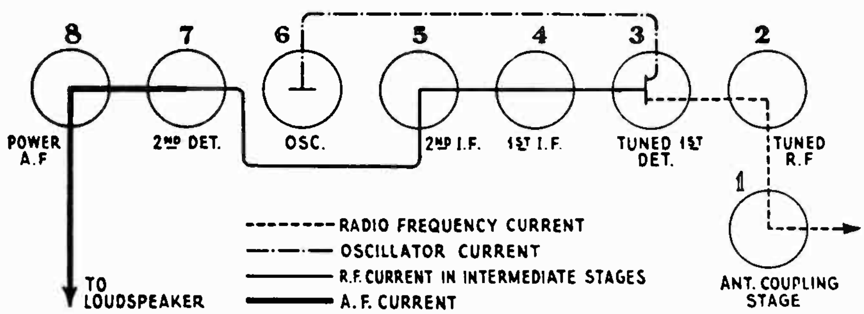


Figure 4—Radiotron sequence

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.

{2} 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 25 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. However, due to its sensitivity Radiola 60 will generally give entirely satisfactory reception with an indoor antenna.

{3} GROUND

A good ground is quite as important as a good antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

[4] RADIOTRONS

A guide shield is provided on all the receiver Radiotron sockets to facilitate the insertion of the Radiotrons. The seven Radiotrons UY-227 are inserted in the five-contact sockets. The Radiotron UX-171A is placed in the four-contact socket in the receiver assembly, and the Radiotron UX-280 is placed in the socket power unit.

In placing Radiola 60 into operation, if no signals are heard when tuning to a station known to be broadcasting, examine the Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more of the same type known to be in operating condition will isolate the damaged one.

Socket No. 2 (Figure 4), the tuned R.F. stage, is the most critical for selection of the Radiotrons. Place in this socket the tube which gives the loudest signal and does not go into oscillation throughout the tuning range. If no tube is found that will not oscillate, a slight re-adjustment of the R.F. compensating condenser may be necessary, as described in Part II, Section 13.

Other stages somewhat critical are the oscillator and second detector, sockets No. 6 and No. 7, respectively. The remaining tubes should be interchanged until a tube is found for the oscillator that gives the loudest signal on a given station. The second detector Radiotron should be selected for its ability to handle large volume. Select the tube for this socket that will permit the volume control to be advanced and give the greatest output without overloading.

[5] LINE SWITCH

A two-way switch is provided in the S.P.U. for adjustment to line voltages. A shield over the terminal strip holds this switch in the 120-volt position. Unless it is definitely known that the line is always below 115 volts the switch should be left in its original position. It is a good plan to leave this switch at the 120-volt position on all lines unless unsatisfactory operation is experienced. If the switch is set at the 110-volt position on supply lines exceeding 115 volts the Radiotrons in the receiver will be damaged.

[6] KNOBS

Radiola 60 uses an improved type of push knob on the station selector and volume control. This knob is removed by simply pulling it off the shaft, and replaced by pushing it on. Very little trouble should be experienced, as no setscrews or other parts that might give trouble are used.

When placing this knob on its shaft care must be exercised not to push it tight against the washer between the knob and cabinet, as then it will bind. Sometimes in new sets the knob will have become pushed against the washer in handling, and bind. The remedy is merely to pull the knob out until it does not bind.

[7] RECEIVING LOUD LOCAL STATIONS

If excess volume control adjustment is used on local stations the signal will apparently have two peaks on the tuning dial. A further advance of the volume control will decrease the volume rather than increase it. This is entirely normal, and is caused by tube overloading. The correct method of tuning Radiola 60 on local stations is to reduce the volume control to the position where the station will be received at only one position on the station selector dial, and then adjust the volume control for the desired volume.

On some stations when tuned in with excessive volume a howl may be experienced. Should a condition of this kind occur the remedy is to reduce the volume control until the howl disappears.

This tuning procedure should be explained to the Radiola owner when an installation is made.

[8] DISTORTION DUE TO LOUD SIGNALS

In some localities extremely close to powerful broadcasting stations, reproduction may be distorted when reducing volume to a point satisfactory to the listener. When installing a set determine by a listening test whether this condition exists or not and apply the following remedy if the reproduction is distorted.

Procure a single-pole single-throw switch (any type will do) and connect it in series with the antenna lead of the receiver. The switch may be located either inside or outside the cabinet in any convenient position. Opening the switch will disconnect the antenna and allow satisfactory reception on signals that would otherwise be distorted. The switch should be closed for reception from other stations.

[9] PICK-UP FROM LONG WAVE HIGH POWER CODE STATIONS

Should Radiola 60 be installed very close to long wave, powerful code stations, it is possible that a certain amount of pick-up and interference from them will be experienced. Trouble of this kind may be eliminated in the following manner:

(a) Procure the following equipment.
Two Radiola 16 antenna coils (RCA Stock No. 5658.)
One .0002 Mfd. fixed condenser.

(b) Connect as shown in Figure 5.

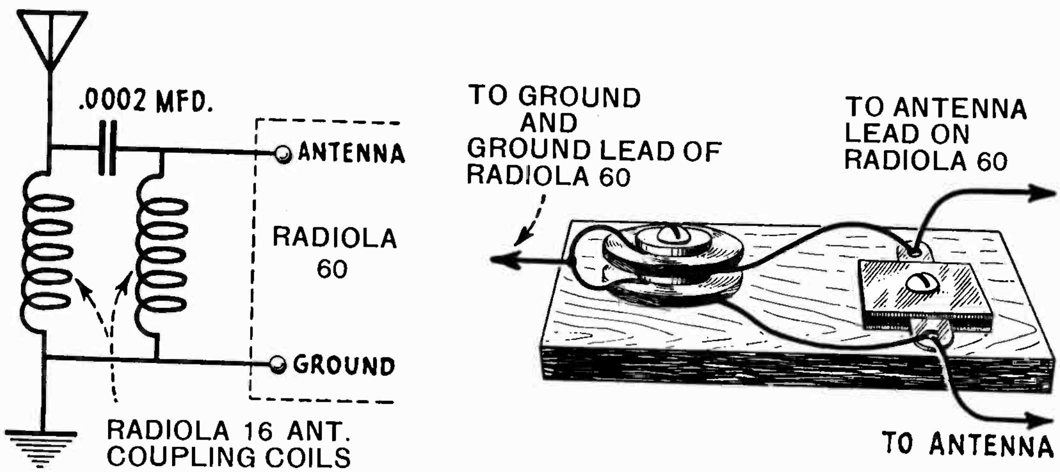


Figure 5—Long wave interference filter

(c) This apparatus may be placed inside of the cabinet of the receiver or made up in a separate unit and placed in any convenient location. It acts as a filter, allowing frequencies of the broadcast band only to reach the receiver.

[10] CONNECTING RADIOLA 60 TO EXTERNAL POWER AMPLIFIERS AND POWER LOUDSPEAKERS

Due to using Radiotron UY-227 with the resulting low value of hum, Radiola 60 may be used in conjunction with power loudspeakers, such as RCA Loudspeakers 104 and 105, and external power amplifiers generally, when it is desirable.

For making such a connection it is necessary to disconnect the receiver audio transformer by removing the red lead from the voltage supply terminal (No. 2 on the S.P.U. terminal strip). Tape this lead and allow it to remain unused. Connect one lead of a Radiola 16 antenna coil (RCA Part No. 5658) to the plate connection of the second detector Radiotron UY-227. To the other lead of the Radiola 16 antenna coil connect one lead of the power amplifier input transformer and to the S.P.U. terminal No. 2 connect the other power speaker input lead. See Figure 6. This connection places a choke coil and the primary of the input transformer of the power amplifier in series with the detector plate supply without also being in series with the audio transformer in the receiver assembly.

Although the Radiotron UX-171A is not used when making such a connection, it must be left in the circuit to properly balance the load on the S.P.U. Without this tube in place an excessive rise in voltage will occur due to reduced load.

PART II—SERVICE DATA

[1] ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna; or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

[2] RADIOTRON SOCKETS

The sockets used in Radiola 60 are a six-gang UY socket assembly, a single UY socket, and two single UX sockets. One of the UX sockets is used in the socket power unit and is of a different design than those used in the receiver assembly.

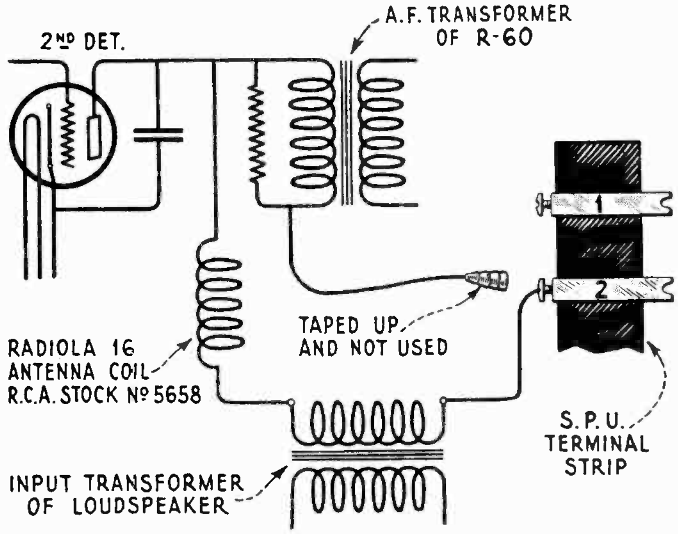


Figure 6—Hook-up of external power amplifiers and RCA Loudspeakers 104 *and* 105 *to Radiola* 60

The bakelite Radiotron guide shields used in the receiver assembly will prevent any possible shock from contact with high voltages in the socket when inserting the Radiotrons. The prongs of the tubes fit into this shield opening very snugly and require only a twist until the prongs find the correct holes into which they fit. This is especially helpful when inserting the five-prong tubes into their sockets.

[3] RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuits sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

[4] LOOSE VOLUME CONTROL

A loose volume control arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame.

[5] ADJUSTMENT FOR SLACK DRUM CONTROL

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash.

After considerable wear or extreme changes of temperature the cable may become slack. To take up this slack open lid of cabinet and turn the cable adjusting screw with clamp until the cable is taut. This screw may become seated after several adjustments are made, thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. Remove the cable adjusting screw and clamp. The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. It will be noted that the tapered pin in the new position cannot be inserted as far as originally. However, it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable

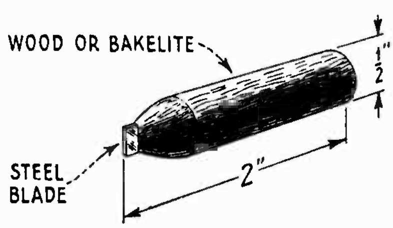


Figure 7—Non-metallic screw driver

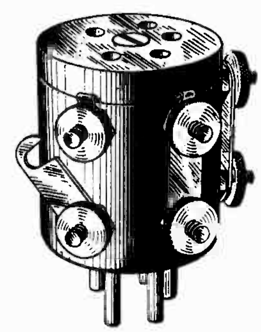


Figure 8—Radiotron socket adapter

again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and an additional half turn slipped on the drum which will provide for taking up all slack. Sufficient grooves are provided on the drum for this purpose.

[6] BROKEN CONDENSER DRIVE CABLE

A broken condenser drive cable can be replaced in the manner described in Part III, Section 7. However, if a new cable is not immediately available a temporary repair can be made in the following manner, provided the break in the cable is not in that section that passes over the small grooved drums.

Splice and solder the two ends together. Splicing consists of interweaving the strands, as with rope and not just twisting the cable ends together as in an electrical wiring splice. Splicing gives greater strength and forms a smaller body on the cable. When soldering use plenty of flux and a small amount of solder. Heat sufficiently so that the solder adheres to all the strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows excess solder to drip away. This is but a temporary repair to be used only until a new cable can be procured.

[7] HUM

If a pronounced hum develops during operation check the following:

(a) Low emission Radiotron UX-280. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(b) Defective center tapped resistance. A short or open of either of these resistances will cause a loud hum and imperfect operation of the Radiola.

(c) Any open of the several grounding connections in the Radiola or voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part II, Section 21.

(d) Use of Radiotron UX-171 instead of Radiotron UX-171A may cause an increase of hum. It is recommended that only Radiotron UX-171A be used as a power amplifier in Radiola 60.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part III, Section 13, and heating it in a slow oven. The open end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

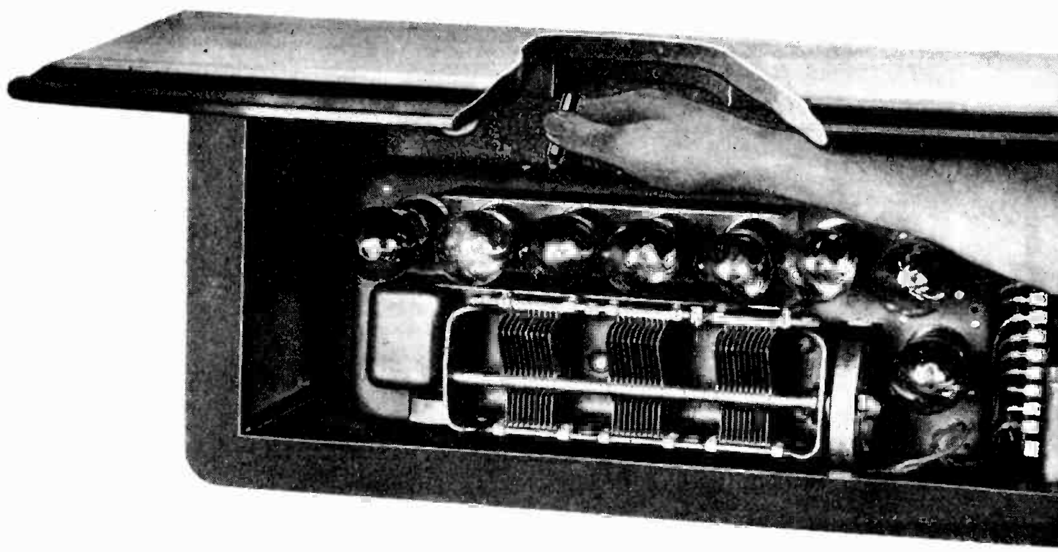


Figure 9—Adjusting oscillator trimming condensers

[8] LOUDSPEAKER POLARITY

The use of an output filter in Radiola 60 makes unnecessary any adjustment for polarity of the output current. Any type of loudspeaker (either horn or cone) can be connected in the manner that gives the most pleasing reproduction.

[9] LOW VOLUME AND WEAK SIGNALS

Low volume or weak signals may be caused by:

(a) Defective antenna system. A poor antenna and ground or one in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2 and 3, should be followed if trouble of this kind is experienced.

(b) Defective Radiotrons. A defective Radiotron in any stage may cause weak signals. Before checking other causes it is a good plan to check all Radiotrons by interchanging them with ones of a similar type known to be in good operating condition.

(c) R.F. compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 13.

(d) Oscillator trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the Radiola may be sensitive at certain portions of the tuning scale and very insensitive at other sections. Should these condensers be badly out of adjustment, only very loud local stations will be heard. The correct method for adjustment of these condensers is given in Part II, Section 12.

(e) Intermediate transformers not correctly tuned or matched. Should the tuning condensers connected across the secondaries of the intermediate transformers be out of adjustment, weak signals and poor tuning or, in some cases no signals will result. Refer to Part II, Section 14, for the correct method of adjusting the I.F. transformers.

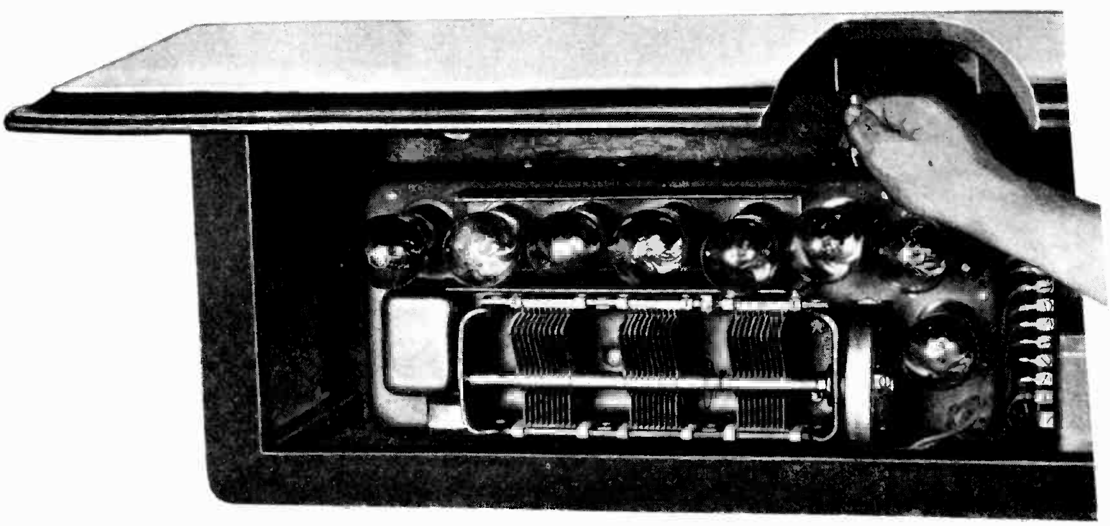


Figure 10—*Adjusting the R.F. compensating condenser*

(f) Defective A.F. transformer or output condenser and choke. A defect in any of these parts will cause weak signals and abnormal operation. Check by means of the continuity test and make any replacement that is necessary.

(g) Low voltage from S.P.U. Check S.P.U. voltages at terminal strip with readings given in Part II, Section 17. Low voltages may be caused by a low emission rectifying tube or defective resistances in the S.P.U. or receiver. Check by means of continuity test.

(h) Open or short of various connections in receiver. Check by means of continuity tests and make any repair or replacement that is necessary.

[10] AUDIO HOWL

Audio howl may be caused by:

(a) Incorrect adjustment of R.F. compensating condenser. A compensating condenser adjusted to the verge of oscillation may cause a howl on nearby stations. Adjust as suggested in Part II, Section 13.

(b) Open A.F. condenser connections. An open of the A.F. by-pass condenser may cause a howl.

(c) Open large by-pass condenser connections. An open of the connections to the large by-pass condensers may cause a howl.

(d) Defective volume control resistance. Should there be an open or short in the volume control or in its adjacent resistances an audio howl may develop.

(e) Vibrating elements in receiver Radiotrons. A gradually developed howl may be due to the loudspeaker causing the receiver Radiotron elements to vibrate. To overcome this condition, interchange the Radiotrons in the receiver, especially the detector, or change the relative angle of the loudspeaker to the receiver.

(f) Poor ground. Install ground system as suggested in Part I, Section 3.

(g) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause a howl.

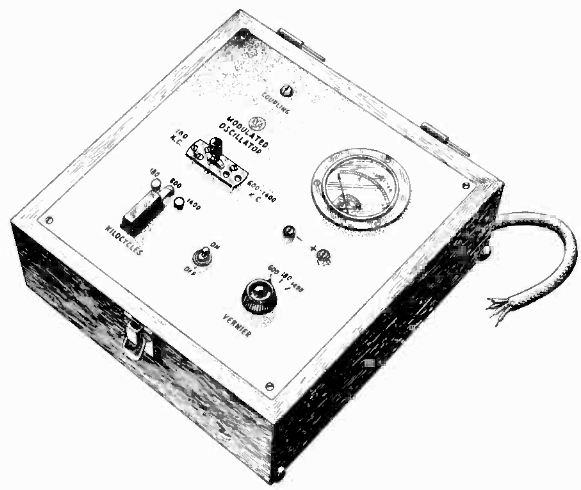


Figure 11—*Test Oscillator* (*Driver*)

(h) Defective resistance in S.P.U. or the receiver assembly. An open resistance unit may cause howl. Under such conditions it is advisable to turn the set "off" until the trouble is found, otherwise excessive voltage rise may cause further damage.

(i) Neutralizing condensers in intermediate transformers out of adjustment. These condensers being out of adjustment might cause an I.F. stage to oscillate which will result in a howl when a station is tuned in, especially at loud volume. Adjust the neutralizing condensers as described in Part II, Section 14.

(j) Open of any of the several ground leads in the Radiola. This may cause some of the circuits to go into oscillation and result in a howl when a station is tuned "in." Generally a loud hum will also be present. The several grounding leads in the Receiver Assembly and in the Socket Power Unit should be checked and any open or poorly soldered joint should be repaired.

[11] DISTORTED REPRODUCTION

Under normal conditions Radiola 60 will deliver a strong signal of excellent quality to the loudspeaker. The high sensitivity of Radiola 60 makes it undesirable to operate the set at full volume when receiving from nearby broadcasting stations. If the loudspeaker production is poor test the output from the receiver. A pair of phones may be used for this purpose. 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, audio stage and the rectifier tube.

(b) High or low plate and grid voltages from the Socket Power Unit or a defective resistor in the Receiver Assembly. In the Socket Power Unit distortion may be caused by a defective Radiotron UX-280 or resistance unit.

(c) Defective A.F. transformer. Check by means of continuity test and replace if necessary.

(d) Trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the beat signal may not be exactly the frequency to which the intermediates are tuned. This will cause weak signals and distortion of those received. This condition may or may not be present throughout the tuning range of the receiver. Adjust as described in Part II, Section 12.

(e) Receiver oscillating. Should some circuit other than the oscillator be oscillating, distortion will be experienced when tuning in a station. This will be accompanied

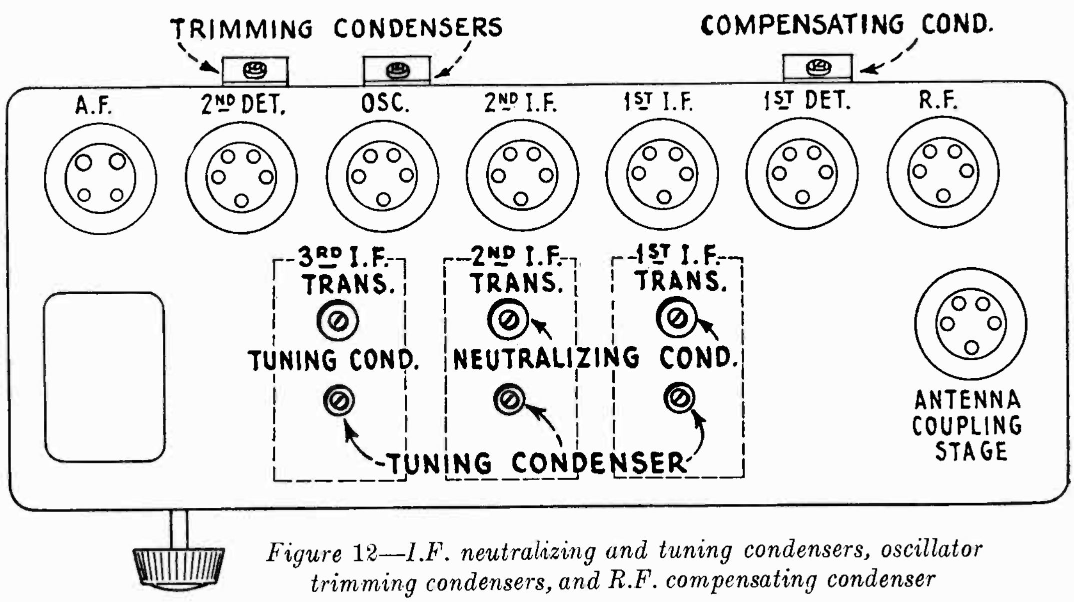


Figure 12—I.F. neutralizing and tuning condensers, oscillator trimming condensers, and R.F. compensating condenser

by a whistle or squeal when the carrier wave of the station is tuned in. To remedy trouble of this kind consult Part II, Section 10.

(f) Intermediate transformers out of line or not properly matched. This will have the effect of giving distorted reproduction and reduce the sensitivity of the receiver to a marked degree. Line up the entire I.F. transformer assembly as described in Part II, Section 14.

[12] ADJUSTMENT OF OSCILLATOR TRIMMING CONDENSERS

Two trimming condensers are provided for adjusting the oscillator circuit so that the beat note will always be 180 K.C. throughout the tuning range of the receiver.

The most noticeable symptom of the oscillator trimming condensers being out of adjustment is insensitivity of the Radiola in some sections or throughout the tuning range. To check the adjustment of the trimming condensers as a possible cause of any noticeable insensitivity in the receiver proceed in the following manner:

(a) Procure the following equipment:

A modulated oscillator giving signals at 1,400 and 600 Kilocycles. Figure 6 shows the constants and circuit diagram of an oscillator satisfactory for this purpose which may be operated entirely from the house lighting circuit.

A short non-metallic screwdriver. Such a screwdriver is shown in Figure 7 with its maximum dimensions.

An adapter (See Figure 8) suitable for connecting to the plate of the second detector Radiotron (No. 7.) This adapter will be found very useful around a repair shop for breaking into various circuits without unsoldering any wire. If no adapter is available connect the milliammeter in series with the connection at terminal No. 2 in the Socket Power Unit. This will necessitate the removal of the terminal strip shield.

A 0-10 milliammeter.

(b) Place the adapter in Radiotron socket No. 7 and connect the milliammeter in series with the plate by opening the link on the adapter and connecting the meter to each plate connection.

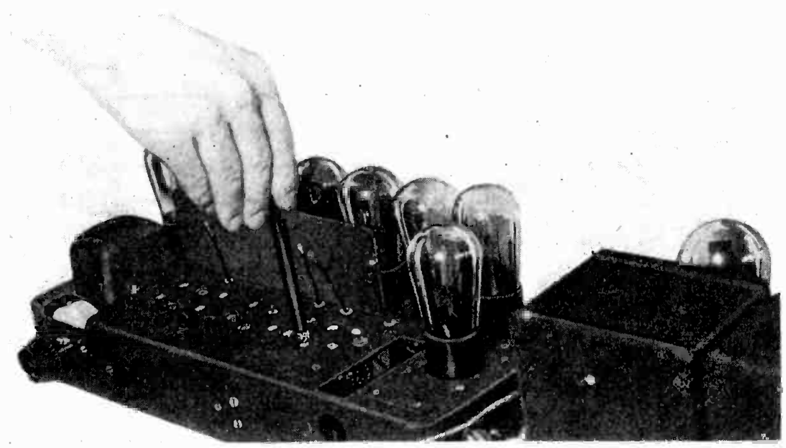


Figure 13—Adjusting the I.F. transformers

(c) With the Radiola in operation, place the oscillator in operation at 1,400 K.C. and tune the Radiola by adjusting the station selector until a deflection caused by the external oscillator is obtained in the milliammeter. Adjust volume control so that deflection is not beyond scale of meter.

(d) Now adjust the oscillator trimming condenser on the left (Figure 9) with the small non-metallic screw-driver until a maximum deflection is obtained in the milliammeter.

(e) Adjust oscillator for 600 K.C. Tune in the Radiola with station selector and then adjust the trimming condenser to the right for maximum deflection of the milliammeter.

(f) Now readjust at 1,400 K.C. as indicated in (c) and (d).

With this adjustment the trimmming condensers are correctly adjusted for maximum efficiency, that is, so adjusted that the beat signal will be 180 K.C. throughout the tuning range.

[13] ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The radio frequency compensating condenser should not be touched unless it is definitely ascertained that no other failure exists as a possible cause of receiver insensitivity, which is the most noticeable indication of the need for adjusting the compensating condenser.

An oscillating condition of the receiver may be caused by improper adjustment of this condenser.

A step by step procedure for making proper adjustment follows:

(a) Procure a small non-metallic screwdriver (See Figure 7.)

(b) Place Radiola in operation in usual manner and tune in a station, preferably at the lower wavelengths.

(c) Locate the position of the compensating condenser (See Figures 10 and 12.)

(d) With the volume control at the position of maximum intensity—not maximum setting—adjust the screw of the condenser until the Radiola goes into oscillation. This will cause a whistle whenever a station is tuned "in." Then turn the screw in the opposite direction until the set just goes out of oscillation and no howl is experienced when receiving loud local stations. This is the correct adjustment for the radio frequency compensating condenser.

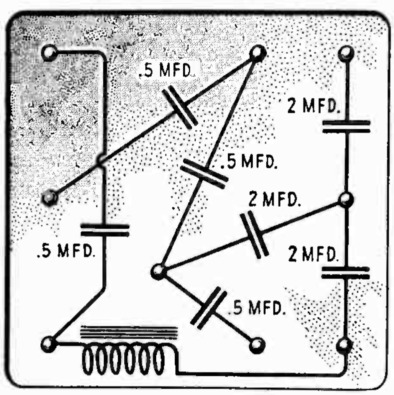


Figure 14—Internal connections of filtering and by-pass condensers, and output condenser and choke

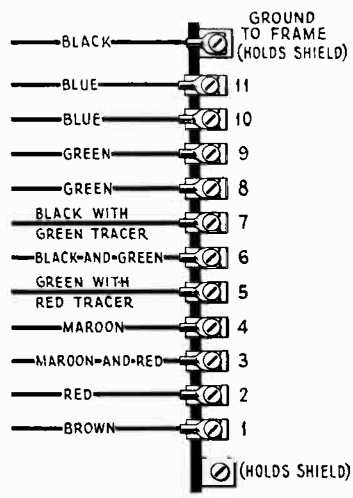


Figure 15—S.P.U. terminal strip with color scheme of connections

[14] ADJUSTMENT OF I. F. TRANSFORMERS

The three I.F. transformers used in Radiola 60 are of the air core, tuned primary and tuned secondary type. The primary condenser is of the fixed type, while the secondary is adjustable. Also in each assembly an adjustable condenser is provided for neutralizing the I.F. stage.

Should a transformer burn out or its primary fixed condenser change in capacity it will be necessary to replace that particular transformer. The correct procedure for making such a replacement is contained in Part III, Section 10.

A simple method of locating a shorted transformer is to use a resistance bridge or the resistance measuring method described in "Radiola 32 Service Notes." The approximate transformer primary D.C. resistance is 20 ohms; secondary 100 ohms. Due to the circuit arrangement it will only be possible to get a reading of 50 ohms on the secondary as the end connection goes to the neutralizing condenser and the reading must be made at the center tap connection. This test can be made from the underside of the chassis. (See circuit diagram Figure 17.)

After replacing a defective I.F. transformer or to make adjustments the following tuning and neutralizing procedure must be followed for correctly lining up the various circuits. This is of utmost importance, as the entire performance of Radiola 60 is based on the correct functioning of its intermediate stages.

The following equipment is needed:

1. A Test Oscillator (Driver). See Figure 11.
2. A coupling lead for coupling the output of the Driver to the grid coil of the first detector.
3. A non-metallic screw-driver.
4. A "dummy" Radiotron UY-227—a normal tube with one heater prong removed.

This Driver, together with all the above items, will be furnished to RCA Distributors by the RCA Service Division.

Preliminary steps to be taken before adjusting the tuning, neutralizing and trimming condensers:—

(a) Remove receiver assembly and S.P.U. from cabinet as described in Part III, Section 1 and Section 10.

(b) Remove main tuning condenser assembly as described in Part III, Section 4.

(c) Replace screw holding ground lead on under side of receiver assembly and make certain that ground lead makes good contact with the chassis frame.

(d) Connect all leads to the S.P.U. terminal strip except No. 2 (red), which should be connected to the clip from the Driver. The other lead with the spade terminal from the Driver should be connected to terminal No. 2 on the S.P.U. terminal strip. These connections merely place the milliammeter in the Driver test set, in series with the plate supply to the second detector.

(e) Now place the coupling coil from the Driver under the center coil of the R.F. and Oscillator assembly. This is the transformer between the tuned R.F. stage and the first detector. Replace all Radiotrons except the Oscillator and turn operating switch "ON." Also connect a loudspeaker to the output pin jacks of the S.P.U.

(f) Place Driver in operation by switching "ON," and set switches and vernier condenser at 180 K.C. The note from the Driver will then be heard in the loudspeaker.

The I.F. transformer tuning condensers may now be adjusted as follows:

(a) Adjust the tuning condensers successively on the third, second and first I.F. transformers (Figure 12) for maximum signal in the loudspeaker and maximum reading on the milliammeter. If pointer should go off milliammeter scale reduce the volume control. After making one adjustment on the transformers it is a good plan to repeat, as slight changes may have occurred in tuning the other circuits. No signal, or a loud howl indicates neutralizing condensers are at either extreme, and should be readjusted.

A maximum reading by adjusting all three tuning condensers indicates correct tuning of the intermediate stages.

It is now necessary to check the neutralization of the I.F. stages as follows:

(a) Leave all adjustments and apparatus in position on completion of tuning, but substitute a pair of phones for the loudspeaker. Place dummy Radiotron in first I.F. socket. Now adjust the neutralizing condenser on the first I.F. transformer. (See Figure 12) for the position of minimum or no signal. This is easily identified and the adjustment is not critical.

(b) Replace the first I.F. tube and place "dummy" tube in second I.F. stage. Repeat the same adjustment as in (a) only adjusting with the neutralizing condenser on the second I.F. transformer. It will be noted that the two condensers on the third transformer are connected in parallel for tuning. This stage does not require neutralizing.

After the I.F. transformers are properly tuned and neutralized they should perform at their maximum efficiency. It is a good plan to check the adjustments of the two oscillator trimming condensers (See Figure 20) at this point. The correct method for doing this is indicated in Part II, Section 12. The Driver illustrated in Figure 11 may be used for this adjustment. The procedure for adjusting the trimming condensers follows:

(a) Replace main tuning condensers and solder all connections in place. Place coupling lead of the oscillator near the Radiola antenna lead.

(b) Set Driver switches and vernier condenser for 1,400 K.C.

(c) With all Radiotrons in place in the receiver tune for Driver signal with main tuning condensers. If reading goes off milliammeter scale reduce volume control.

(d) Adjust trimming condenser on left (facing front of Radiola, Figure 12) for a maximum reading.

(e) Shift frequency of Driver to 600 K.C. and tune in with main tuning condensers. Adjust trimming condenser on right for maximum milliammeter reading. This is the condenser on the right of the other trimming condenser (See Figure 20).

(f) After adjusting at 600 K.C., check again at 1,400 K.C., and make any readjustment necessary.

This check of the trimming condensers completes the adjustments to be made on Radiola 60 with the Driver. The receiver assembly and S.P.U. should now be returned to the cabinet and the Radiola returned to normal operation.

Due to the increased sensitivity of the receiver it may be necessary to reduce the setting of the R.F. compensating condenser to prevent the tuned R.F. stage from oscillating. This can be ascertained by tuning in stations of different wavelengths and noting if the receiver oscillates at any point throughout its tuning range. (See Part II, Section 13.)

[15] FILTER CONDENSERS AND OUTPUT CONDENSER AND CHOKE

The output choke and condenser, and the filtering and by-pass condensers are located in one container in the S.P.U. Figure 14 shows the internal connections. The procedure for testing this unit is to "click test" the choke for an open, and charge and discharge the condensers individually by shorting their terminals with a screw-driver. A condenser that will not retain its charge is defective. Approximately 200 volts D.C. should be used when making this test.

An open output condenser or an open or shorted choke will cause weak and distorted reproduction. A defective filter condenser is indicated by excessively hot plates, possibly showing color, in Radiotron UX-280. Shorted by-pass condensers will cause abnormal operation or inoperation.

[16] VOLTAGE SUPPLY SYSTEM

Figure 16 illustrates a schematic diagram of the cathode, grid and plate voltage supply system of the various tubes used in the receiver assembly.

This receiver uses the series supply arrangement for securing different drops through various sections of a resistor placed in the plate return lead to secure proper bias for the grid circuits and proper potential for applying to the cathodes and heaters. Electrically the volume control is a section of this resistance and it functions by varying the grid bias on the R.F. and I.F. stages sufficiently to give a positive control of signal strength delivered to the second detector.

A bleeder resistor of 20,000 ohms is provided across the supply circuit at the 135-volt position. The use of this resistor prevents any excessive rise in voltage that would otherwise occur upon removal of all Radiotrons or if some failure resulting in reduced load occurred in the receiver.

[17] VOLTAGE READINGS

When checking Radiola 60 for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man will need both an A.C. and D.C. Voltmeter, the D.C. meter being 600 ohms per volt or higher in resistance. The following voltages at the terminal strip of the S.P.U. are correct with all tubes in place and the line adjustment switch in the correct position for that particular location. The tubes must be in good condition otherwise the D.C. voltages may be excessively high.

The shield over the terminal strip must be removed before any readings can be made. The terminal numbers are counted from front to rear of the Radiola, No. 1 being near the front and No. 11 near the rear.

Terminals	*Correct Voltage*
1 to 7	200 D.C.
2 to 7	210 D.C.
3 to 7	160 D.C.
4 to 7	110 D.C.
8 to 9	5 A.C.
10 to 11	2.25 A.C.

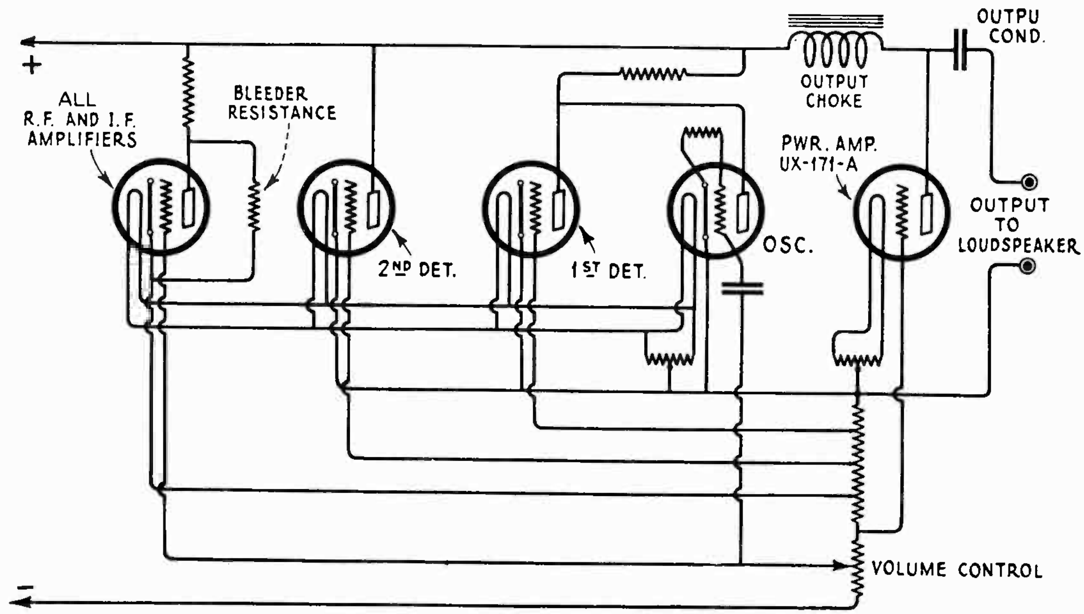


Figure 16—Schematic circuit diagram of the voltage supply system

[18] CHECKING RESISTANCE VALUES

When checking a Radiola 60 for possible trouble it is always a good plan to check the various resistance values of different strips used both in the receiver assembly or in the socket power unit. These values are shown in the schematic circuit diagram, Figure 3. A resistance bridge should be used for checking these values, or if this is not available, the method suggested in "RCA Radiola 32 Service Notes" (page 16) will give good results for the lower values of resistance. The high values, such as 14,300 and 20,000 ohms may be checked by measuring the voltage drop across them, after ascertaining that all other circuits are in correct operating condition.

[19] RADIOLA 60 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly (Figure 17) and S.P.U. (Figure 18). Disconnect the antenna and ground leads; the cable connecting the S.P.U. to the receiver assembly; and the A.C. supply cord at its outlet.

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. The receiver sockets, numbers and lugs used in these tests are shown in Figures 17 and 19. The S.P.U. terminal numbers are shown in Figures 15 and 18.

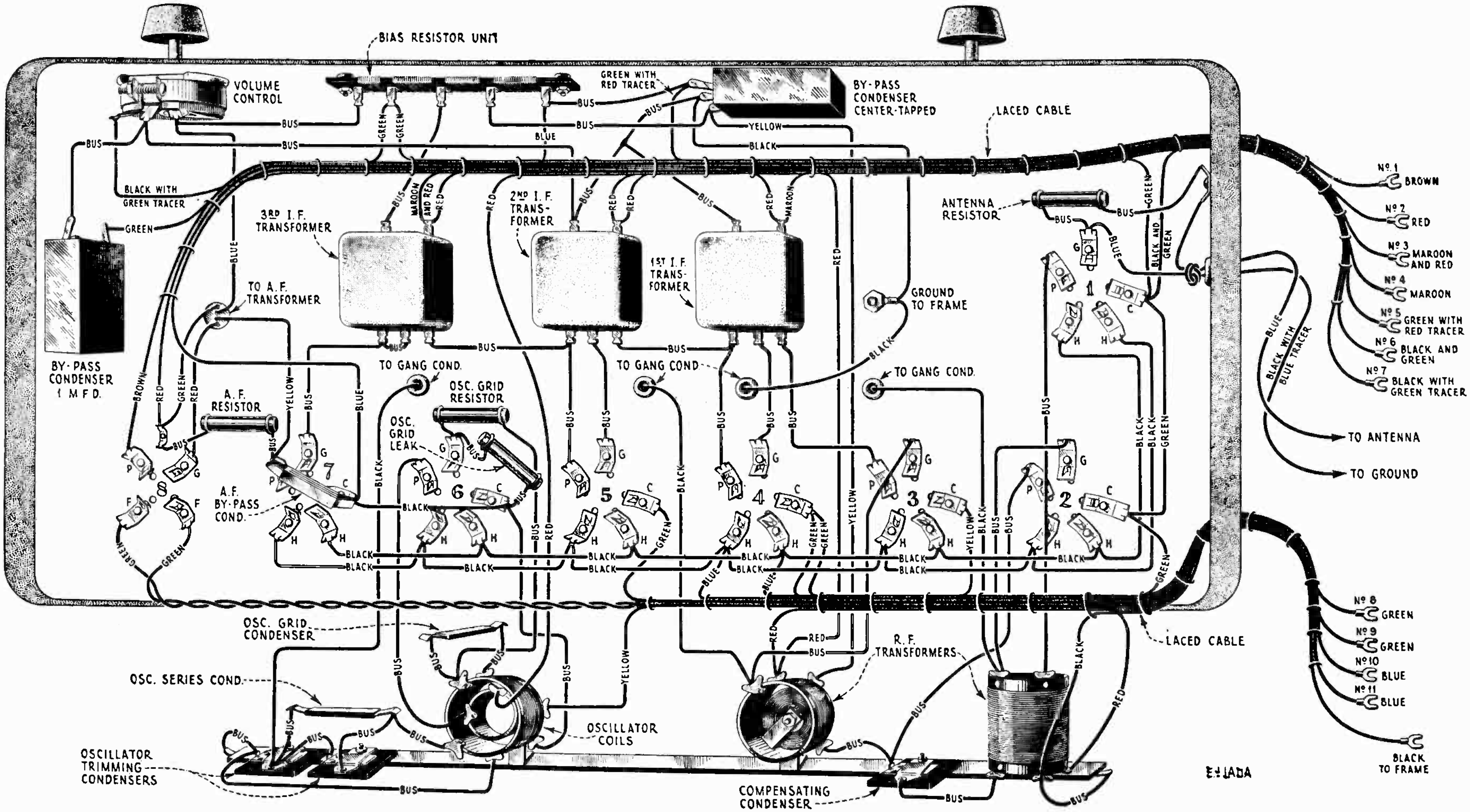


Figure 17—Wiring continuity and location of parts in receiver assembly

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove all Radiotrons and Disconnect Cable at Terminal Strip

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna lead to ground lead	Closed	Open antenna resistor
	Antenna lead to G1	Closed	Open connection
	G2 to ground	Closed	Open secondary of 1st R.F. transformer
	G3 to Lug No. 5	Closed	Open secondary of 2nd R.F. transformer or resistance unit.
	G4 to ground	Closed	Open secondary of 1st I.F. transformer
	G5 to ground	Closed	Open secondary of 2nd I.F. transformer
	G7 to ground	Closed	Open secondary of 3rd I.F. transformer or resistance unit
	G8 to Lug No. 6	Closed	Open secondary of audio transformer or resistance unit
	Lug No. 5 to Lug No. 7	Closed	Open resistance unit or volume control
	Ground to Lug No. 7	Closed	Open volume control contact arm or poor connection
Plate	P1 to Lug No. 3	Closed	Open primary 1st R.F. transformer
	P2 to Lug No. 3	Closed	Open primary 2nd R.F. transformer
	P3 to Lug No. 4	Closed	Open primary 1st I.F. transformer
	P4 to Lug No. 3	Closed	Open primary 2nd I.F. transformer
	P5 to Lug No. 3	Closed	Open primary 3rd I.F. transformer
	P6 to Lug No. 4	Closed	Open plate coil of oscillator coils
	P7 to Lug No. 2	Closed	Open primary of audio transformer
	P8 to Lug No. 1	Closed	Open connection
Filament	Cathodes No. 1, No. 2, No. 4 and No. 5 to Lug No. 6	Closed	Open connection
	Cathodes No. 3, No. 6 and No. 7 to Lug No. 5	Closed	Open pick-up winding of oscillator or connection
	Lug No. 8 to one filament contact Socket No. 8	Closed	Open connection
	Lug No.9 to other closed filament contact Socket No. 8	Closed	Open connection
	Lug No. 10 to one heater contact of Sockets Nos. 1, 2, 3, 4, 5, 6 and 7	Closed	Open connections
	Lug No. 11 to other heater contact of Sockets Nos. 1, 2, 3, 4, 5, 6 and 7	Closed	Open connections
Miscellaneous	G2 to P2	Open	Shorted compensating condenser
	G4 to P4	Open	Shorted neutralizing condenser
	G5 to P5	Open	Shorted neutralizing condenser
	G6 to Cathode 6	Closed (Weak)	Open oscillator grid leak
	G8 to Lug No. 5	Closed	Open resistance unit or secondary of A.F. transformer
	G8 to Lug No. 7	Closed	Open secondary of A.F. transformer or open volume control

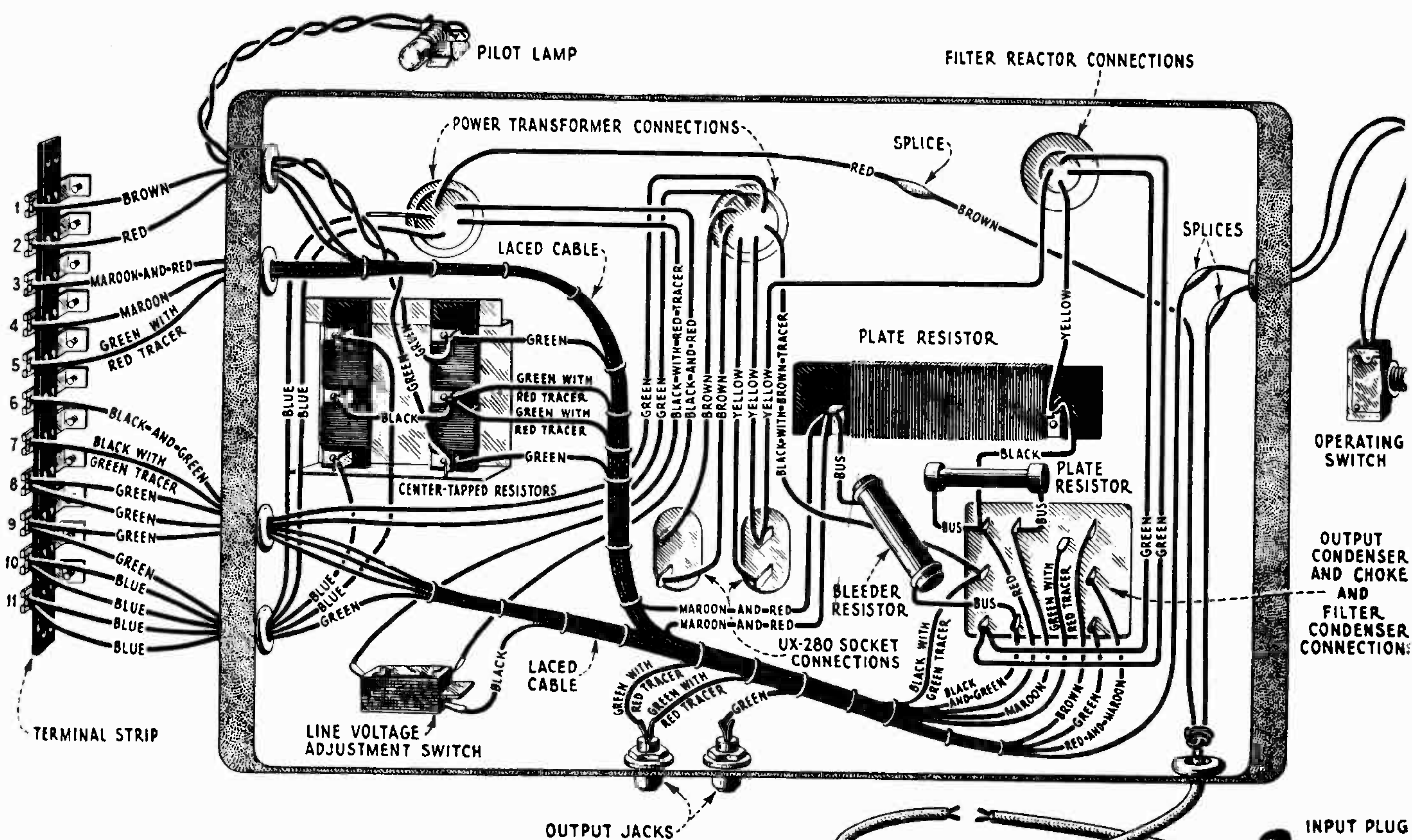


Figure 18—*Wiring continuity and location of parts in socket power unit*

SOCKET POWER UNIT CONTINUITY TESTS

Remove Radiotron UX-280 and Disconnect Cable at Terminal Strip

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
	G to P of UX-280 socket	Closed	Open high voltage winding of power transformer
	Across filament contacts of UX-280 socket	Closed	Open UX-280 filament winding of power transformer
	One filament contact of UX-280 socket to No. 1	Closed	Open output choke or filter reactors
	Terminal No. 1 to No. 3	Closed	Open resistance unit or output choke
	Terminal No. 1 to No. 4	Closed	Open resistance unit or output choke
S.P.U.	Terminal No. 3 to No. 6	Closed	Open resistance unit
	Terminal No. 4 to No. 5	Open	Shorted .5 mfd. condenser
	Terminal No. 5 to No. 6	Open	Shorted .5 mfd. condenser
	Terminal No. 5 to No. 7	Open	Shorted 2 mfd. condenser
	Terminal No. 8 to No. 9	Closed	Open UX-171A filament winding and resistance unit
	Terminal No. 10 to No. 11	Closed	Open UY-227 filament winding and resistance unit
	One loudspeaker jack to No. 1	Open	Shorted output condenser
	Other jack to No. 5	Closed	Open connection

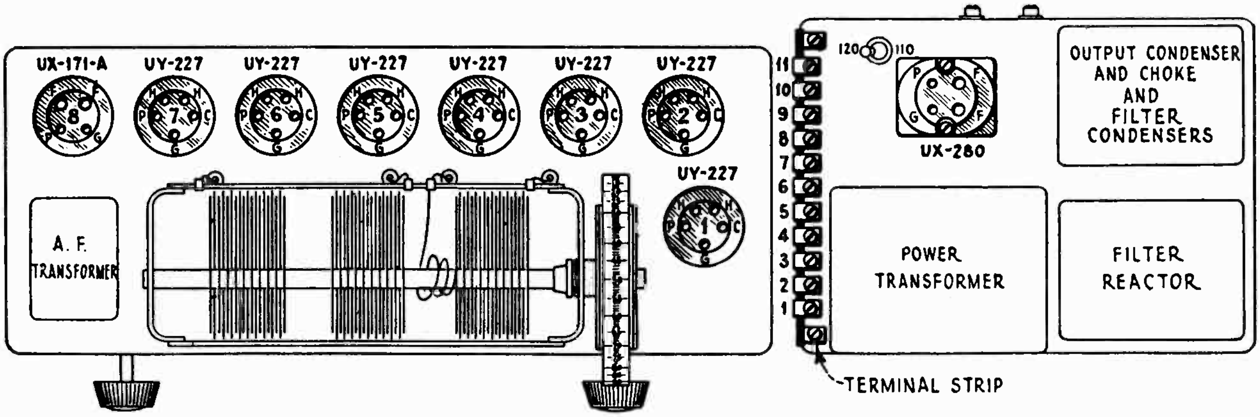


Figure 19—Radiotron socket contacts and location of parts

PART III—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 60 are readily accessible and replacements can be easily made. Figure 1 illustrates the various parts in a top view of the receiver assembly; Figure 2 shows the parts of the S.P.U., and Figure 20 illustrates the receiver sub-chassis parts. The following detailed procedure outlines the simplest method to be used in making replacements.

{1} REPLACING THE VOLUME CONTROL

(a) Remove the knobs on the volume control and station selector. These are of the push type, and they are removed by seizing them with the fingers and pulling away from the receiver. To replace, merely push them on the shaft, first matching the knob socket, with its removable flat spring, to the shaft.

(b) Release the pilot lamp and socket by pulling it from the small angle bracket to which it is clipped in place. A slight pull, upward and backward, will release it.

(c) Remove the shield from the terminal strip and then release all the lugs held in place by the screws at the top of each terminal.

(d) Remove the four machine screws that hold the receiver chassis assembly in place. These screws are located on the under side of the cabinet. When turning the cabinet on its side be careful not to place a heavy strain on the moulded feet of the cabinet, as they may be damaged.

(e) The chassis may now be lifted clear of the cabinet. (See Figure 21.)

(f) Place the receiver chassis in a convenient place to work on, and with the volume control up so that the two screws and nuts that hold it to the receiver frame can be removed. The three soldered connections must also be removed.

(g) Remove the old volume control and fasten the new one in position by means of the two machine screws and nuts, and replace the three soldered connections. The correct connections of these leads are shown in Figure 17.

(h) Replace receiver assembly in cabinet and fasten with machine screws. Return cable to its original position.

(i) Test Radiola and, if O. K., return shield to its original position.

{2} REPLACING R.F. TRANSFORMER AND OSCILLATOR ASSEMBLY

The two radio frequency transformers and the oscillator coils are mounted on a metal strip, together with free small adjustable condensers and two fixed condensers.

This assembly must be replaced as a unit—the matching of the coils being an important point in the operation of the receiver. When making replacement adopt the following procedure:

(a) Remove receiver chassis from cabinet as described in Part III, Section 1.

(b) Turn chassis on side and unsolder all leads to the assembly being replaced.

(c) Remove the five machine screws and lock washers that hold the metal supporting strip to the receiver frame.

(d) The assembly may now be removed and the new assembly fastened in position with the five machine screws and washers previously removed.

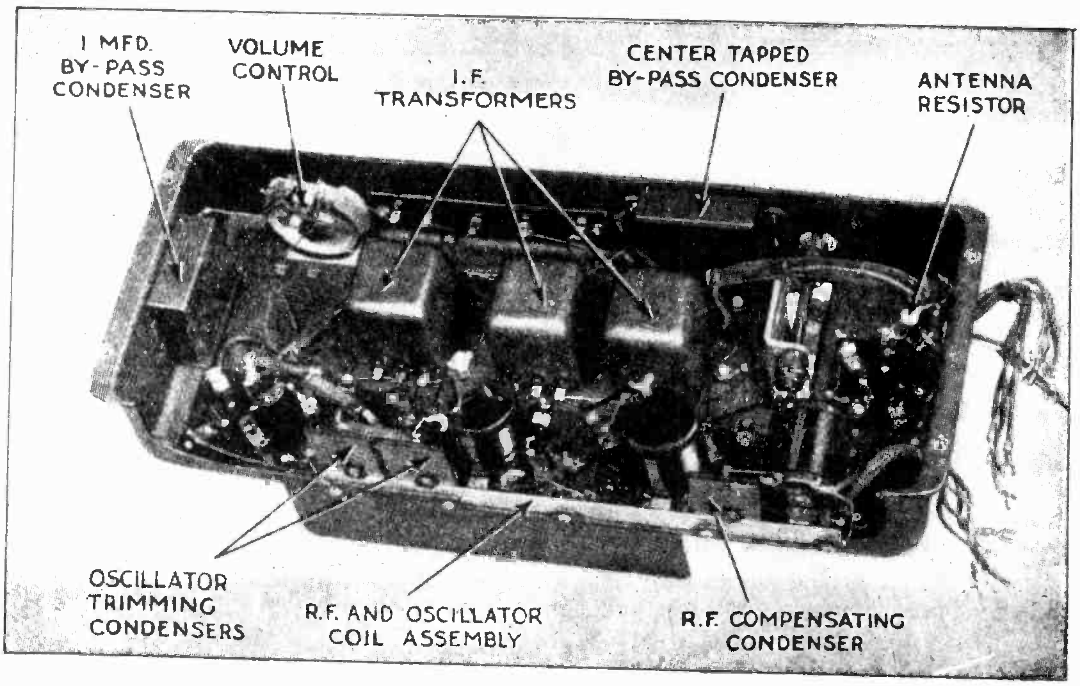


Figure 20—Receiver sub-chassis assembly, showing location of various parts

(e) Resolder all connections in their correct position on the assembly. This is shown in Figure 17.

(f) The receiver assembly may now be returned to the cabinet in the reverse order of that used to remove it.

(g) The two oscillator trimming condensers must now be adjusted as described in Part II, Section 12 and adjust the R.F. compensating condenser as described in Part II, Section 13.

(h) Test the receiver and, if O. K., replace the terminal strip shield.

[3] REPLACING RADIOTRON GANG SOCKETS

One socket assembly on the receiver chassis is of the gang variety, the others being two single units. All are held in place, together with their shields, by means of rivets which clamp them on the metal chassis frame. Use the following procedure when replacing these sockets:

(a) Remove the receiver assembly from the cabinet as described in Part III, Section 1.

(b) Unsolder all connections to the particular socket or assembly being removed. The R.F. transformer assembly should be removed as a unit to provide room for replacing the six-gang Radiotron socket.

(c) Drill out the rivets holding the Radiotron socket to be replaced. The socket and shield will be released together, in the case of the single UY socket. In the case of the single UX or the gang UY the shield will remain in place, due to overlapping both socket units, the socket or assembly not being removed serving to hold the shield in place.

(d) Remove the old Radiotron socket and fasten the new one in position by means of screws, nuts and washers. Resolder all connections and replace the R.F. assembly if removed. The correct connections are shown in Figure 17.

Figure 21—Removing receiver assembly from cabinet

(e) Fasten receiver assembly in cabinet, connect cable and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[4] REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and drive are replaced as one unit. A step-by-step procedure follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Remove the three screws, nuts and lock washers that hold the condenser assembly to the metal frame.

(c) Now pull the condensers as far forward as possible and unsolder the four leads connected at the rear. Releasing the condensers and pulling them forward provides ample space in which to do the unsoldering job and keeps solder material clear of the tube shield. Remove the entire assembly by tilting slightly and pulling clear.

(d) Place the new assembly in the position occupied by the old one and solder the four leads to their proper connections.

(e) Fasten the three screws, nuts and lock washers in their proper position. Make sure that the screw that holds the ground connection on the under side of the chassis makes firm contact.

(f) Return the receiver to the cabinet and replace all connections in the reverse order of that used to remove them.

{5} REPLACING BY-PASS CONDENSERS

Radiola 60 employs two by-pass condensers in the receiver assembly. They are both located on the under side of this assembly, and replacement is made in the following manner:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Unsolder the connections to the condenser it is desired to replace.

(c) With a screw-driver bend up the metal tabs holding the condenser to the side of the receiver frame. These tabs bend easily, and when turned up makes possible the removal of the condenser.

(d) The new condenser should now be fastened in place in the position formerly occupied by the old one.

(e) Resolder the connections as shown in Figure 17.

(f) Fasten the reciver assembly in the cabinet in the reverse order of that used to remove it.

{6} REPLACING THE AUDIO TRANSFORMER

Radiola 60 employs one audio transformer, located at the left side of the receiver assembly facing the front of the Radiola. Should a replacement become necessary use the following procedure:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Place the receiver chassis on its side and unsolder all connections to the audio transformer.

(c) Now turn up the four tabs that hold the transformer in place and remove it. The new one is then fastened in position.

(d) Resolder the leads from the new transformer to their correct points of connection as indicated in Figure 17.

(e) Fasten the receiver assembly in the cabinet in the reverse order of that used to remove it.

{7} REPLACING CONDENSER DRIVE CABLE

(a) Remove receiver assembly from cabinet as described in Part III, Section 1. Place chassis on a table so that the cable on the grooved drums is accessible.

(b) Release the cable adjusting screw and clamp, and remove old cable from drums completely.

(c) Starting from the rear grooved drum, place eye of new cable over pin, which should be in a horizontal position and next to side of the assembly that is closest to the Socket Power Unit when in the cabinet, and wind on three complete turns and then bring cable up to large drum.

(d) Now pass cable over large drum. Turn the drum so the cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing the cable to the track on the other side of the drum.

(e) Follow on around other track in same direction until a point is reached where cable is directly above front grooved drum.

(f) Starting on the third groove back from the front of the drum, wind on two and a half turns and slip eye over pin. The cable is now in its correct position, although probably slack.

(g) The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the grooves are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of its controls. Care should be taken not to take up too much, as the cable may be stretched or possibly broken.

(h) Return receiver assembly to cabinet in the reverse order of that used to remove it.

{8} REPLACING DIAL SCALES

After considerable use a dial scale may become soiled or illegible and a new scale desired. A step-by-step procedure to make replacement follows:

(a) Open lid of Radiola 60.

(b) Turn dial so that the two screws that hold the dial in place are on top.

(c) Loosen screws, washers and nuts that hold dial in place.

(d) The old dial may now be pulled clear and the new one placed in the position occupied by the old one. Examine dial from the front of the Radiola to see that the numbers on the dial are in their correct position.

(e) Tighten screws holding dial in place and close lid of cabinet.

{9} REPLACING EITHER POWER CABLE

Two laced cables are employed in Radiola 60 receiver assembly, one for filament supply and one for the plate and grid supplies. Should it be necessary to replace either of these cables, use the following procedure:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Turn assembly bottom side up and unsolder all connections to the cable being replaced.

(c) Remove old cable and connect up the new cable as indicated in Figure 17, soldering all connections.

(d) Return assembly to cabinet in reverse order of that used to remove it.

{10} REPLACING INTERMEDIATE TRANSFORMERS

Should it be found necessary to replace or adjust the I.F. transformers, the Dealer should send the receiver chassis to his Distributor. See Part II, Section 14. This is of utmost importance, as the entire performance of the Radiola 60 is based on the correct functioning of its intermediate stages.

{11} REPLACING TAPPED RESISTANCE UNIT IN RECEIVER ASSEMBLY

A tapped resistance unit in the receiver assembly of Radiola 60 provides the various grid and cathode voltages. To replace this tapped resistance unit proceed as follows:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Unsolder all connections to the tapped resistance unit.

(c) Remove the two screws, nuts and washers that hold the resistance unit in place.

This will release the unit and the new one can be fastened in place with the screws, nuts and washers previously removed.

(d) Solder all the leads to their correct connections. (See Figure 17.)

(e) Fasten receiver assembly to cabinet in the reverse order used to remove it.

[12] REPLACING FILTER CONDENSERS AND OUTPUT CONDENSER AND CHOKE

The filter condensers, by-pass condensers, and output condensers and choke are all enclosed as a unit in a metal container. Should replacement be necessary use the following procedure:

Figure 22—Removing socket power unit from cabinet

(a) Remove the shield and all connections from the Socket Power Unit terminal strip.

(b) Remove the four machine screws that hold the S.P.U. to the cabinet.

(c) Remove the collar holding the operating switch to the escutcheon plate on the front panel. Removing the escutcheon and turning the switch from the rear makes removal of the collar much easier and prevents marring of the escutcheon.

(d) The S.P.U. may now be lifted clear of the cabinet and placed in a convenient position to work upon.

(e) Unsolder all connections to the unit being replaced, also release the two resistors attached to its connecting terminals.

(f) Bend up the tabs that hold the unit to the S.P.U. base. Remove the old unit and fasten the new one in position by bending the tabs down so that it is held tightly to the S.P.U. base.

(g) Replace and solder all connections and resistance units removed. Their correct connections are shown in Figure 18.

(h) Return the Socket Power Unit to the cabinet in the reverse order of that used to remove it. Replace all connections and test. If O.K., replace the shield over the terminal strip.

{13} REPLACING POWER TRANSFORMER OR FILTER REACTOR

The power transformer and filter reactor are both held in place by means of tabs which form a part of their case, being turned over on the under side of the S.P.U. base. A step-by-step replacement procedure follows:

(a) Remove S.P.U. from cabinet as described in Part III, Section 12.

(b) Unsolder all connections to unit being replaced. If the power transformer is being replaced release the two screws that hold the center tapped resistance units in place, so they may be pulled clear when bending the tabs on the power transformer.

(c) Bend up the tabs that hold the unit to the S.P.U. base.

(d) The old unit may now be removed and the new one placed in position. Bend over the tabs on the new one so that it is fastened tightly to the S.P.U. base.

(e) Solder all connections as shown in Figure 18.

(f) Fasten the S.P.U. in the cabinet in the reverse order of that used to remove it.

{14} REPLACING TERMINAL STRIP

Should the terminal strip on the S.P.U. require replacement use the following procedure:

(a) Remove the S.P.U. from cabinet as described in Part III, Section 12.

(b) Unsolder all leads to the terminal strip.

(c) Release two screws holding strip to S.P.U. base.

(d) The strip may now be removed and replaced by a new one.

(e) Fasten new strip in position by means of two machine screws, lock washers and nuts previously removed.

(f) Solder all leads to terminal strip. The color scheme and correct connections are shown in Figure 18.

(g) Return S.P.U. to cabinet in the reverse order, and connect to receiver assembly.

{15} REPLACING MISCELLANEOUS PARTS IN S. P. U.

The center tapped resistors, plate supply resistors, line switch and UX-280 socket in Radiola 60 may require replacement. They are all attached to the base by means of machine screws and nuts, and replacement is very simple. The following general outline will apply to all these units:

(a) Remove S.P.U. from cabinet as described in Part III, Section 12.

(b) Unsolder leads from defective unit.

(c) Remove defective unit from base and replace with new unit.

(d) Solder leads to new unit as indicated in Figure 18.

(e) Return S.P.U. to cabinet in reverse order of that used to remove it.

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, P. II, S. 4
	Defective power cable	Replace power cable, P. III, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective I.F. transformer	See P. III, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Defective Oscillator coil	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective by-pass condenser	Replace by-pass condenser, P. III, S. 5
	Defective socket power unit	Check socket power unit by means of continuity test, and make any repairs or replacements necessary, P. II, S. 19
Weak Signals	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 13
	Trimming condensers out of adjustment	Adjust trimming condensers, P. II, S. 12
	I.F. transformers not correctly aligned	See P. II, S. 14
	Defective power cable	Repair or replace cable, P. III, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective I.F. transformer	See P. III, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Dirty prongs of Radiotrons	Clean prongs with fine sandpaper, P. I, S. 3
	Defective by-pass condenser	Replace defective by-pass condensers, P. III, S. 5
	Defective main tuning condenser	Replace defective tuning condensers, P. III, S. 4
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. II, S. 17
	Defective socket power unit	Check socket power unit by means of continuity tests and make any repairs or replacements necessary, P. II, S. 19
Poor Quality	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Defective by-pass condenser	Replace defective by-pass condenser, P. III, S. 5
	Dirty contact arm of volume control	Clean contact arm on volume control, P. II, S. 4
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper, P. I, S. 3
	Volume control advanced too far	Reduce setting of volume control, P. I, S. 7
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 13
	Defect in audio system	Check and repair any defect, P. II, S. 10
	Open grid circuit in any stage	Check circuit and repair defect
Excessive Hum	Defective center tapped resistance unit	Replace defective resistance unit, P. III, S. 15
	Socket plug position	Reverse socket plug
	Line voltage low	Set line switch for low line voltage, P. I, S. 5
Radiotrons Fail to Light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer, P. III, S. 13
	No. A.C. line voltage	Turn A.C. line voltage "On"
Play in Station Selector	Slack cable	Take up on cable adjusting screw, P. II, S. 5

RCA
Radiola 62

SERVICE NOTES

Prepared Especially for RCA Dealers

RCA Radiola 62

First Edition 25M

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 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 the RCA Distributors, and the 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's 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 RCA Loudspeakers and Radiolas.

This information has been compiled from experience with RCA Dealer's 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 in the performance of service work.

CONTENTS

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—MAKING REPLACEMENTS

ILLUSTRATIONS

RCA RADIOLA 62

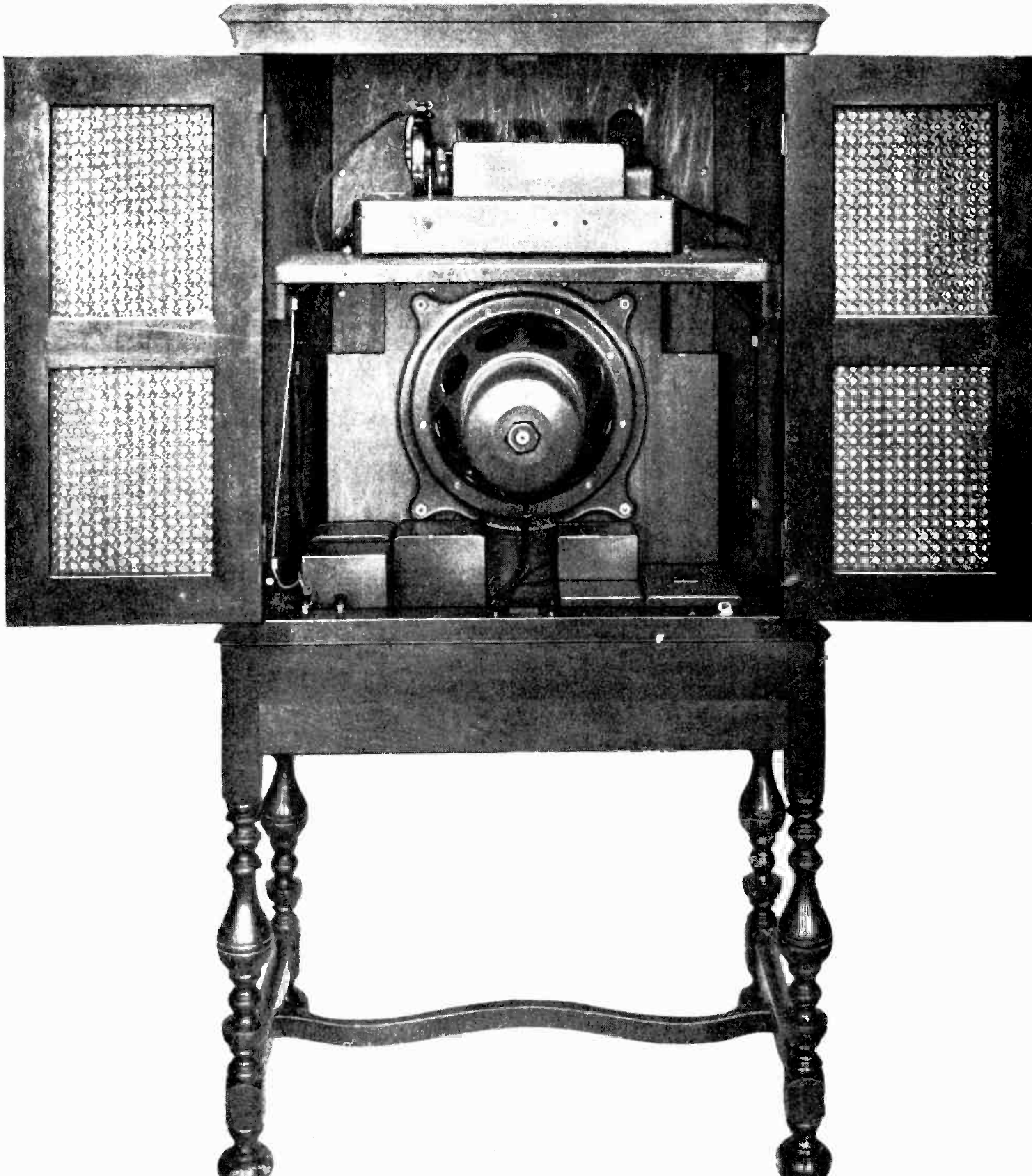

Figure 1—Rear interior view of Radiola 62, showing Receiver Chassis at top. Reproducer below shelf and S.P.U. at bottom left and Field Supply Unit at bottom right

RCA RADIOLA 62

(105-125 Volts. 50-60 Cycle A. C.)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 62 is an eight-tube socket powered radio receiver employing seven UY-227 Radiötrons and one UX-171A Radiotron. One Radiotron UX-280 is used in a socket power unit for supplying all grid and plate voltages. A dry disc type rectifier furnishes direct current of the correct voltage to the field of the reproducer unit. Radiola 62 is fundamentally a console cabinet model of Radiola 60, utilizing a new type dynamic reproducer and having such circuit changes as are necessary for use with a speaker of this type. Figure 1 illustrates a rear view showing the principal parts. Figure 2 illustrates the socket power unit and Figure 3 shows the field supply unit

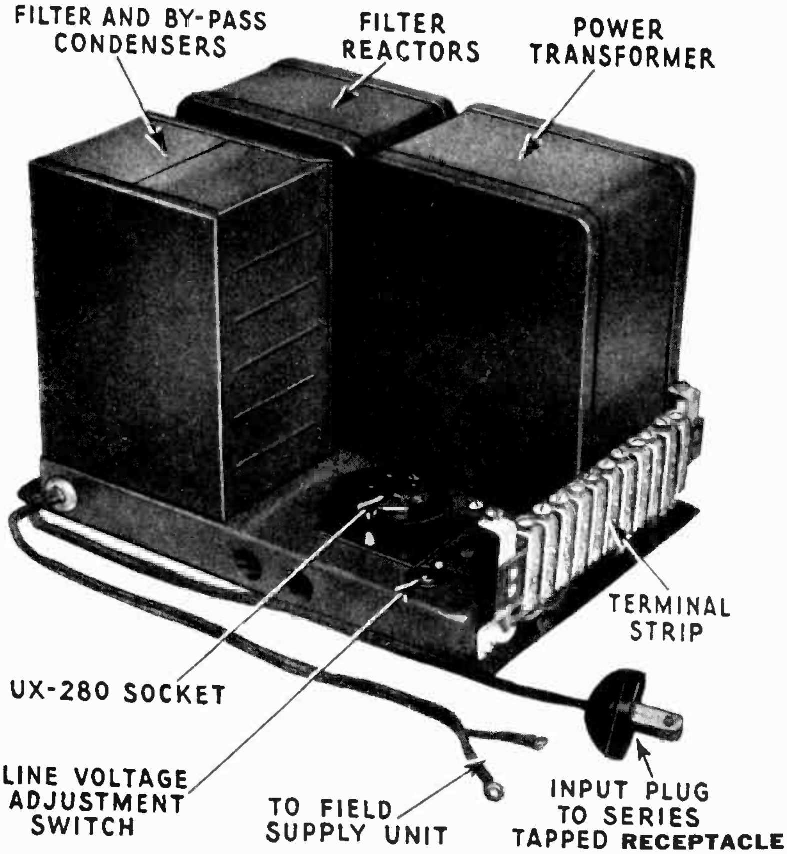

Figure 2—Socket power unit

Radiola 62 is designed to operate on alternating current of 105 to 125 volts, 50 to 60 cycles, such as is used for house lighting. Connection to D. C. lines or to A. C. lines of different rating may damage the Radiola or the Radiotrons.

Radiola 62 is also made in models designed for 105-125 volts, 25-40 cycles A. C. operation. In this model the power transformer is different from that used in the 50-60 cycle models and the condenser shunted across the output of the disc rectifier has a capacity of 6 mfd. instead of 4 mfd., as used in the 50-60 cycle sets. All other parts are identical in both models and the Service Notes apply to each equally well.

The following circuit characteristics are incorporated in Radiola 62.

(a) As already stated, Radiola 62 uses seven Radiotrons UY-227 and one Radiotron UX-171A connected up in an eight-tube super-heterodyne circuit with a UX-280 in the S. P. U. for grid and plate supply.

(b) A new type dynamic reproducer unit is used, the field current for this unit being obtained from a dry disc type of rectifier, thus keeping the load on the Radiotron UX-280 at a minimum value.

(c) The circuit consists of one untuned coupling stage, one tuned R.F. stage, a tuned heterodyne detector, two intermediate R.F. stages, an oscillator, a second detector and a power amplifier.

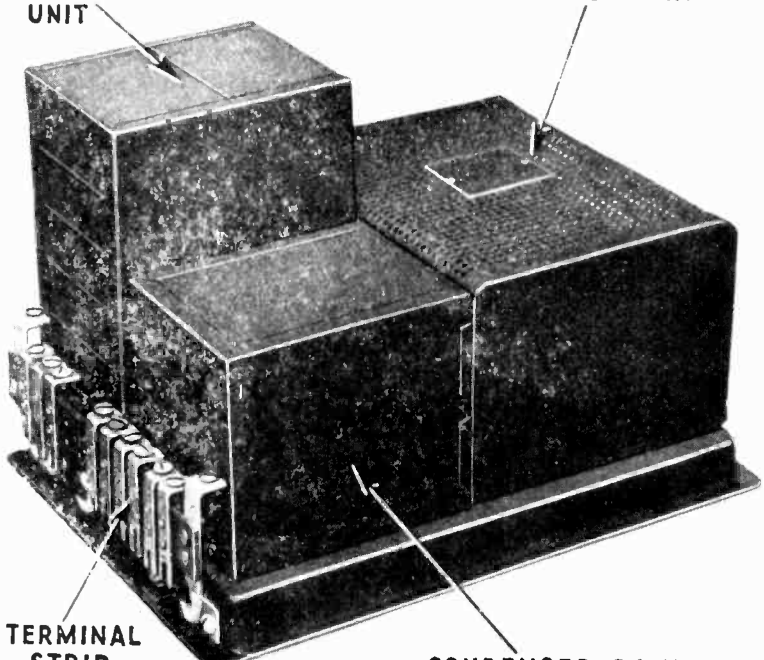

Figure 3—Field supply unit

(d) The second detector, operated at 160 volts plate potential with grid bias, changes the radio frequency current of the intermediate stages into audio frequency current. This gives sufficient output to operate the power tube directly from the second detector, thus eliminating any distortion that might be present if an intermediate audio stage were used.

(e) The volume control regulates the grid bias on all radio and intermediate frequency amplifying stages, giving a positive control of volume, even on nearby local stations, without distortion.

Figure 4 illustrates the sequence of the Radiotrons in the receiver, omitting Radiotron UX-280 in the socket power unit. From right to left, when facing the front of the Radiola, 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 across a 2000-ohm resistance and functions as a coupling tube to the antenna system.

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

Radiotron No. 3 is the tuned heterodyne detector. It is tuned by the center of the gang condensers.

Radiotrons No. 4 and No. 5 are the first and second intermediate frequency stages. These stages are tuned to a frequency of 180 K.C., giving ample distance between the two peaks of the oscillator to eliminate any possibility of stations coming in at more than one point on the tuning dial.

Radiotron No. 6 is the oscillator. It is tuned by the third of the gang condensers. Two trimming condensers are provided at the rear of the receiver assembly for adjusting the oscillator circuit to keep the beat note at the correct frequency for the intermediate stages.

Radiotron No. 7 is the second detector. It operates at a plate potential of 160 volts with the proper grid bias and does not use a grid leak or condenser. Its output is sufficient to drive the power amplifier.

Radiotron No. 8 is the power amplifier. A choke and condenser arrangement couples this tube to the step-down transformer that matches the impedance of this output circuit to that of the cone coil of the reproducer unit. This arrangement gives a quality of reproduction not obtainable with the use of an output transformer alone.

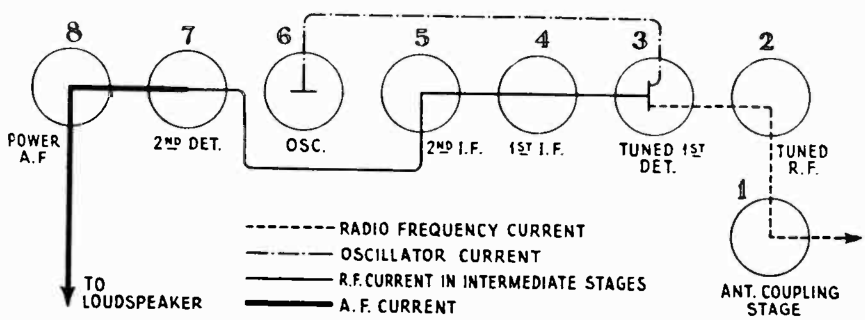

Figure 4—Radiotron sequence

These various principles incorporated in Radiola 62 and illustrated in the schematic circuit Figure 5, provides a radio receiver of advanced design, excellent performance and good tone quality.

PART I—INSTALLATION

[1] ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiola 62 the antenna length need only be approximately 25 feet. 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. Bring the lead-in wire from the outside through a porcelain tube insulator to the inside of the house for connection to the receiver.

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.

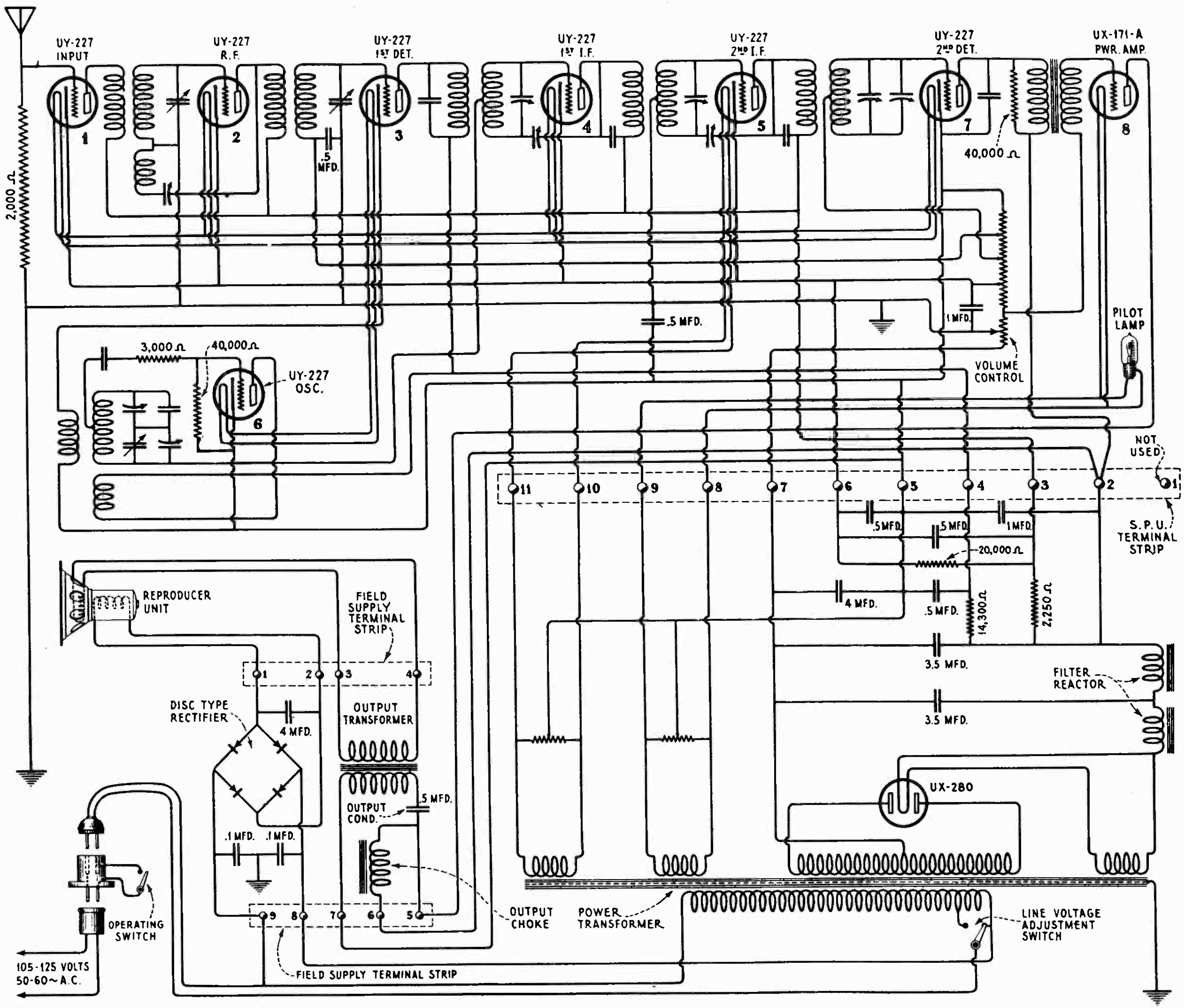

Figure 5—Schematic circuit diagram of Radiola 62

[2] 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 25 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. However, due to its sensitivity, Radiola 62 will generally give entirely satisfactory reception with an indoor antenna.

[3] GROUND

A good ground is quite as important as a good antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

A spark will occur if the power supply is "on" when making the ground connection. This action is normal, being caused by the discharge of one of the .1 mfd. condensers connected across the power input to the disc rectifier. No current is consumed as no load is being drawn through the condenser.

[4] RADIOTRONS

A guide shield is provided on all the receiver Radiotron sockets to facilitate the insertion of the Radiotrons. The seven Radiotrons UY-227 are inserted in the five-contact sockets. The Radiotron UX-171A is placed in the four-contact socket in the receiver assembly, and the Radiotron UX-280 is placed in the socket power unit.

In placing Radiola 62 into operation, if no signals are heard when tuning to a station known to be broadcasting, examine the Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more of the same type known to be in operating condition will isolate the damaged one.

Socket No. 2 (Figure 4), the tuned R.F. stage, is the most critical for selection of the Radiotrons. Place in this socket the tube which gives the loudest signal and does not go into oscillation throughout the tuning range. If no tube is found that will not oscillate, a slight re-adjustment of the R.F. compensating condenser may be necessary, as described in Part II, Section 13.

Other stages somewhat critical are the oscillator and second detector, sockets No. 6 and No. 7, respectively. The remaining tubes should be interchanged until a tube is found for the oscillator that gives the loudest signal on a given station. The second detector Radiotron should be selected for its ability to handle large volume. Select the tube for this socket that will permit the volume control to be advanced and give the greatest output without overloading.

[5] LINE SWITCH

A two-way switch is provided in the S.P.U. for adjustment to line voltages. A shield over the terminal strip holds this switch in the 120-volt position. Unless it is definitely known that the line is always below 115 volts the switch should be left in its original position. It is a good plan to leave this switch at the 120-volt position on all lines unless unsatisfactory operation is experienced. If the switch is set at the 110-volt position on supply lines exceeding 115 volts the Radiotrons in the receiver will be damaged.

[6] KNOBS

Radiola 62 uses an improved type of push knob on the station selector and volume control shafts. This knob is removed by simply pulling it off the shaft, and replaced by pushing it on. Very little trouble should be experienced, as no setscrews or other parts that might give trouble are used.

When placing this knob on its shaft care must be exercised not to push it tight against the washer between the knob and cabinet, as then it will bind. Sometimes in handling new sets the knob will have become pushed against the washer and bind. The remedy is merely to pull the knob out until it does not bind.

[7] RECEIVING LOUD LOCAL STATIONS

If excess volume control adjustment is used on local stations the signal will apparently have two peaks on the tuning dial. A further advance of the volume control will decrease the volume rather than increase it. This is entirely normal, and is caused by tube overloading. The correct method of tuning Radiola 62 on local stations is to reduce the volume control to the position where the station will be received at only one position on the station selector dial, and then adjust the volume control for the desired volume.

On some stations when tuned in with excessive volume a howl may be experienced. The remedy is to reduce the volume control until the howl disappears.

This tuning procedure should be explained to the Radiola owner when an installation is made.

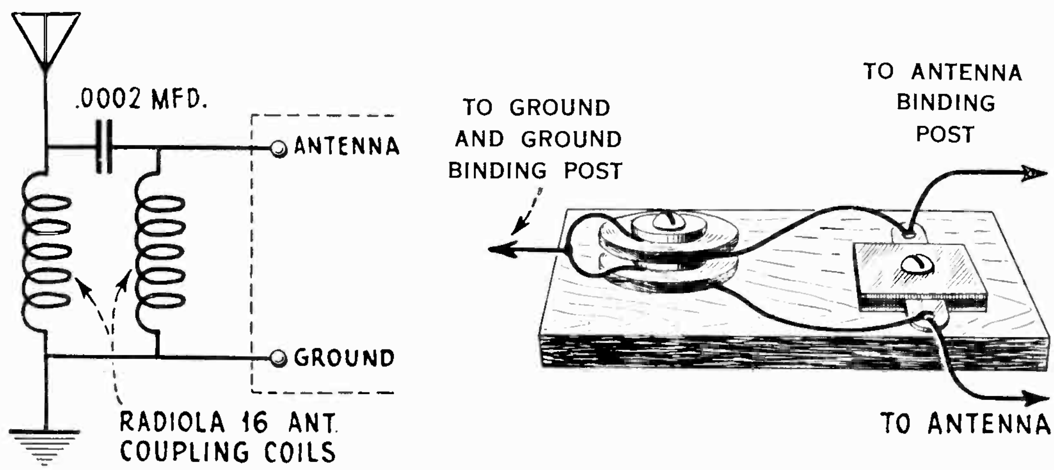

Figure 6—Long wave interference filter

[8] DISTORTION DUE TO LOUD SIGNALS

In some localities extremely close to powerful broadcasting stations, reproduction may be distorted when reducing volume to a point satisfactory to the listener. When installing a set, determine by a listening test whether this condition exists or not and apply the following remedy if the reproduction is distorted.

Procure a single-pole single-throw switch (any type will do) and connect it in series with the antenna lead of the receiver. The switch may be located either inside or outside the cabinet in any convenient position. Opening the switch will disconnect the antenna and allow satisfactory reception on signals that would otherwise be distorted. The switch should be closed for reception from other stations.

[9] PICK-UP FROM LONG WAVE HIGH POWER CODE STATIONS

Should Radiola 62 be installed very close to long wave, powerful code stations, it is possible that a certain amount of pick-up and interference from them will be experienced. Trouble of this kind may be eliminated in the following manner:

(a) Procure the following equipment:
  Two Radiola 16 antenna coils (RCA Stock No. 5658).
  One .0002 Mfd. fixed condenser.

(b) Connect as shown in Figure 6.

(c) This apparatus may be placed inside of the cabinet of the receiver or made up in a separate unit and placed in any convenient location. It acts as a filter, allowing frequencies of the broadcast band only to reach the receiver.

[10] LOCATION OF RADIOLA IN ROOM

As with other musical instruments, the location of Radiola 62 in the room should be chosen with care. Various positions should be tried until the most desirable reproduction is obtained. If this position is outside the radius of the connection cord to the A.C. outlet, an extension cord can be used.

[11] SHIPPING BRACKET FOR REPRODUCER UNIT

Radiola 62 is shipped with a metal yoke and wooden support to hold the reproducer unit in place during shipment. This wooden block and the metal yoke holding it should be removed when placing Radiola 62 into operation as it may resonate at audible frequencies and affect the reproducing qualities of the Radiola. The front flange of the reproducer offers ample support for the reproducer unit on all occasions except when shipping.

PART II—SERVICE DATA

[1] ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna; or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

[2] RADIOTRON SOCKETS

The sockets used in Radiola 62 are a six-gang UY socket assembly, a single UY socket, and two single UX sockets. One of the UX sockets is used in the socket power unit and is of a different design than that used in the receiver assembly.

The bakelite Radiotron guide shields used in the receiver assembly will prevent any possible shock from contact with high voltages in the socket when inserting the Radiotrons. The prongs of the tubes fit into this shield opening very snugly and require only a twist until the prongs find the correct holes into which they fit. This is especially helpful when inserting the five-prong tubes into their sockets.

[3] RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuits sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

[4] LOOSE VOLUME CONTROL

A loose volume control arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame.

[5] ADJUSTMENT FOR SLACK DRUM CONTROL

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash.

After considerable wear or extreme changes of temperature the cable may become slack. To take up this slack open lid of cabinet and turn the cable adjusting screw with clamp until the cable is taut. This screw may become seated after several adjustments are made, thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. Remove the cable adjusting screw and clamp. The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. It will be noted that the tapered pin in the new position cannot be inserted as far as originally. However, it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and an additional half turn slipped on the drum which will provide for taking up all slack. A sufficient number of grooves are provided on the drum for this purpose.

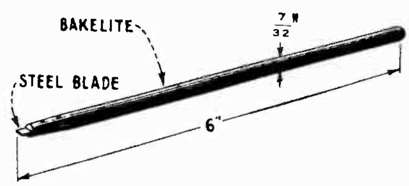

Figure 7— Dimensions of the non-metallic screw driver

[6] BROKEN CONDENSER DRIVE CABLE

A broken condenser drive cable can be replaced in the manner described in Part III, Section 7. However, if a new cable is not immediately available a temporary repair can be made in the following manner, provided the break in the cable is not in that section that passes over the small grooved drums.

Splice and solder the two ends together. Splicing consists of interweaving the strands, as with rope, and not just twisting the cable ends together as in an electrical wiring splice. Splicing gives greater strength and forms a smaller body on the cable. When soldering use plenty of flux and a small amount of solder. Heat sufficiently so that the solder adheres to all the strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows excess solder to drip away. This is but a temporary repair to be used only until a new cable can be procured.

[7] HUM

If a pronounced hum develops during operation check the following:

(a) Low emission Radiotron UX-280. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(b) Defective center tapped resistance. A short or open of either of these resistances will cause a loud hum and imperfect operation of the Radiola.

(c) Any open of the several grounding connections in the Radiola or voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part II, Section 22.

(d) Use of Radiotron UX-171 instead of Radiotron UX-171A may cause an increase of hum. It is recommended that only Radiotron UX-171A be used as a power amplifier in Radiola 62.

(e) Defective disc rectifier or condenser across output of rectifier may cause excessive hum and faulty operation. A check of this condition can be made as described in Part II, Section 19.

(f) Antenna and ground leads reversed. Reversing these leads opens the condenser center ground connection in the field supply unit and causes hum.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part III, Section 14, and heating it in a slow oven. The open end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

[8] DISTORTION IN REPRODUCER UNIT

Distortion in the reproducer unit may be due to any of the following causes:

(a) Cone out of alignment. Refer to Part II, Section 21.

(b) Leads from cone coil broken away from side of cone. Make these leads fast with a little shellac.

(c) Loose grille, escutcheons or baffle board. Any loose part in the cabinet will cause a rattle. Tighten all loose parts.

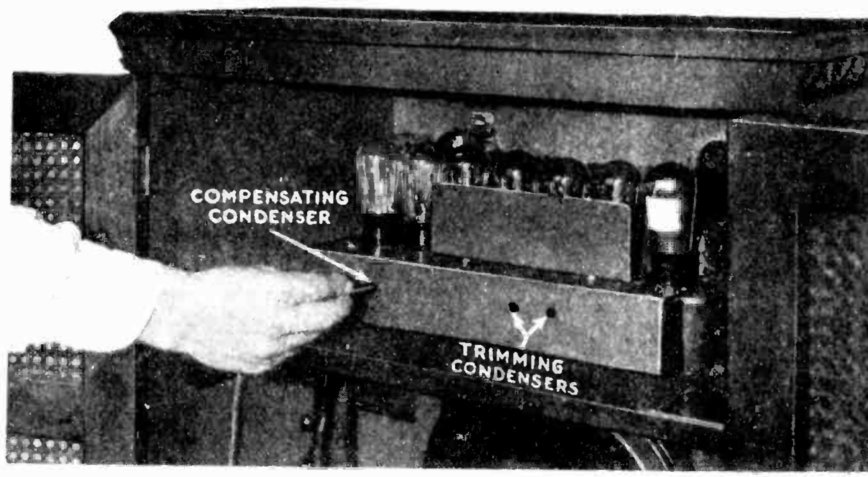

Figure 8—Method of adjusting trimming and compensating condensers

[9] LOW VOLUME AND WEAK SIGNALS

Low volume or weak signals may be caused by:

(a) Defective antenna system. A poor antenna and ground or one in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2 and 3, should be followed if trouble of this kind is experienced.

(b) Defective Radiotrons. A defective Radiotron in any stage may cause weak signals. Before checking other causes it is a good plan to check all Radiotrons by interchanging them with ones of a similar type known to be in good operating condition.

(c) R.F. compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 13.

(d) Oscillator trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the Radiola may be sensitive at certain portions of the tuning scale and very insensitive at other sections. Should these condensers be badly out of adjustment, only very loud local stations will be heard. The correct method for adjustment of these condensers is given in Part II, Section 12.

(e) Intermediate transformers not correctly tuned or matched. Should the tuning condensers connected across the secondaries of the intermediate transformers be out of adjustment, weak signals and poor tuning or, in some cases, no signals will result. Refer to Part II, Section 14, for the correct method of adjusting the I.F. transformers.

(f) Defective A.F. transformer or output condenser and choke. A defect in any of these parts will cause weak signals and abnormal operation. Check by means of the continuity test and make any replacement that is necessary.

(g) Low voltage from S.P.U. Check S.P.U. voltages at terminal strip with readings given in Part II, Section 17. Low voltages may be caused by a low emission rectifying tube or defective resistances in the S.P.U. or receiver. Check by means of continuity test.

(h) Open or short of various connections in receiver. Check by means of continuity tests and make any repair or replacement that is necessary.

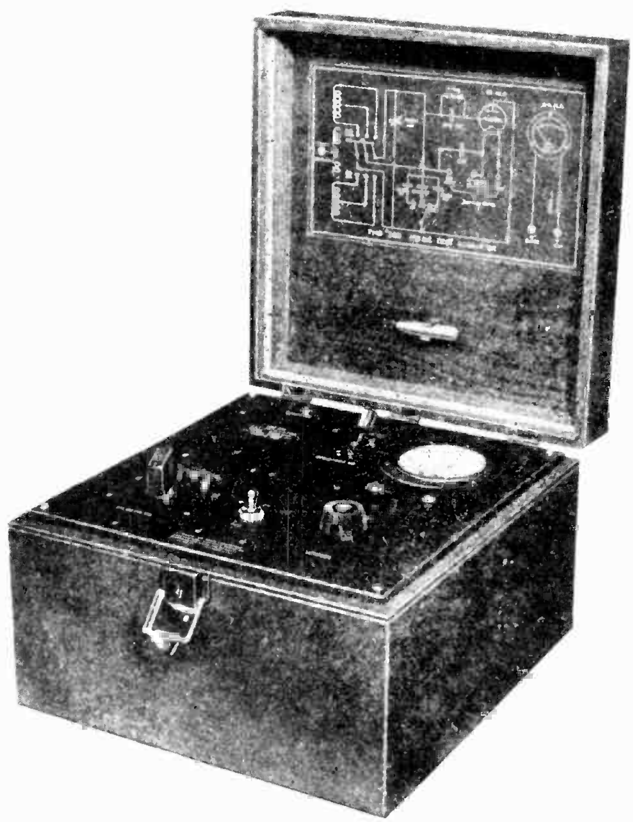

Figure 9—180 K.C. Test Oscillator

[10] AUDIO HOWL

Audio howl may be caused by:

(a) Incorrect adjustment of R.F. compensating condenser. A compensating condenser adjusted to the verge of oscillation may cause a howl on nearby stations. Adjust as suggested in Part II, Section 13.

(b) Open A.F. condenser connections. An open of the A.F. by-pass condenser may cause a howl.

(c) Open large by-pass condenser connections. An open of the connections to the large by-pass condensers may cause a howl.

(d) Defective volume control resistance. Should there be an open or short in the volume control or in its adjacent resistances an audio howl may develop.

(e) Vibrating elements in receiver Radiotrons. A gradually developed howl may be due to the loudspeaker causing the receiver Radiotron elements to vibrate. To overcome this condition, interchange the Radiotrons in the receiver, especially the second detector.

(f) Poor ground. Install ground system as suggested in Part I, Section 3.

(g) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause a howl.

(h) Defective resistance in S.P.U. or the receiver assembly. An open resistance unit may cause howl. Under such conditions it is advisable to turn the set "off" until the trouble is found, otherwise excessive voltage rise may cause further damage.

(i) Neutralizing condensers in intermediate transformers out of adjustment. These condensers being out of adjustment might cause an I.F. stage to oscillate which will result in a howl when a station is tuned in, especially at loud volume. Adjust the neutralizing condensers as described in Part II, Section 14.

(j) Open of any of the several ground leads in the Radiola. This may cause some of the circuits to go into oscillation and result in a howl when a station is tuned "in." Generally a loud hum will also be present. The several grounding leads in the Receiver Assembly and in the Socket Power Unit should be checked and any open or poorly soldered joint should be repaired.

[11] DISTORTED REPRODUCTION

Under normal conditions Radiola 62 will deliver a strong signal of excellent quality to the loudspeaker. The high sensitivity of Radiola 62 makes it undesirable to operate the set at full volume when receiving from nearby broadcasting stations. If the loudspeaker production is poor, test the output from the receiver. A pair of phones may be used for this purpose. 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 second detector, audio stage and the rectifier tube.

(b) High or low plate and grid voltages from the Socket Power Unit or a defective resistor in the Receiver Assembly. In the Socket Power Unit distortion may be caused by a defective Radiotron UX-280 or resistance unit.

(c) Defective A.F. transformer. Check by means of continuity test and replace if necessary.

(d) Trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the beat signal may not be exactly the frequency to which the intermediates are tuned. This will cause weak signals and distortion of those received. This condition may or may not be present throughout the tuning range of the receiver. Adjust as described in Part II, Section 12.

(e) Receiver oscillating. Should some circuit other than the oscillator be oscillating, distortion will be experienced when tuning in a station. This will be accompanied by a whistle or squeal when the carrier wave of the station is tuned in. To remedy trouble of this kind see Part II, Section 10.

(f) Intermediate transformers out of line or not properly matched. This will have the effect of giving distorted reproduction and reduce the sensitivity of the receiver to a marked degree. Line up the entire I.F. transformer assembly as described in Part II, Section 14.

[12] ADJUSTMENT OF OSCILLATOR TRIMMING CONDENSERS

Two trimming condensers are provided for adjusting the oscillator circuit so that the beat note will always be 180 K.C. throughout the tuning range of the receiver.

The most noticeable symptom of the oscillator trimming condensers being out of adjustment is insensitivity of the Radiola in some sections or throughout the tuning range. To check the adjustment of the trimming condensers as a possible cause of any noticeable insensitivity in the receiver proceed in the following manner:

(a) Procure the following equipment:

A modulated oscillator giving signals at 1,400 and 600 Kilocycles. The test oscillator shown in Figure 9 is suitable for this purpose.

A long, thin, non-metallic screwdriver. Such a screwdriver is shown in Figure 7 with its dimensions.

A 0-10 milliammeter. Connect the milliammeter in series with the red lead that turns to the receiver assembly as it enters the braided cable and connecting to lug No. 2 of the S.P.U. terminal strip. This places the meter in series with the plate supply of the second detector.

(b) With the Radiola in operation, place the oscillator in operation at 1,400 K.C. close to the antenna lead and tune the Radiola by adjusting the station selector until a deflection caused by the external oscillator is obtained in the milliammeter. Adjust volume control so that deflection is not beyond scale of meter.

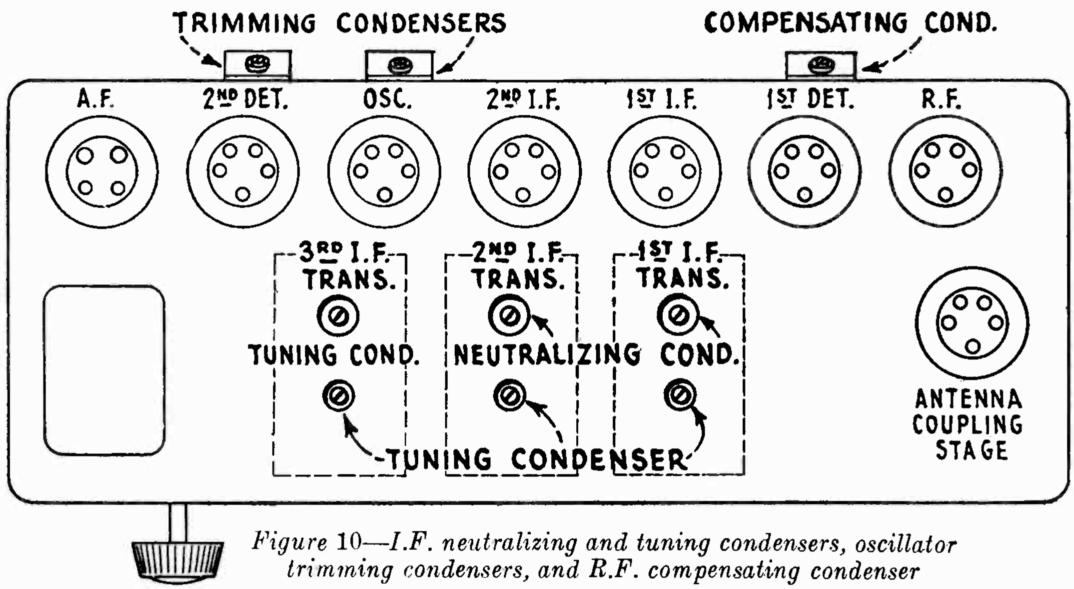

Figure 10—I.F. neutralizing and tuning condensers, oscillator trimming condensers, and R.F. compensating condenser

(c) Now adjust the oscillator trimming condenser on the right, facing rear of Radiola (Figure 8) with the long, thin, non-metallic screwdriver until a maximum deflection is obtained in the milliammeter.

(d) Adjust oscillator for 600 K.C. Tune in the Radiola with station selector and then adjust the trimming condenser to the left for maximum deflection of the milliammeter.

(e) Now readjust at 1,400 K.C. as indicated in (b) and (c).

With this adjustment the trimming condensers are correctly adjusted for maximum efficiency, that is, so adjusted that the beat signal will be 180 K.C. throughout the tuning range.

[13] ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The radio frequency compensating condenser should not be touched unless it is definitely ascertained that no other failure exists as a possible cause of receiver insensitivity, which is the most noticeable indication of the need for adjusting the compensating condenser.

An oscillating condition of the receiver may be caused by improper adjustment of this condenser.

A step by step procedure for making proper adjustment follows:

(a) Procure a long, thin, non-metallic screwdriver (See Figure 7).

(b) Place Radiola in operation in usual manner and tune in a weak station, preferably at the middle or upper wavelengths. If only a loud signal is available, disconnect the antenna.

(c) Locate the position of the compensating condenser (See Figure 8).

(d) With the volume control at the position of maximum setting adjust the screw of the condenser until the Radiola goes into oscillation. This will cause a whistle whenever a station is tuned "in." Then turn the screw in the opposite direction until the set just goes out of oscillation and no howl is experienced when receiving loud local stations. Now tune in stations throughout the range of the receiver and note whether oscillations occur. If they do, it will be necessary to reduce the setting slightly. This is the correct adjustment for the radio frequency compensating condenser.

[14] ADJUSTMENT OF I. F. TRANSFORMERS

The three I.F. transformers used in Radiola 62 are of the air core, tuned primary and tuned secondary type. The primary condenser is of the fixed type, while the secondary is adjustable. Also in each assembly an adjustable condenser is provided for neutralizing the I.F. stage.

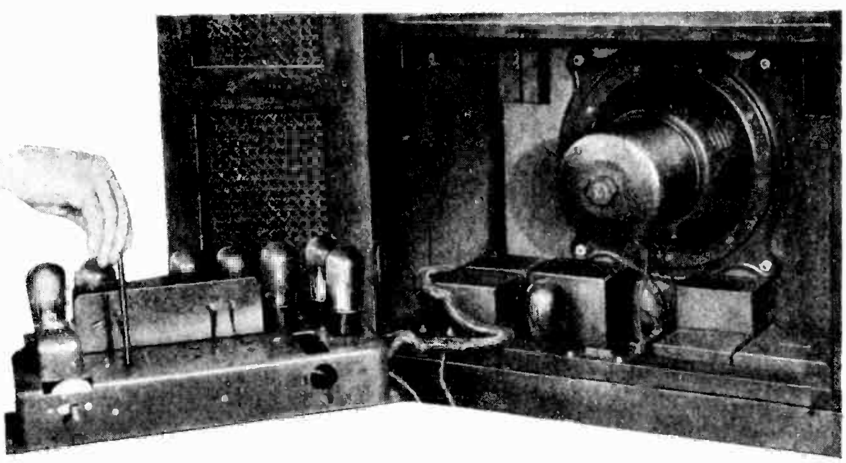

Figure 11—Adjusting tuning condensers in I.F. stages

Should a transformer burn out or its primary fixed condenser change in capacity it will be necessary to replace that particular transformer. The correct procedure for making such a replacement is contained in Part III, Section 10.

A simple method of locating a shorted transformer is to use a resistance bridge or the resistance measuring method described in "Radiola 32 Service Notes." The approximate transformer primary D.C. resistance is 20 ohms; secondary 100 ohms. Due to the circuit arrangement it will only be possible to get a reading of 50 ohms on the secondary as the end connection goes to the neutralizing condenser and the reading must be made at the center tap connection. This test can be made from the underside of the chassis. (See wiring continuity diagram, Figure 20.)

After replacing a defective I.F. transformer or to make adjustments, the following tuning and neutralizing procedure must be followed for correctly lining up the various circuits. This is of utmost importance, as the entire performance of Radiola 62 is based on the correct functioning of its intermediate stages.

The following equipment is needed:

1. A Test Oscillator (Driver). See Figure 9.

2. A coupling lead for coupling the output of the Driver to the grid coil of the first detector.

3. A non-metallic screwdriver.

4. A "dummy" Radiotron UY-227—a normal tube with one heater prong removed.

The RCA Service Division will advise RCA Distributors how to obtain this Driver and the above items.

Preliminary steps to be taken before adjusting the tuning, neutralizing and trimming condensers:—

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Remove main tuning condenser assembly as described in Part III, Section 4.

(c) Replace screw holding ground lead on under side of receiver assembly and make certain that ground lead makes good contact with the chassis frame.

(d) Connect all lugs to the S.P.U. and field supply terminal strips. Unsolder the red lead—connected to lug No. 2—that turns to the receiver assembly as it enters the braided cable and connect it to the clip from the Driver. The other lead with the spade terminal from the Driver should also be connected to terminal No. 2 on the S.P.U. terminal strip. These connections merely place the milliammeter in the Driver test set, in series with the plate supply to the second detector.

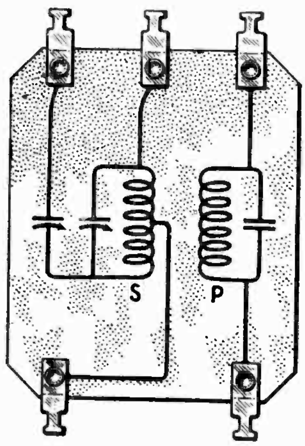

Figure 12—*Internal connections of I.F. transformers.*

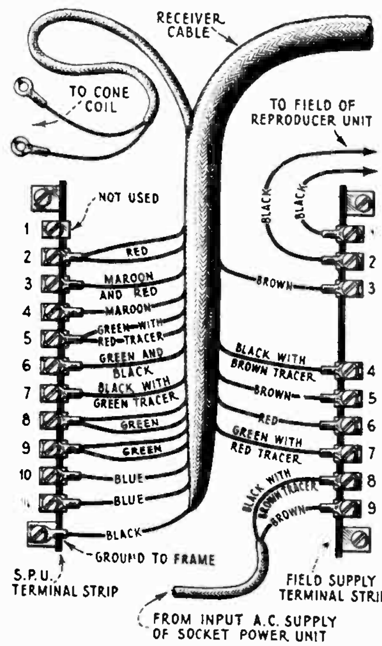

Figure 13—*Receiver Cable connections to the S.P.U. and Field Supply terminal strips.*

(e) Now place the coupling coil from the Driver under the center coil of the R.F. and Oscillator assembly. This is the transformer between the tuned R.F. stage and the first detector. Replace all Radiotrons except the Oscillator and turn operating switch "ON."

(f) Place Driver in operation by switching "ON," and set switches and vernier condenser at 180 K.C. The note from the Driver will then be heard in the loudspeaker.

The I.F. transformer tuning condensers may now be adjusted as follows:

(a) Adjust the tuning condensers successively on the third, second and first I.F. transformers (Figures 10 and 11), for maximum signal in the loudspeaker and maximum reading on the milliammeter. If pointer should go off milliammeter scale reduce the volume control. After making one adjustment on the transformers it is a good plan to repeat, as slight changes may have occurred in tuning the other circuits. No signal, or a loud howl indicates neutralizing condensers are out of adjustment and they should be readjusted.

A maximum reading by adjusting all three tuning condensers indicates correct tuning of the intermediate stages.

It is now necessary to check the neutralization of the I.F. stages as follows:

(a) Leave all adjustments and apparatus in position on completion of tuning, but substitute a pair of phones for the loudspeaker by disconnecting leads to terminals 3 and 4 of the field supply unit and connect phone tips to these terminals. Place dummy Radiotron in first I.F. socket. Now adjust the neutralizing condenser on the first I.F. transformer for the position of minimum or no signal. This is easily identified and the adjustment is not critical.

(b) Replace the first I.F. tube and place "dummy" tube in second I.F. stage and adjust the neutralizing condenser on the second I.F. transformer for position of minimum or no signal as described in the preceding paragraph (a). Figure 12 illustrates the internal connections of the I.F. transformers. It will be noted that the two condensers on the third transformer are connected in parallel for tuning. This stage does not require neutralizing.

After the I.F. transformers are properly tuned and neutralized they should perform at their maximum efficiency. It is a good plan to check the adjustments of the two oscillator trimming condensers (See Figure 20) at this point. The correct method

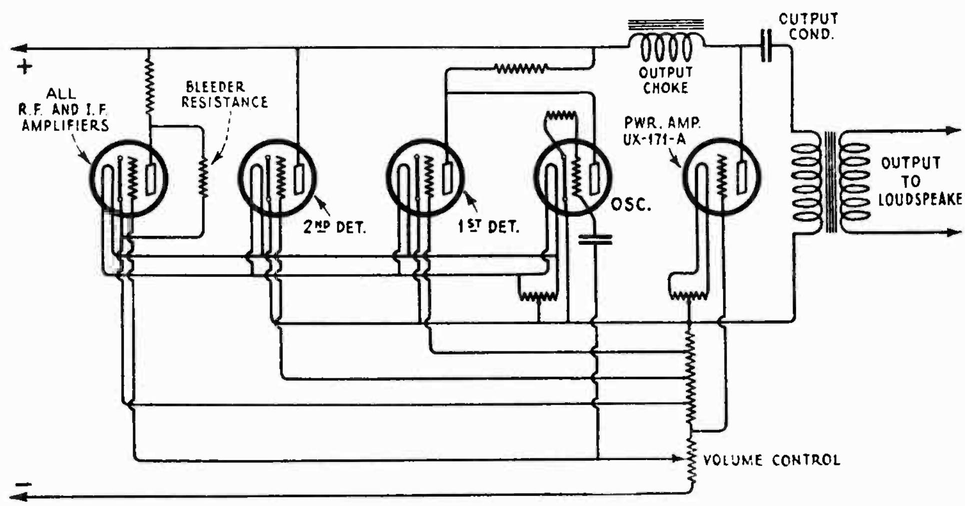

Figure 14—Schematic circuit diagram of the voltage supply system

for doing this is indicated in Part II, Section 12. The Driver illustrated in Figure 9 may be used for this adjustment. The procedure for adjusting the trimming condensers follows:

(a) Replace main tuning condensers and solder all connections in place. Place coupling lead of the oscillator near the Radiola antenna lead.

(b) Set Driver switches and vernier condenser for 1,400 K.C.

(c) With all Radiotrons in place in the receiver tune for Driver signal with main tuning condensers. If reading goes off milliammeter scale reduce volume control.

(d) Adjust trimming condenser on right (facing rear of Radiola, Figure 8) for a maximum reading.

(e) Shift frequency of Driver to 600 K.C. and tune in with main tuning condensers. Adjust trimming condenser on left for maximum milliammeter reading. This is the condenser on the left of the other trimming condenser.

(f) After adjusting at 600 K.C., check again at 1,400 K.C., and make any readjustment necessary.

This check of the trimming condensers completes the adjustments to be made in Radiola 62 with the Driver. The receiver assembly should now be returned to the cabinet (Figure 13 shows the cable connections) and the Radiola returned to normal operation.

Due to the increased sensitivity of the receiver it may be necessary to reduce the setting of the R.F. compensating condenser to prevent the tuned R.F. stage from oscillating. This can be ascertained by tuning in stations of different wavelengths and noting if the receiver oscillates at any point throughout its tuning range. (See Part II, Section 13.)

[15] OUTPUT CONDENSER AND CHOKE, OUTPUT TRANSFORMER AND FILTER CONDENSERS

The filter condensers are located in one container in the S.P.U. (See Figure 2) and their internal connections are shown in Figure 15. The output condenser and choke and output transformer comprising the coupling unit in the field supply, are located in another unit. The internal connections are shown in Figure 15A. The procedure for testing the choke or transformer windings is to "click test" for an open. To test the condensers they should be charged and then discharged by shorting their terminals with a screwdriver. A condenser that will not retain its charge is defective. Approximately 200 volts D.C. should be used when making this test.

An open output condenser or an open or shorted choke will cause weak and distorted reproduction. A defective filter condenser is indicated by excessively hot plates, possibly showing color, in Radiotron UX-280. Shorted by-pass condensers will cause abnormal operation or inoperation.

[16] VOTLAGE SUPPLY SYSTEM

Figure 14 illustrates a schematic diagram of the cathode, grid and plate voltage supply system of the various tubes used in the receiver assembly.

This receiver uses the series supply arrangement for securing different drops through various sections of a resistor placed in the plate return lead to secure proper bias for the grid circuits and proper potential for applying to the cathodes and heaters. Electrically the volume control is a section of this resistance and it functions by varying the grid bias on the R.F. and I.F. stages sufficiently to give a positive control of signal strength delivered to the second detector.

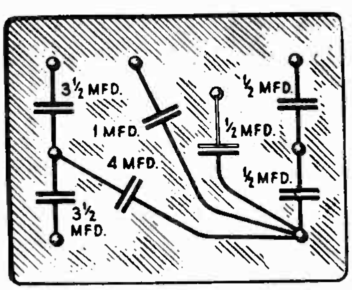

Figure 15—*Internal connections of filter and by-pass condensers*

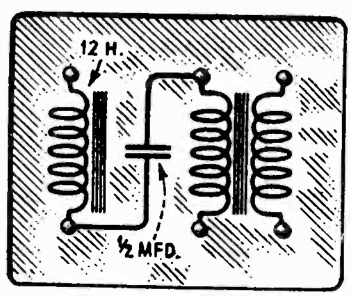

Figure 15A—*Internal connections of the coupling unit*

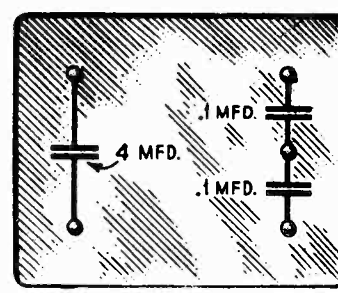

Figure 16—*Internal connections of condenser bank for field supply unit*

A bleeder resistor of 20,000 ohms is provided across the supply circuit at the 135-volt position. The use of this resistor prevents any excessive rise in voltage that would otherwise occur upon removal of all Radiotrons or if some failure resulting in reduced load occurred in the receiver.

[17] VOLTAGE READINGS

When checking Radiola 62 for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man will need both an A.C. and D.C. Voltmeter, the D.C. meter being 600 ohms per volt or higher in resistance. The following voltages at the terminal strip of the S.P.U. are correct with all tubes in place, the line adjustment switch in the correct position for that particular location and the set in operating condition. The tubes must be in good condition otherwise the D.C. voltages may be excessively high.

The shield over the terminal strip must be removed before any readings can be made. The terminal numbers are counted from front to rear of the Radiola, No. 1 being near the front and No. 11 near the rear.

Terminals	*Correct Voltage*
2 to 7	210 D.C.
3 to 7	160 D.C.
4 to 7	110 D.C.
8 to 9	5 A.C.
10 to 11	2.5 A.C.

[18] CHECKING RESISTANCE VALUES

When checking a Radiola 62 for possible trouble it is always a good plan to check the various resistance values of different strips used both in the receiver assembly or in the socket power unit. These values are shown in the schematic circuit diagram, Figure 5. A resistance bridge should be used for checking these values, or if this is not available, the method suggested in "RCA Radiola 32 Service Notes" (page 16) will give good results for the lower values of resistance. The high values, such as 14,300 and 20,000 ohms may be checked by measuring the voltage drop across them, after ascertaining that all other circuits are in correct operating condition.

[19] TESTING DISC RECTIFIER

The disc rectifier may be checked by measuring the output voltage that is delivered to the field of the reproducer unit. This should be 100 volts with the field connected. With the field disconnected it should rise slightly to about 140 volts.

Across the output of the rectifier is connected a 4 mfd. condenser. (See Figure 16.) Should this condenser become shorted, the fuses on the line will probably blow and the set

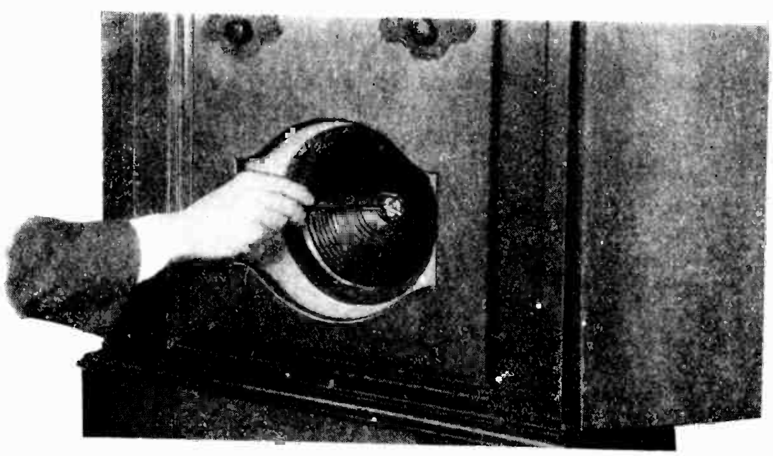

Figure 17—Adjusting the position of the cone

become inoperative. If the fuses do not blow immediately, the rectifier will be damaged. A shorted condenser can be located by means of a click test and it should be replaced as described in Part III, Section 18.

Precaution—The operation of the disc rectifier depends on the pressure to which the discs are held. *Do not* loosen the bolts that hold them together as it is highly improbable they can be returned to normal operation without special instruments. Should replacement become necessary, remove the bracket and unit together. The replacement part is supplied with brackets so that replacement is comparatively easy.

[20] REPRODUCER UNIT

Radiola 62 uses a new type eight-inch dynamic reproducer which makes possible excellent quality of reproduction. The field coil assembly is the same as that used in Loudspeaker 105 with the exception that the mounting bracket is not used. The flange, however, is larger and is designed so that the entire unit may be supported by it from the baffle board. The cone is an eight-inch corrugated type, giving a smooth response to all frequencies and having a treatment to make it weatherproof and free from rattle.

A check on the continuity of the cone coil or field can be made by disconnecting them from all other terminals and click testing for continuity. An open of either coil will indicate a defect which must be remedied by replacing the entire cone or the field coil.

[21] CENTERING CONE OF REPRODUCER UNIT

To properly center a new cone or one out of center use the following procedure:

(a) Remove the grille by pulling the left side when facing the front of the Radiola.

(b) Loosen center screw of cone, but do not remove it.

(c) Insert three cardboard strips about the thickness of a visiting card, 1½" x ¼" in size, through the center web of the cone into the space between the pole piece and the cone (Figure 17). This will give the cone coil the same clearance on all sides of the pole piece.

(d) Tighten the center screw holding the web of the cone and remove the three strips. The cone is now properly centered. Replace the grille previously removed.

[22] RADIOLA 62 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly, socket power unit and field supply unit of Radiola 62. Disconnect the antenna and ground leads; the cable connecting the power units to the receiver and loudspeaker and the A.C. supply cord at its outlet.

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 across the battery terminals should be used in making these tests. The receiver Radiotron sockets, numbers and lugs used in these tests are shown in Figure 18. The receiver continuity wiring diagram is illustrated in Figure 20. The S.P.U. and field supply unit terminal numbers are shown in Figures 19 and 21.

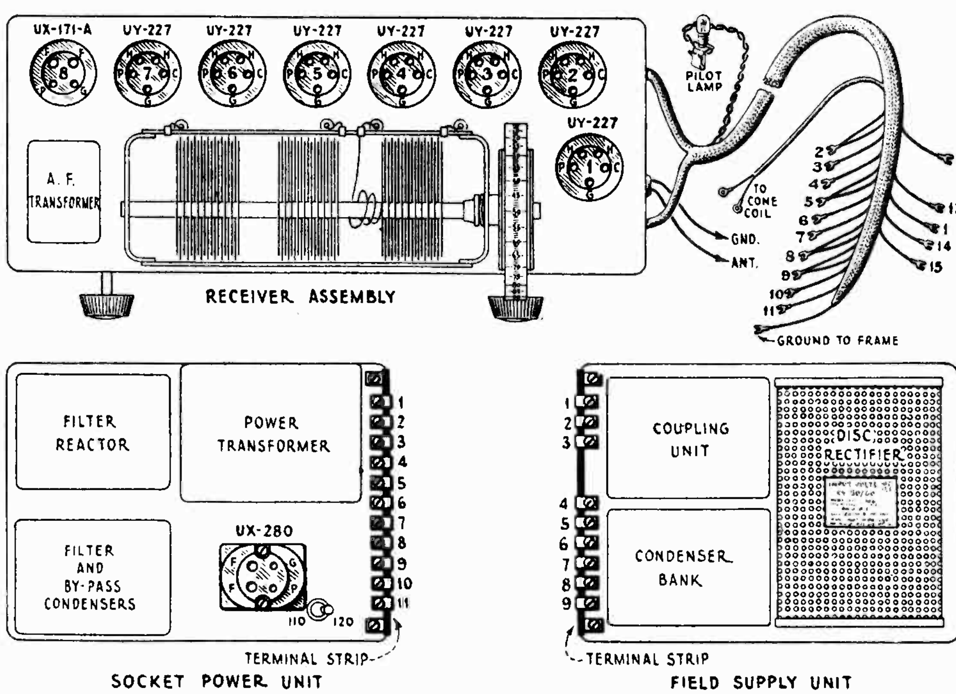

Figure 18—*Radiotron socket contacts, location of parts, connection lugs and terminal strips of the socket power and field supply units*

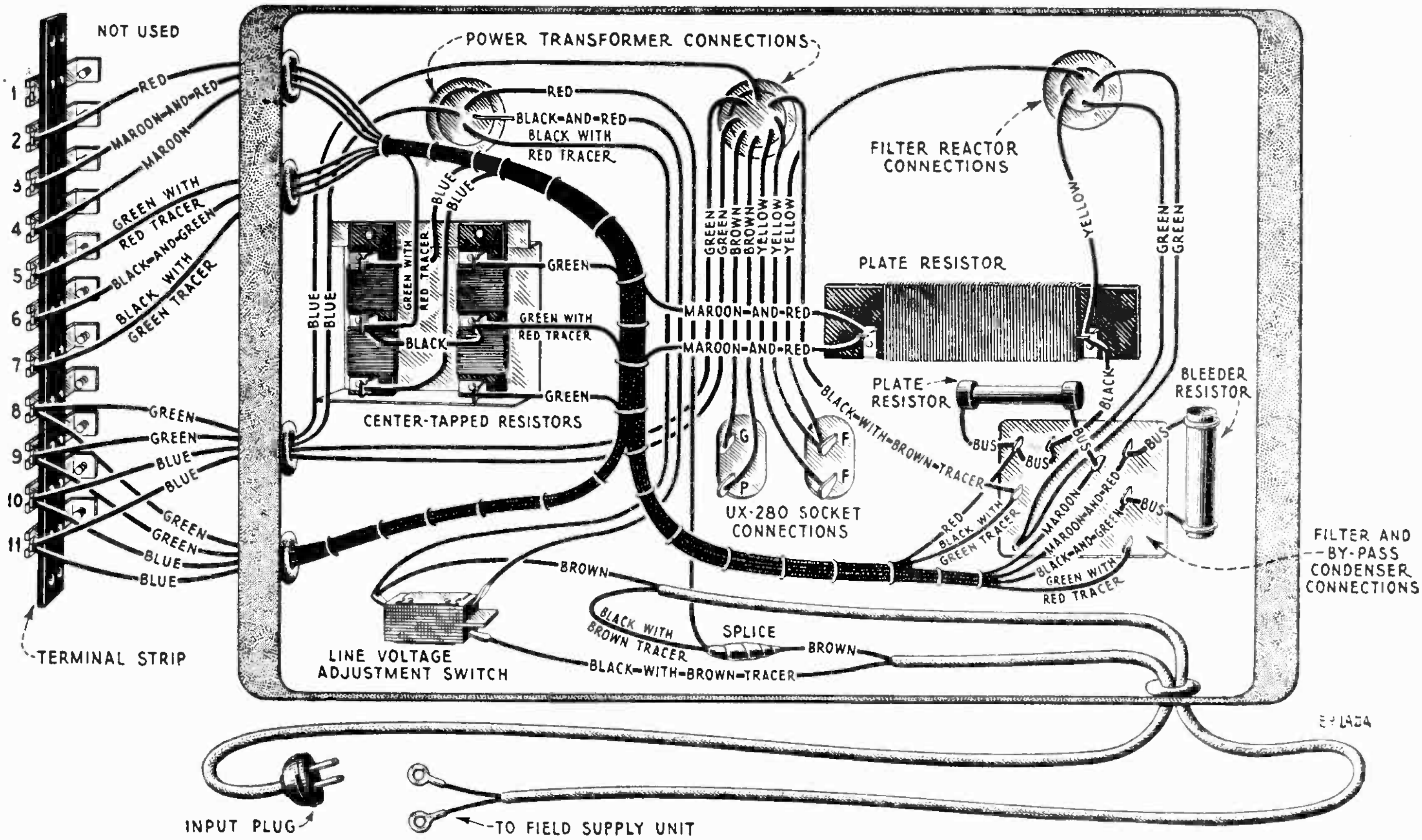

Figure 19—Continuity wiring diagram of the socket power unit

SOCKET POWER UNIT CONTINUITY TESTS

Remove Radiotron UX-280 and Disconnect Cable at Terminal Strip

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
G to P of UX-280 socket	Closed	Open high voltage winding of power transformer
Across filament contacts of UX-280 socket	Closed	Open UX-280 filament winding of power transformer
One filament contact of UX-280 socket to No. 2	Closed	Open filter reactors
Terminal No. 2 to No. 3	Closed	Open resistance unit
Terminal No. 2 to No. 4	Closed	Open resistance unit
Terminal No. 2 to No. 5	Open	Shorted 1 mfd. condenser
Terminal No. 2 to No. 7	Open	Shorted 3½ mfd. condenser
Terminal No. 3 to No. 6	Closed	Open resistance unit
Terminal No. 4 to No. 5	Open	Shorted .5 mfd. condenser
Terminal No. 5 to No. 6	Open	Shorted .5 mfd. condenser
Terminal No. 5 to No. 7	Open	Shorted 4 mfd. Condenser
Terminal No. 8 to No. 9	Closed	Open UX-171A filament winding and resistance unit
Terminal No. 10 to No. 11	Closed	Open UY-227 filament winding and resistance unit.

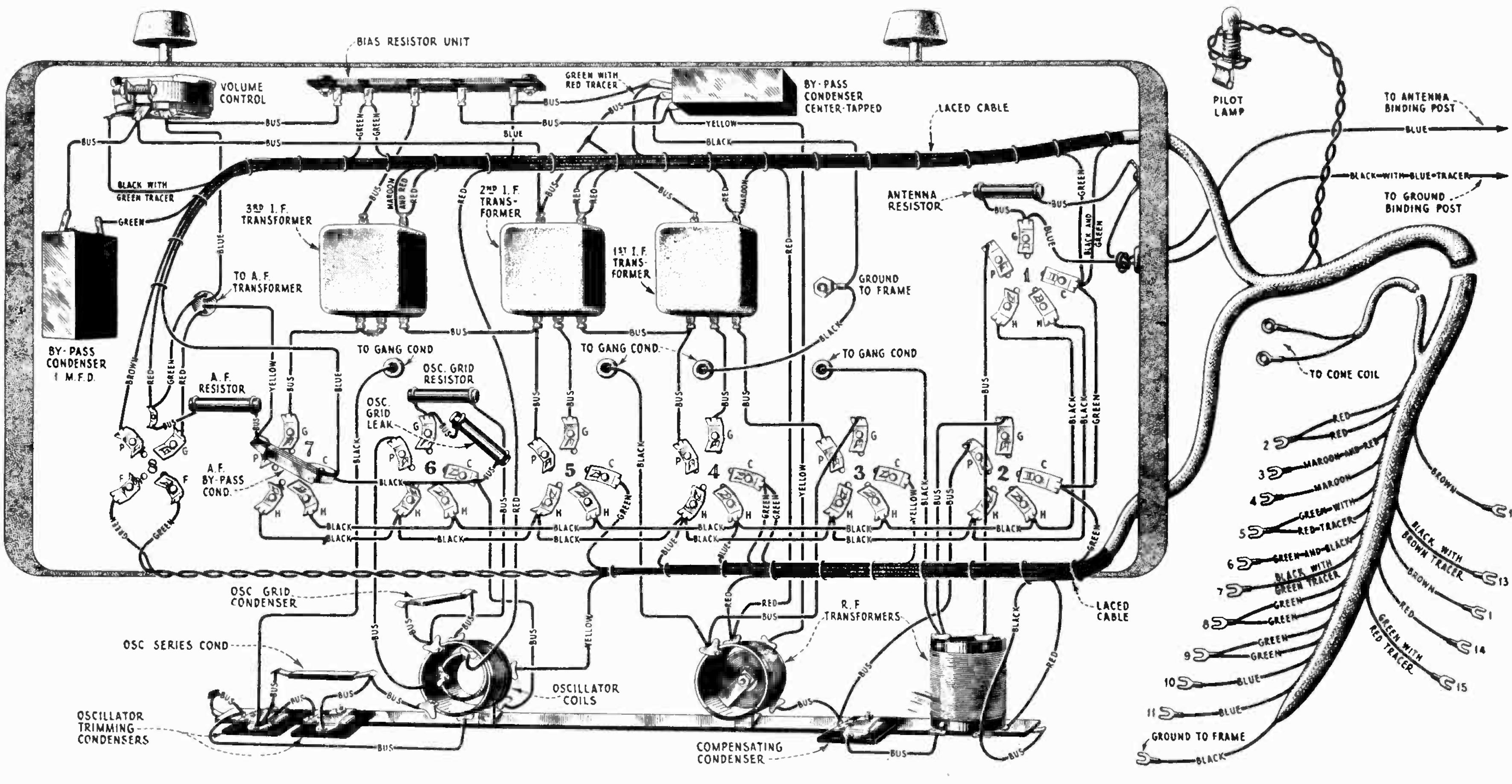

Figure 20—Continuity wiring diagram of receiver

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove all Radiotrons and Disconnect Cable at Terminal Strips

See Figure 18 for cable lugs, terminals, and Radiotron socket contacts

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna lead to ground lead	Closed	Open antenna resistor
	Antenna lead to G1	Closed	Open connection
	G2 to ground	Closed	Open secondary of 1st R.F. transformer
	G3 to Lug No. 5	Closed	Open secondary of 2nd R.F. transformer or resistance unit
	G4 to ground	Closed	Open secondary of 1st I.F. transformer
	G5 to ground	Closed	Open secondary of 2nd I.F. transformer
	G7 to ground	Closed	Open secondary of 3rd I.F. transformer or resistance unit
	G8 to Lug No. 6	Closed	Open secondary of audio transformer or resistance unit
	Lug No. 5 to Lug No. 7	Closed	Open resistance unit or volume control
	Ground to Lug No. 7	Closed	Open volume control contact arm or poor connection
Plate	P1 to Lug No. 3	Closed	Open primary 1st R.F. transformer
	P2 to Lug No. 3	Closed	Open primary 2nd R.F. transformer
	P3 to Lug No. 4	Closed	Open primary 1st I.F. transformer
	P4 to Lug No. 3	Closed	Open primary 2nd I.F. transformer
	P5 to Lug No. 3	Closed	Open primary 3rd I.F. transformer
	P6 to Lug. No. 4	Closed	Open plate coil of oscillator coils
	P7 to Lug No. 2	Closed	Open primary of audio transformer
	P8 to Lug No. 1	Closed	Open connection
Filament	Cathodes No. 1, No. 2, No. 4 and No. 5 to Lug No. 6	Closed	Open connection
	Cathodes No. 3, No. 6 and No. 7 to Lug No. 5	Closed	Open pick-up winding of oscillator or connection
	Lug No. 8 to one filament contact Socket No. 8	Closed	Open connection
	Lug No. 9 to other closed filament contact Socket No. 8	Closed	Open connection
	Lug No. 10 to one heater contact of Sockets Nos. 1, 2, 3, 4, 5, 6 and 7	Closed	Open connections
	Lug No. 11 to other heater contact of Sockets Nos. 1, 2, 3, 4, 5, 6 and 7	Closed	Open connections
Miscellaneous	G2 to P2	Open	Shorted compensating condenser
	G4 to P4	Open	Shorted neutralizing condenser
	G5 to P5	Open	Shorted neutralizing condenser
	G6 to Cathode 6	Closed (Weak)	Open oscillator grid leak
	G8 to Lug No. 5	Closed	Open resistance unit or secondary of A.F. transformer
	G8 to Lug No. 7	Closed	Open secondary of A.F. transformer or open volume control
	Lug No. 12 to Lug No. 13	Closed	Open cone coil of reproducer unit
	Lug No. 14 to Lug No. 2	Closed	Open connection
	Lug No. 15 to Lug No. 5	Closed	Open connection

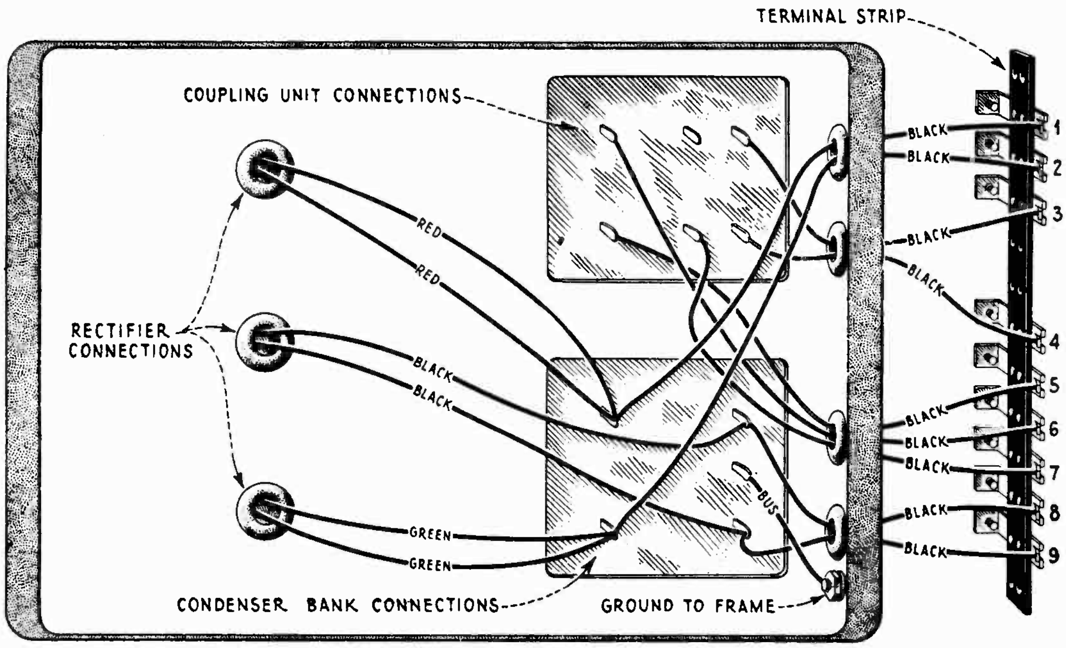

Figure 21—Continuity wiring diagram of field supply unit

FIELD SUPPLY UNIT CONTINUITY TESTS

Remove all Cable Connections

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
3 to 4	Closed	Open secondary of output transformer
5 to 6	Closed	Open output choke
5 to 7	Open	Shorted output condenser

VOLTAGE READINGS AT FIELD SUPPLY UNIT

Connect all Cables and turn power "On"

Terminals	*Voltage*
1 to 2	100 D.C.
5 to 6	10 D.C.
5 to S.P.U. No. 7	200 D.C.
8 to 9	120 A.C.

[23] VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron Socket with the receiver in operating condition should prove of value when checking is done with test sets such as the Weston Model 537 Type 2 or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and line voltages. Therefore the following values must be taken as approximately those that will be found under varying conditions. These readings are equally applicable to Radiola 60. The numbers in column 1 indicate the tube socket numbers shown in Figure 18.

VOLUME CONTROL AT ZERO

110-volt line. Switch at 110-volt position.

Tube No.	*Cathode to heater. Volts*	*Cathode or filament to Grid. Volts*	*Cathode or filament to Plate. Volts*	*Plate Current Milliamps.*	*Filament or heater. Voltage*
1	30	30	165	—	2.5
2	30	30	165	—	2.5
3	—	11	90	.75	2.5
4	30	30	165	—	2.5
5	30	30	165	—	2.5
6	—	—	75	7.0	2.5
7	—	20	175	1.0	2.5
8	—	37	160	18.0	5.0

VOLUME CONTROL AT MAXIMUM

110-volt line. Switch at 110-volt position.

Tube No.	*Cathode to heater. Volts*	*Cathode or filament to Grid. Volts*	*Cathode or filament to Plate. Volts*	*Plate Current Milliamps.*	*Filament or heater. Voltage*
1	27	10	130	3.5	2.5
2	27	10	130	3.5	2.5
3	—	10	70	.5	2.5
4	25	10	130	9.0	2.5
5	25	10	130	9.0	2.5
6	—	—	65	7.5	2.5
7	—	20	165	.75	2.5
8	—	35	150	6.0	5.0

PART III—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 62 are readily accessible and replacements can be easily made. Figure 22 illustrates the parts in the receiver assembly, Figure 2 in the S.P.U. and Figure 3 in the field supply unit. The following detailed procedure outlines the simplest method to be used in making replacements.

[1] REPLACING THE VOLUME CONTROL

(a) Remove the knobs on the volume control and station selector. These are of the push type, and they are removed by simply pulling them off the shafts. Between each knob and the cabinet will be found a dilecto washer. These washers must also be removed. To replace, merely push the knob on to the shaft, first matching the knob socket with its flat spring to the shaft.

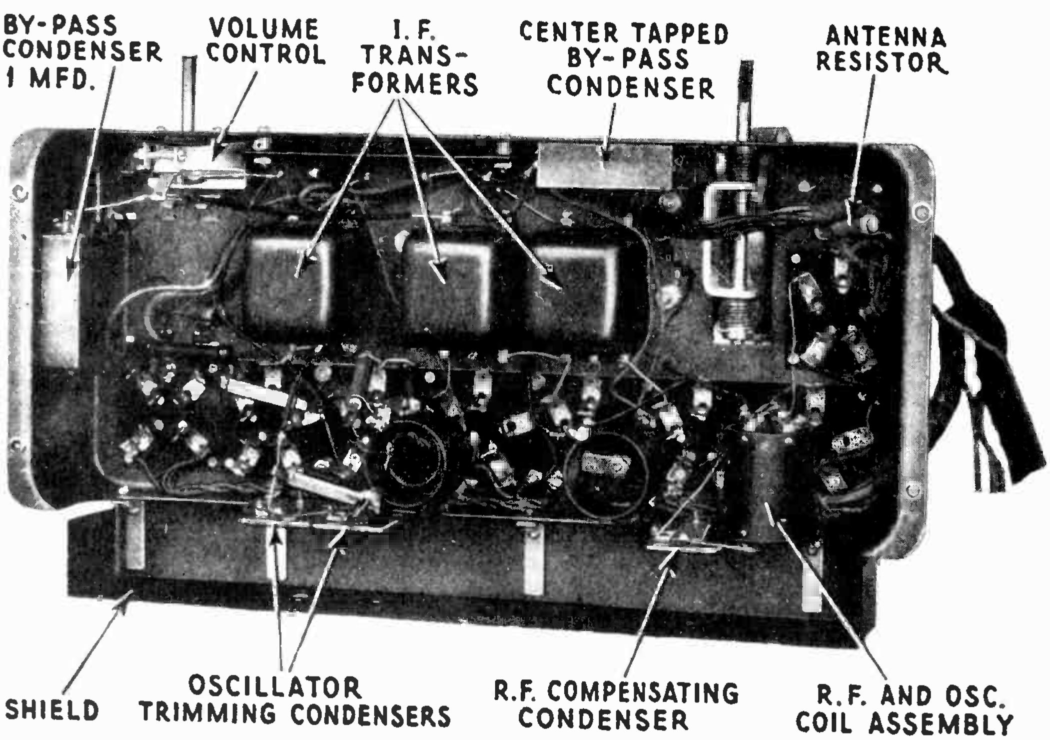

Figure 22—Receiver sub-Chassis showing principal parts

(b) Open rear doors and release the pilot lamp and socket by pulling it from the small angle bracket to which it is clipped in place. A slight pull, upward and backward, will release it.

(c) Remove the shield and insulating cover that are over the two terminal strips. Then remove all cable connections to each strip.

(d) Release the two connections to the cone coil terminals from the cable. These are located on the loudspeaker flange.

(e) Remove the clamps that hold the cable and antenna wire to the side of the cabinet.

(f) Remove the antenna and ground wires from their binding posts.

(g) Pull cable, antenna and ground leads through the hole in the shelf until all leads are clear.

(h) Remove the four screws that hold the receiver assembly to the shelf.

(i) The receiver assembly may now be lifted clear of the cabinet. (See Figure 23.) Place the volume control up and remove the two screws and nuts that hold it in place. The three soldered connections must also be removed.

(j) Remove the old volume control and fasten the new one in position by means of the two machine screws and nuts, and resolder the three connections. The correct connections of these leads are shown in Figure 20.

(k) Return receiver assembly in cabinet and replace all cables and leads in the reverse manner of that used to remove them.

(l) Test Radiola and if O. K. return shield to its original position.

[2] REPLACING R. F. TRANSFORMER AND OSCILLATOR ASSEMBLY

The two radio frequency transformers and the oscillator coils are mounted on a metal strip, together with three small adjustable condensers and two fixed condensers.

This assembly must be replaced as a unit—the matching of the coils being an important point in the operation of the receiver. Use the following procedure:

(a) Remove receiver chassis from cabinet as described in Part III, Section 1.

(b) Turn chassis on side and unsolder all leads to the assembly being replaced.

(c) Remove the five machine screws and lock washers that hold the metal supporting strip to the receiver frame.

(d) The assembly may now be removed and the new assembly fastened in position with the five machine screws and washers previously removed.

(e) Resolder all connections in their correct position on the assembly. This is shown in Figure 20.

(f) The receiver assembly may now be returned to the cabinet in the reverse manner of that used to remove it.

[3] REPLACING RADIOTRON GANG SOCKETS

One socket assembly on the receiver chassis is of the gang variety, the others being two single units. All are held in place, together with their shields, by means of rivets which clamp them on the metal chassis frame. Use the following procedure when replacing these sockets:

(a) Remove the receiver assembly from the cabinet as described in Part III, Section 1.

(b) Unsolder all connections to the particular socket or assembly being removed. The R.F. transformer assembly should be removed as a unit to provide room for replacing the six-gang Radiotron socket.

(c) Drill out the rivets holding the Radiotron socket to be replaced. The socket and shield will be released together, in the case of the single UY socket. In the case of the single UX or the gang UY the shield overlaps and will be held in place by the socket not removed.

(d) Remove the old Radiotron socket and fasten the new one in position by means of screws, nuts and washers. Resolder all connections and replace the R.F. assembly if removed. The correct connections are shown in Figure 20.

(e) Fasten receiver assembly in cabinet, connect cable and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[4] REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and drive are replaced as one unit as follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Remove the three screws, nuts and lock washers that hold the condenser assembly to the metal frame.

(c) Now pull the condensers as far forward as possible and unsolder the four leads connected at the rear. Releasing the condensers and pulling them forward provides ample space in which to do the unsoldering job and keeps solder material clear of the tube shield. Remove the entire assembly by tilting slightly and pulling clear.

(d) Place the new assembly in the position occupied by the old one and solder the four leads to their proper connections.

(e) Fasten the three screws, nuts and lock washers in their proper position. Make sure that the screw that holds the ground connection on the under side of the chassis makes firm contact.

(f) Return the receiver to the cabinet and replace all connections in the reverse order of that used to remove them.

[5] REPLACING BY-PASS CONDENSERS

Radiola 62 employs two by-pass condensers in the receiver assembly. They are both located on the under side of this assembly, and replacement is made in the following manner:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Unsolder the connections to the condenser it is desired to replace.

(c) With a screwdriver bend up the metal tabs holding the condenser to the side of the receiver frame. These tabs bend easily, and when turned up make possible the removal of the condenser.

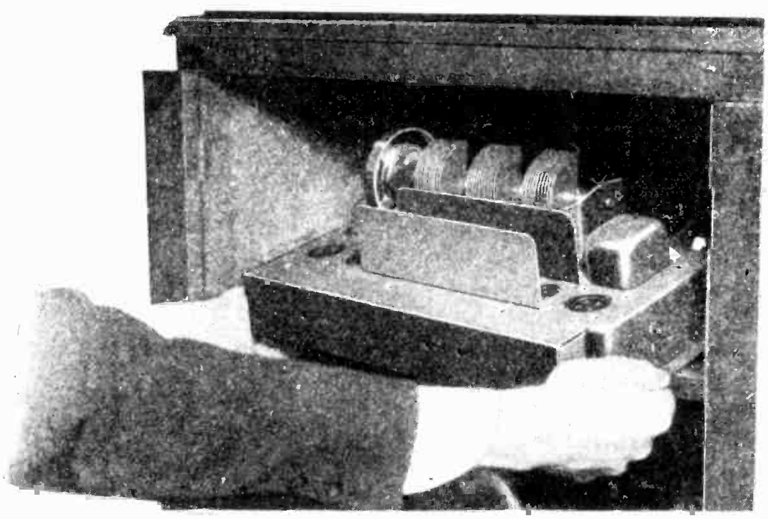

Figure 23—Removing receiver chassis from cabinet

(d) The new condenser should now be fastened in place in the position formerly occupied by the old one.

(e) Resolder the connections as shown in Figure 20.

(f) Fasten the receiver assembly in the cabinet in the reverse order of that used to remove it.

[6] REPLACING THE AUDIO TRANSFORMER

Radiola 62 employs one audio transformer, located at the left side of the receiver assembly facing the front of the Radiola. Should a replacement become necessary use the following procedure:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Place the receiver chassis on its side and unsolder all connections to the audio transformer.

(c) Now turn up the four tabs that hold the transformer in place and remove it. The new one is then fastened in position.

(d) Resolder the leads from the new transformer to their correct points of connection as indicated in Figure 20.

(e) Fasten the receiver assembly in the cabinet in the reverse order of that used to remove it.

[7] REPLACING CONDENSER DRIVE CABLE

(a) Remove receiver assembly from cabinet as described in Part III, Section 1. Place chassis on a table so that the cable on the grooved drums is accessible.

(b) Release the cable adjusting screw and clamp, and remove old cable from drums completely.

(c) Starting from the rear grooved drum, place eye of new cable over pin, which should be in a horizontal position and next to side of the assembly that is closest to the Socket Power Unit when in the cabinet, and wind on three complete turns and then bring cable up to large drum.

(d) Now pass cable over large drum. Turn the drum so the cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing the cable to the track on the other side of the drum.

(e) Follow on around other track in same direction until a point is reached where cable is directly above front grooved drum.

(f) Starting on the third groove back from the front of the drum, wind on two and a half turns and slip eye over pin. The cable is now in its correct position, although probably slack.

(g) The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the grooves are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of its controls. Care should be taken not to take up too much, as the cable may be stretched or possibly broken.

(h) Return receiver assembly to cabinet in the reverse order of that used to remove it

[8] REPLACING DIAL SCALES

After considerable use a dial scale may become soiled or illegible and a new scale desired. A step-by-step procedure to make replacement follows:

(a) Open rear door of Radiola 62.

(b) Turn dial so that the two screws that hold the dial in place are toward the rear.

(c) Loosen screws, washers and nuts that hold dial in place.

(d) The old dial may now be pulled clear and the new one placed in the position occupied by the old one. Examine dial from the front of the Radiola to see that the numbers on the dial are in their correct position.

(e) Tighten screws holding dial in place and close doors of cabinet.

[9] REPLACING POWER CABLE

A combination laced and braided cable is used in Radiola 62 for connecting the S.P.U. and field supply unit to the receiver assembly and the reproducer unit. Should it be necessary to replace this cable use the following procedure:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Turn assembly bottom side up and unsolder all connections to the cable.

(c) Remove old cable and connect up the new cable as indicated in Figure 20, soldering all connections.

(d) Return assembly to cabinet in reverse order of that used to remove it.

[10] REPLACING INTERMEDIATE TRANSFORMERS

Radiola 62 has three intermediate frequency transformers, all three being exactly the same mechanically, and interchangeable electrically after the correct adjustments have been made for their particular position in the circuit. A step-by-step replacement procedure follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Remove tuning condenser assembly as described in Part III, Section 4.

(c) Unsolder the connections of the transformer being replaced. Then turn up the metal tabs on the upper side of the receiver chassis. The old transformer may now be replaced by the new one. Turn over the metal tabs to hold it in place and resolder all connections. These are shown in Figure 20. Be careful not to heat any connection more than necessary to make a good joint, as excessive heat may change the capacity of the primary fixed condenser, thus rendering the entire transformer assembly defective.

(d) Before returning the main tuning condensers to the receiver chassis it will be necessary to tune and neutralize the transformer just connected in position. The correct procedure for doing this is contained in Part II, Section 14.

(e) The procedure given in Part II, Section 14 may now be carried out. Then return the tuning condenser assembly in the reverse order of that used to remove it. The entire receiver may now be tested and a check made on the adjustment of the oscillator trimming condensers as described in Part II, Section 12. After all tests and adjustments are completed the receiver assembly should be returned to the cabinet in the reverse order of that used to remove it.

[11] REPLACING TAPPED RESISTANCE UNIT IN RECEIVER ASSEMBLY

A tapped resistance unit in the receiver assembly of Radiola 62 provides the various grid and cathode voltages. To replace this tapped resistance unit proceed as follows:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Unsolder all connections to the tapped resistance unit.

(c) Remove the two screws, nuts and washers that hold the resistance unit in place. This will release the unit and the new one can be fastened in place with the screws, nuts and washers previously removed.

(d) Solder all the leads to their correct connections. (See Figure 20.)

(e) Return receiver assembly to cabinet in the reverse order used to remove it.

[12] REPLACING CONE OF REPRODUCER UNIT

Should it be desirable to replace a cone, the entire reproducer unit must be removed from the cabinet. In order to do this use the following procedure:

(a) Remove the cover over the terminal strip and remove the field supply leads from terminals 1 and 2 of the field supply unit.

(b) Remove the two cone coil leads and the connections from the power cable that are connected to the terminals on the flange of the reproducer unit.

(c) Remove the four nuts that hold the reproducer to the baffle board, at the same time supporting the reproducer by hand to prevent it falling on the S.P.U. Place the unit in some position convenient for work.

(d) Remove the nine nuts and machine screws that hold the cone ring in place. Remove this ring.

(e) Remove the screw and washer that centers the cone. The cone may now be removed and the new one placed in the position occupied by the old one.

(f) Return the centering screw; the ring and its nine screws and nuts to position, but do not tighten. The cone should now be centered as described in Part II, Section 21 and all screws tightened.

(g) The unit should now be returned to the cabinet in the reverse manner of that used to remove it.

[13] REPLACING FILTER CONDENSERS AND BY-PASS CONDENSERS

The filter condensers and by-pass condensers are enclosed as a unit in a metal container. Should replacement be necessary, use the following procedure:

(a) Remove the shield and all connections from the Socket Power Unit terminal strip.

(b) Remove the four machine screws that hold the S.P.U. to the cabinet. The S.P.U. may now be lifted clear of the cabinet.

(c) Unsolder all connections to the unit being replaced, also release the two resistors attached to its connecting terminal.

(d) Bend up the tabs that hold the unit to the S.P.U. base. Remove the old unit and fasten the new one in position by bending the tabs down so that it is held tightly to the S.P.U. base.

(e) Replace and solder all connections and the resistance units previously removed. Their correct connections are shown in Figure 19.

(f) Return the S.P.U. to the cabinet in the reverse order of that used to remove it. Replace all connections and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[14] REPLACING POWER TRANSFORMER OR FILTER REACTOR

The power transformer and filter reactor are both held in place by means of tabs which form a part of their case, being turned over on the under side of the S.P.U. base. A step-by-step replacement procedure follows:

(a) Remove S.P.U. from cabinet as described in Part III, Section 13.

(b) Unsolder all connections to unit being replaced. If the power transformer is being replaced release the two screws that hold the center tapped resistance units in place, so they may be pulled clear when bending the tabs on the power transformer.

(c) Bend up the tabs that hold the unit to the S.P.U. base.
(d) The old unit may now be removed and the new one placed in position. Bend over the tabs on the new one so that it is fastened tightly to the S.P.U. base.
(e) Solder all connections as shown in Figure 19.
(f) Fasten the S.P.U. in the cabinet in the reverse order of that used to remove it.

[15] REPLACING TERMINAL STRIP

Should the terminal strip on the S.P.U. require replacement use the following procedure:
(a) Remove the S.P.U. from cabinet as described in Part III, Section 13.
(b) Unsolder all leads to the terminal strip.
(c) Release two screws holding strip to S.P.U. base.
(d) The strip may now be removed and replaced by a new one.

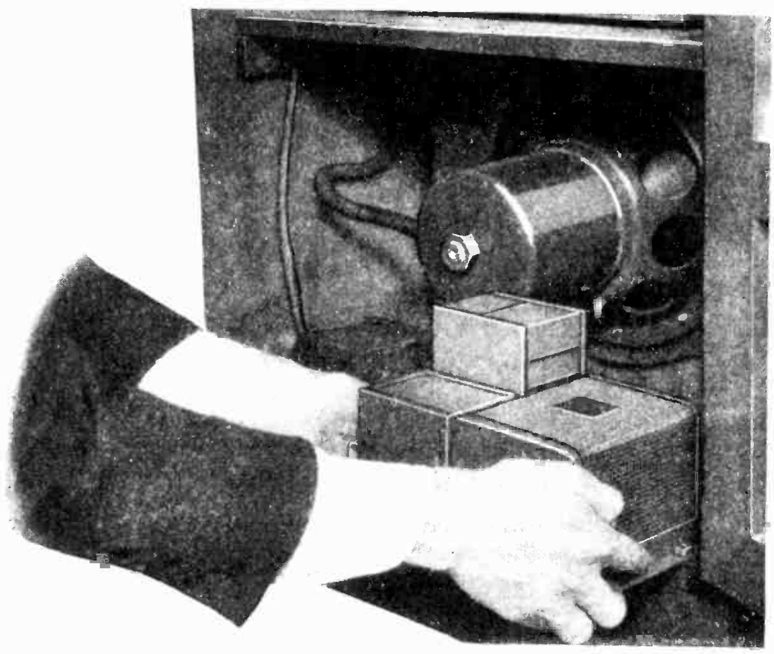

Figure 24—Removing the field supply unit from the cabinet

(e) Fasten new strip in position by means of two machine screws, lock washers and nuts previously removed.
(f) Solder all leads to terminal strip. The color scheme and correct connections are shown in Figure 19.
(g) Return S.P.U. to cabinet in the reverse order, and connect to receiver assembly.

[16] REPLACING MISCELLANEOUS PARTS IN S. P. U.

The center tapped resistors, plate supply resistors, line switch and UX-280 socket in Radiola 62 may require replacement. They are all attached to the base by means of machine screws and nuts, and replacement is very simple. The following general outline will apply to all these units:
(a) Remove S.P.U. from cabinet as described in Part III, Section 13.
(b) Unsolder leads from defective unit.
(c) Remove defective unit from base and replace with new unit.
(d) Solder leads to new unit as indicated in Figure 19.
(e) Return S.P.U. to cabinet in reverse order of that used to remove it.

[17] REPLACING COUPLING UNIT

A choke and condenser together with a step-down transformer are used to couple the output of the Radiotron UX-171A to the cone coil of the reproducer unit. Should replacement become necessary, proceed as follows:

(a) Remove the shield and insulating strip over the field supply terminal strip.

(b) Remove all connections to this strip and then remove the four machine screws used to hold the unit in place.

(c) Remove the field supply unit to a place convenient for work. See Figure 24.

(d) Unsolder all connections to the coupling unit being replaced. Turn up the tabs holding it in place and remove the defective unit from base.

(e) The new unit should now be placed in the position occupied by the old one and fastened in place by bending its tabs. All connections should be soldered in place as shown in Figure 21.

(f) The field supply unit is then returned to the cabinet in the reverse manner of that used to remove it and the Radiola returned to normal operation.

[18] REPLACING CONDENSER BANK OF FIELD SUPPLY UNIT

Across the output of the disc rectifier there is a 4 mfd. condenser. Also across the input A.C. supply are two .1 mfd. condensers connected in series with the mid-point grounded. These condensers are contained in one unit and are replaced as follows:

(a) Remove field supply unit from cabinet as described in Part III, Section 17.

(b) Unsolder the connections to the condenser bank being replaced. Turn up the tabs that hold it in place and remove from field supply unit base.

(c) Place the new unit in the place occupied by the old one and turn tabs to hold unit in place.

(d) Resolder all connections in their correct positions. These are shown in Figure 21.

(e) The unit is then returned to the cabinet in the reverse order of that used to remove it.

[19] REPLACING RECTIFIER STACK

The disc rectifier used in Radiola 62 is made in two units, either of which may be replaced independently of the other. The replacement procedure follows:

(a) Remove the field supply unit from the cabinet as described in Part III, Section 17.

(b) Remove the protective screen over the rectifier unit by bending up the tabs that hold it in place.

(c) Unsolder all connections to the defective unit.

(d) Release the unit by removing the bolts and nuts that hold it in place. Place the new unit in the position occupied by the old one and fasten in place.

(e) Resolder all connections removed. These are shown in Figure 21.

(f) Return shield to its correct position and fasten in place by turning down its tabs.

(g) Return field supply unit to cabinet in reverse manner of that used to remove it and return Radiola to normal operation.

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, P. II, S. 4
	Defective power cable	Replace power cable, P III, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective I.F. transformer	Replace I.F. transformer, P. III, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Defective Oscillator coil	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective by-pass condenser	Replace by-pass condenser, P. III, S. 5
	Defective socket power unit	Check socket power unit by means of continuity test, and make any repairs or replacements necessary, P. II, S. 22
	Defective Field Supply Unit	Check field supply unit and make any repairs or replacements necessary
	Open cone coil of reproducer unit	Check cone coil and if open replace cone
Weak Signals	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 13
	Trimming condensers out of adjustment	Adjust trimming condensers, P. II, S. 12
	I.F. transformers not correctly aligned	Align I.F. transformers correctly, P. II, S. 14
	Defective power cable	Repair or replace cable, P. III, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective I.F. transformer	Replace I. F. transformer, P. III, S. 10
	Defective A.F. transformer	Replace A. F. transformer, P. III, S. 6
	Dirty prongs of Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
	Defective by-pass condenser	Replace defective by-pass condensers, P. III, S. 5
	Defective main tuning condenser	Replace defective tuning condensers, P. III, S. 4
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. II, S. 17
	Defective socket power unit	Check socket power unit by means of continuity tests and make any repairs or replacements necessary, P. II, S. 22
Poor Quality	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Defective by-pass condenser	Replace defective by-pass condenser, P. III, S. 5
	Dirty contact arm of volume control	Clean contact arm on volume control, P. II, S. 4
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
	Volume control advanced too far	Reduce setting of volume control, P. I, S. 7
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 13
	Defect in audio system	Check and repair any defect, P. II, S. 10
	Open grid circuit in any stage	Check circuit and repair defect
	Microphonic Radiotrons	Interchange Radiotrons
Excessive Hum	Defective center tapped resistance unit	Replace defective resistance unit, P. III, S. 16
	Socket plug position	Reverse socket plug
	Line voltage low	Set line switch for low line voltage, P. I, S. 5
	Antenna and ground leads reversed	Connect antenna and ground leads correctly
Radiotrons Fail to Light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer, P. III, S. 14
	No. A.C. line voltage	Turn A.C. line voltage "On"

RCA
Radiola 64
SERVICE NOTES

RCA Radiola 64

Regular Edition—25M

Radio Corporation of America
SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT
233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

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A WORD OR TWO ABOUT SERVICE

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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—MAKING REPLACEMENTS

ILLUSTRATIONS

RCA RADIOLA 64

Figure 2—Rear interior cabinet view showing reproducer in top section; receiver chassis in center section and socket power unit in lower section

RCA RADIOLA 64

(105-125 Volts, 50-60 Cycle A. C.)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 64 is a walnut console cabinet model of the standard Radiola 60 Super-Heterodyne receiver combined with features never before found in any radio receiver. A new dynamic reproducer driven by Radiotron UX-250 gives a quality of reproduction closely resembling the original rendition at the broadcasting studio. Features such as the automatic volume control tube for maintaining the level of sound at any predetermined value over a large range of signal variations, such as fading or when tuning from station to station, a visual tuning indicator for accurately tuning by sight rather than by sound, and a sensitivity con-

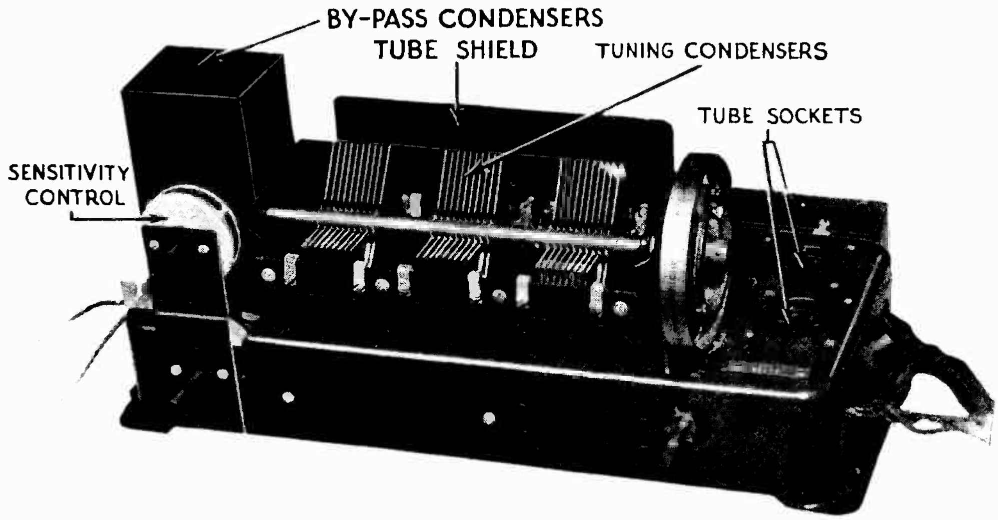


Figure 3—Top view of receiver chassis showing principal parts

trol for regulating the input to the receiver and thus controlling the noise level are features that distinguish Radiola 64 from all other radio receivers. Excellent sensitivity and unparalleled selectivity and tone quality are inherent characteristics of RCA Radiola 64. Figure 2 is a rear cabinet view showing the main parts. Figures 3 and 4 show the top and sub-chassis views of the receiver, and Figures 5 and 6 the socket power unit.

Radiola 64 is made in models both for 105-125 volts, 50-60 cycle A.C. operation and 105-125 volts, 25-40 cycle A.C. operation. The difference in these models is the power transformer. Should it be desirable to change a 50-60 cycle Radiola 64 for operation on 25-40 cycles or vice versa, a change of the power transformer is all that is necessary. These transformers may be obtained through the regular RCA channels as a replacement part.

CIRCUIT CHARACTERISTICS

The following circuit characteristics are incorporated in the design of Radiola 64.

(a) It is an eight-tube super-heterodyne circuit using seven Radiotrons UY-227 and one Radiotron UX-250. In addition one Radiotron UY-227 is used as a volume control tube and two Radiotrons UX-281 are used in a full wave rectifying circuit to supply all grid, plate and cathode voltages and field current for the reproducer unit.

(b) The circuit consists of one untuned coupling stage; one tuned R.F. stage; a tuned heterodyne detector circuit; two intermediate R.F. stages; an oscillator; a second detector and a power amplifier.

(c) A grid bias second detector is used, making possible the use of a high plate voltage with consequent high output and giving a quality of reproduction only obtainable

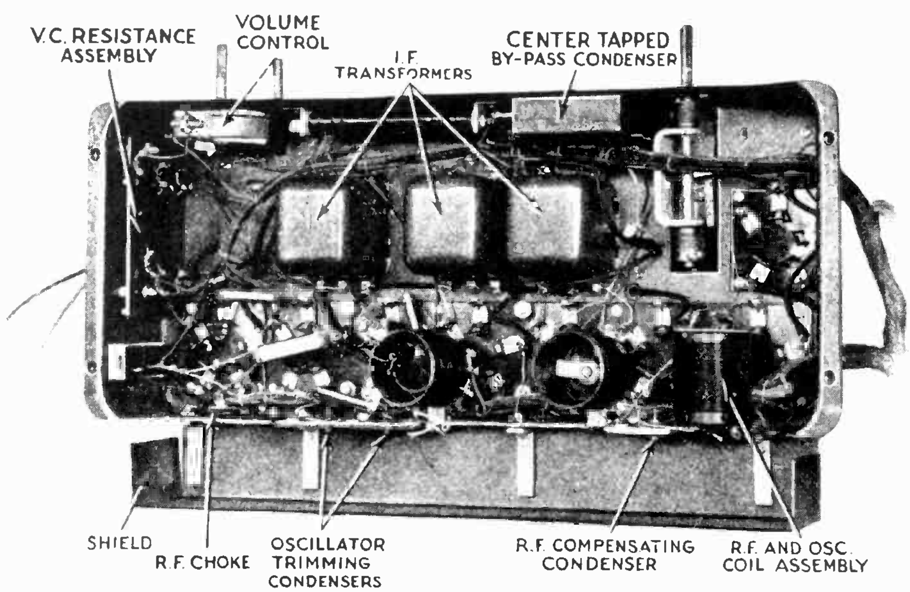


Figure 4—Sub-chassis view of receiver showing principal parts

with this type of detector. The output of this tube is used to drive the Radiotron UX-250 without an intermediate audio stage. This combination of a high output grid bias detector and absence of the usual intermediate audio stage results in a quality of reproduction not obtainable in other circuit arrangements.

(d) A sensitivity control in the antenna input circuit regulates the amount of input voltage to the grid of the coupling tube. A volume control is also provided for controlling the overall amplification of the receiver by regulating the bias on the volume control tube. The sensitivity control is installed for the purpose of regulating the input so that any existing background noise may be reduced to a level where it is not objectionable. See "Sensitivity and Volume Control," page 8, for operating method.

(e) A special tube is provided as an automatic volume control. This tube maintains any pre-determined level of volume over a large range of variations of strength in signal pick-up.

(f) A milliammeter placed in the plate circuit of the R.F. and I.F. amplifiers is used as a tuning meter to provide for visual adjustment of the station selector. It has a reversed scale so that normal plate current will give a zero reading. An incoming signal will cause a change of bias on these tubes thereby reducing the plate current and causing a deflection in the meter.

(g) Use of Radiotron UX-250 as a power amplifier provides a reserve of power rarely needed, but contributing to the quality of reproduction at any volume.

RADIOTRON SEQUENCE

Figure 7 illustrates the sequence of the Radiotrons in the receiver, omitting Radiotron UX-250 and two Radiotrons UX-281 in the S.P.U. From right to left when facing the front of the Radiola 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 across the sensitivity control, and functions as a coupling tube to the antenna system.

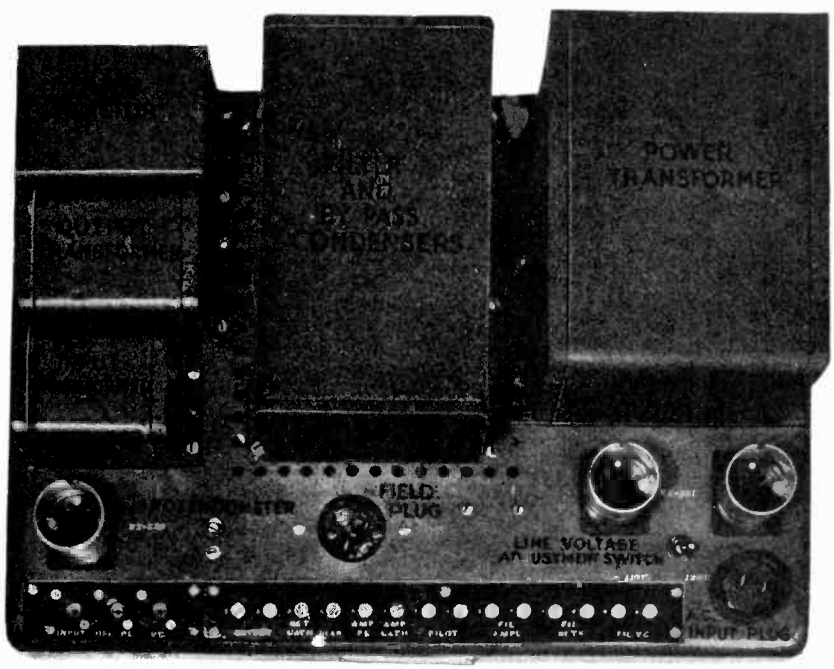


Figure 5—Top view of socket power unit showing principal parts

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

Radiotron No. 3 is the tuned heterodyne detector. It is tuned by the center of the gang condensers.

Radiotrons No. 4 and No. 5 are the first and second intermediate stages. These stages are tuned to a frequency of 180 K.C. giving ample distance between the two peaks of the oscillator to eliminate any possibility of stations coming in at more than one point on the tuning dial.

Radiotron No. 6 is the oscillator. It is tuned by the third of the gang condensers. Two trimming condensers are provided at the rear of the receiver assembly for adjusting the oscillator circuit so that a constant frequency difference from the tuned R.F. stage will be maintained by the oscillator throughout its tuning range.

Radiotron No. 8 is the automatic volume control tube. It functions to maintain a constant volume level regardless of variations of incoming signal intensity.

OPERATION AND PERFORMANCE

Several features in Radiola 64 are different from other radio receivers and an explanation will give the reader an understanding of their action.

SENSITIVITY AND VOLUME CONTROL

The sensitivity control is provided to adjust the sensitivity of Radiola 64 according to varying local receiving conditions at times when atmospherics, power line disturbances, and the like, produce an undesirable background of noise.

To adjust the sensitivity control turn volume control to position for maximum volume and set station selector to a position where no signals are heard and where background noise is loudest. Starting at maximum, slowly turn the sensitivity control counter-clockwise until the noise is satisfactorily subdued. This adjustment will probably not have to be changed during several hours of receiver operation.

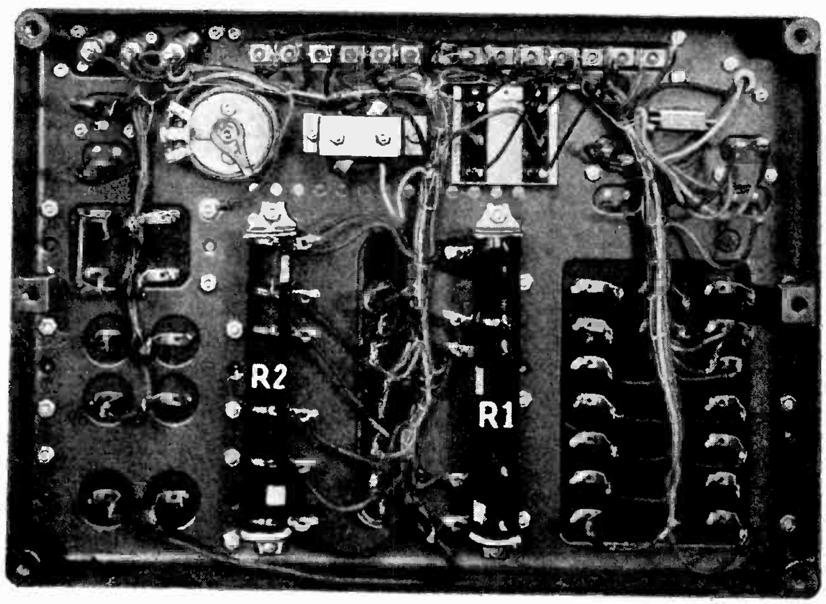


Figure 6—Sub-chassis view of socket power unit showing principal parts

Distortion may occur when receiving from powerful local stations with the volume control set for reproduction at room volume. Reducing the setting of the sensitivity control will increase the sensitivity of the R.F. amplifiers and clear up this distortion.

The volume control should be set for the desired volume on a station of moderate or high power. The automatic volume control tube will tend to maintain this volume on different signals of wide variations in intensity.

TUNING METER

Until the current is turned "On" the tuning meter (Figure 8) should register at its maximum position. On turning on the power and without any station tuned in it should read zero after the Radiotrons UY-227 have heated up. Tuning to a station should give a reading. Correct tuning is accomplished by adjusting the station selector for a maximum reading on the tuning meter.

PERFORMANCE

Radiola 64 being a very sensitive receiver and reproducing practically all audible frequencies at their true value must be properly operated if best results are to be obtained. The preceding notes on "Sensitivity and Volume Control" and "Tuning Meter" should be observed to obtain best results. Improper tuning will affect quality of reproduction, and failure to use the sensitivity control may result in considerable noise back ground at some locations.

PART I—INSTALLATION

[1] ANTENNA (Outdoor Type)

Due to the high sensitvity of Radiola 64 the antenna length need only be approximately 25 feet. 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. Bring the lead-in wire from the outside through a porcelain tube insulator to the inside of the house for connection to the receiver.

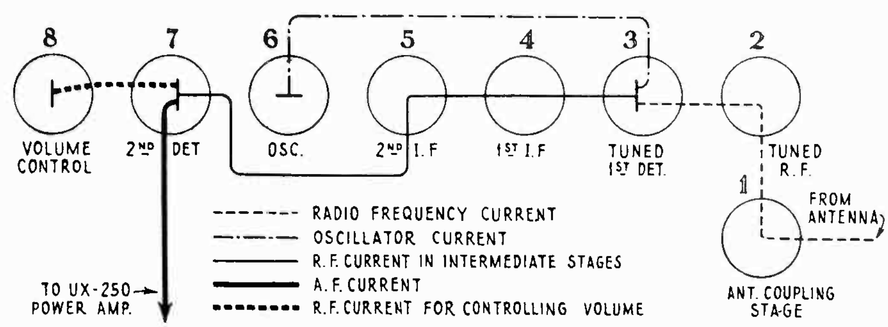


Figure 7—Radiotron sequence

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.

[2] 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 25 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. However, due to its sensitivity Radiola 64 will generally give entirely satisfactory reception with an indoor antenna.

[3] GROUND

A good ground is quite as important as a good antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

[4] RADIOTRONS

Place the eight Radiotrons UY-227 in the receiver assembly. A guide shield is provided to facilitate the insertion of these tubes. Place the tube in the opening of the shield and then turn until the prongs slip in place. The Radiotrons UX-250 and UX-281 should be placed in the Socket Power Unit. Their correct places are shown by lettering on the base of the S.P.U.

In placing Radiola 64 into operation, if no signals are heard when tuning to a station known to be operating, examine the Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more of the same type known to be in operating condition will isolate the damaged one.

The Radiotron used as the volume control (Socket No. 8) is the most critical and should be selected first. It should be chosen on the basis of complete cut-off of loudest local stations at a minimum setting of the volume control and the greatest volume at a maximum setting when tuned to a weak or distant station.

Socket No. 2, the tuned R.F. stage, is also quite critical for the selection of Radiotrons. Select for this socket the tube that gives the loudest signal, without going into oscillation throughout the tuning range, with the volume control at maximum. If a non-oscillating tube is not found, a slight readjustment of the compensating condenser, as described in Part II, Section 17, may be necessary.

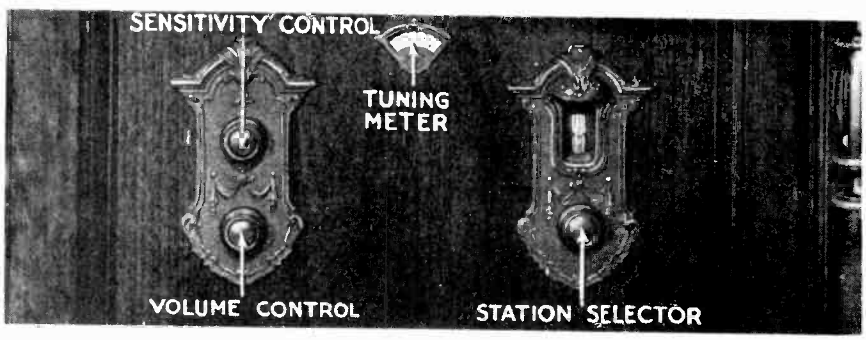


Figure 8—Tuning controls and tuning meter

Other stages somewhat critical are the oscillator and second detector, sockets Nos. 6 and 7 respectively. The remaining tubes should be interchanged until a tube is found for the oscillator that gives the loudest signal on a given station. The second detector should be selected for its ability to handle large volume. Select the tube for this socket that will cause the greatest volume to be delivered from the loudspeaker.

While selecting these tubes the volume control should be at maximum and any adjustments necessary should be made at the sensitivity control. In some cases it may be advisable to remove the volume control tube while selecting those for other sockets.

[5] LINE SWITCH

A two-way switch is provided in the S.P.U. for adjustment to line voltages. This switch is set at the 120-volt position in new sets. Unless it is definitely known that the line is always below 115 volts the switch should be left in its original position. It is a good plan to leave this switch at the 120-volt position on all lines unless unsatisfactory operation is experienced. If the switch is set at the 110-volt position on supply lines exceeding 115 volts the Radiotrons in the receiver will be damaged.

[6] KNOBS

Radiola 64 uses an improved type of push knob on the station selector and volume controls. This knob is removed by simply pulling it off the shaft, and replaced by pushing it on. Very little trouble should be experienced, as no setscrews or other parts that might give trouble are used.

When placing this knob on its shaft care must be exercised not to push it tight against the escutcheon, as then it will bind. Sometimes in new sets the knob will have become pushed against the escutcheon. The remedy is merely to pull the knob until it clears the escutcheon.

[7] PICK-UP FROM LONG WAVE HIGH POWER CODE STATIONS

Should Radiola 64 be installed very close to long wave, powerful code stations, it is possible that a certain amount of pick-up and interference from them will be experienced. Trouble of this kind may be eliminated in the following manner:

(a) Procure the following equipment.
Two Radiola 16 antenna coils (RCA Stock No. 5658.)
One .0002 Mfd. fixed condenser.

(b) Connect as shown in Figure 9.

(c) This apparatus may be placed inside the cabinet or made up in a separate unit and placed in any convenient location. It acts as a filter, allowing frequencies of the broadcast band only to reach the receiver.

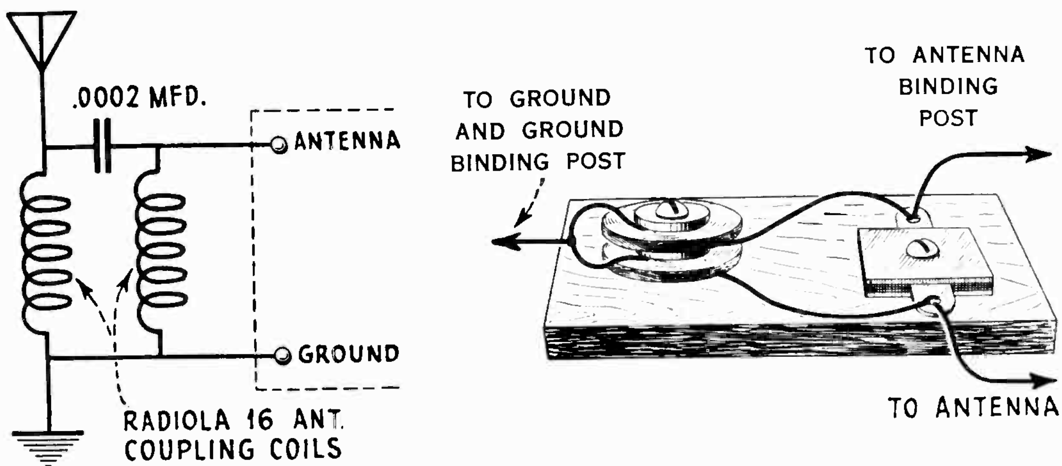


Figure 9—Long wave interference filter

[8] ADJUSTMENT OF HUM SUPPRESSOR

An adjusting screw on the S.P.U. is provided for adjustment to reduce hum. Should it be desirable to make such an adjustment proceed as follows:

(a) Place Radiola into normal operation, allowing sufficient time for all tubes to function properly. Turn the station selector to a position where no stations are received.

(b) With an insulated screw driver, adjust screw (See Figure 10), until the position is found where the least A.C. hum is heard in the reproducer unit.

If this adjustment does not reduce the hum satisfactorily some defect exists in the set. For trouble of this kind see Part II, Section 7.

PART II—SERVICE DATA

[1] ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna; or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

A grating noise may also be caused by dirty contacts in the sensitivity or volume control. Turning each of these controls to their extreme positions several times will generally remedy such trouble. Noisy operation may be caused by rosin from the soldering terminals lodging on the resistance in these controls. The resistance should be scraped clean.

[2] RADIOTRON SOCKETS

The sockets used in Radiola 64 are a seven-gang UY socket assembly, a single UY socket, and three single UX sockets. The three UX sockets are used in the socket power unit and are of a different design than those used in the receiver assembly.

The bakelite Radiotron guide shields used in the receiver assembly will prevent any possible shock from contact with high voltages in the socket when inserting the Radiotrons. The prongs of the tubes fit into this shield opening very snugly and require only a twist until the prongs find the correct holes into which they fit. This is especially helpful when inserting the five-prong tubes into their sockets.

[3] RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuits sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed. Due to the relatively large filament current of Radiotron UY-227 it is imperative that the socket contacts make firm contact with the tube prongs.

If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

[4] LOOSE VOLUME OR SENSITIVITY CONTROL

A loose volume or sensitivity control arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame.

[5] ADJUSTMENT FOR SLACK DRUM CONTROL

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash.

After considerable wear or extreme changes of temperature the cable may become slack. To take up this slack open rear doors of cabinet and turn the cable adjusting screw with clamp until the cable is taut. This screw may become seated after several adjustments are made, thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. Remove the cable adjusting screw and clamp. The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. It will be noted that the tapered pin in the new position cannot be inserted as far as originally. However, it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and an additional half turn slipped on the drum which will provide for taking up all slack. Sufficient grooves are provided on the drum for this purpose.

[6] BROKEN CONDENSER DRIVE CABLE

A broken condenser drive cable can be replaced in the manner described in Part III, Section 2. However, if a new cable is not immediately available a temporary repair can be made in the following manner, provided the break in the cable is not in that section that passes over the small grooved drums.

Splice and solder the two ends together. Splicing consists of interweaving the strands, as with rope and not just twisting the cable ends together as in an electrical wiring splice. Splicing gives greater strength and forms a smaller body on the cable. When soldering use plenty of flux and a small amount of solder. Heat sufficiently so that the solder adheres to all the strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows excess solder to drip away. This is but a temporary repair to be used only until a new cable can be procured.

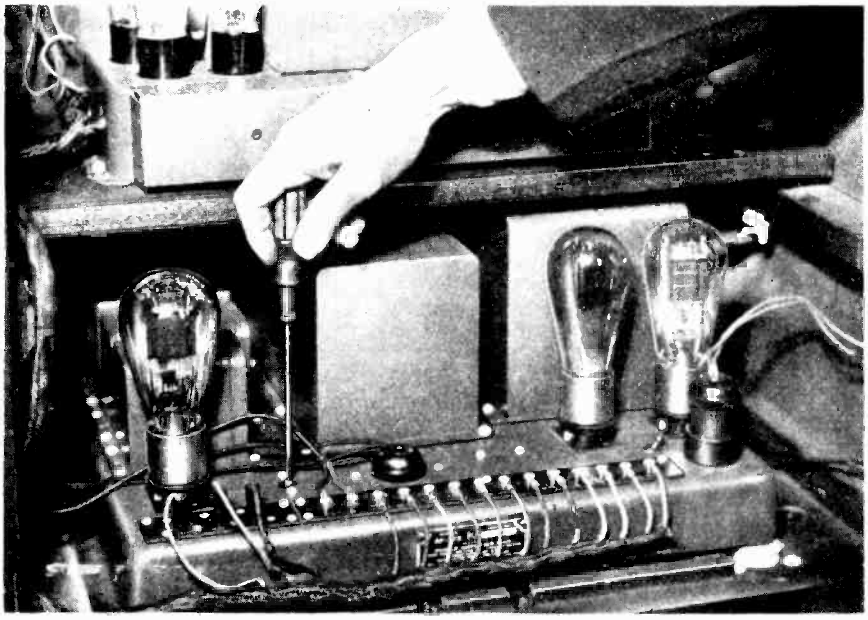


Figure 10—Adjusting the hum suppressor

[7] HUM

If a pronounced hum develops during operation check the following:

(a) S.P.U. potentiometer not properly adjusted. Adjust as described in Part I, Section 8.

(b) Low emission Radiotrons UX-281. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(c) Defective center tapped resistance. A short or open of any of these resistances will cause a loud hum and imperfect operation of the Radiola.

(d) Any open of the several grounding connections in the Radiola or voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part II, Section 26.

(e) Power line interference. This can be checked by removing the antenna and ground and the first R.F. Radiotron from the Radiola. If the hum disappears it is an indication that the trouble is external to the Radiola. In this case locate the trouble and have it corrected according to local conditions.

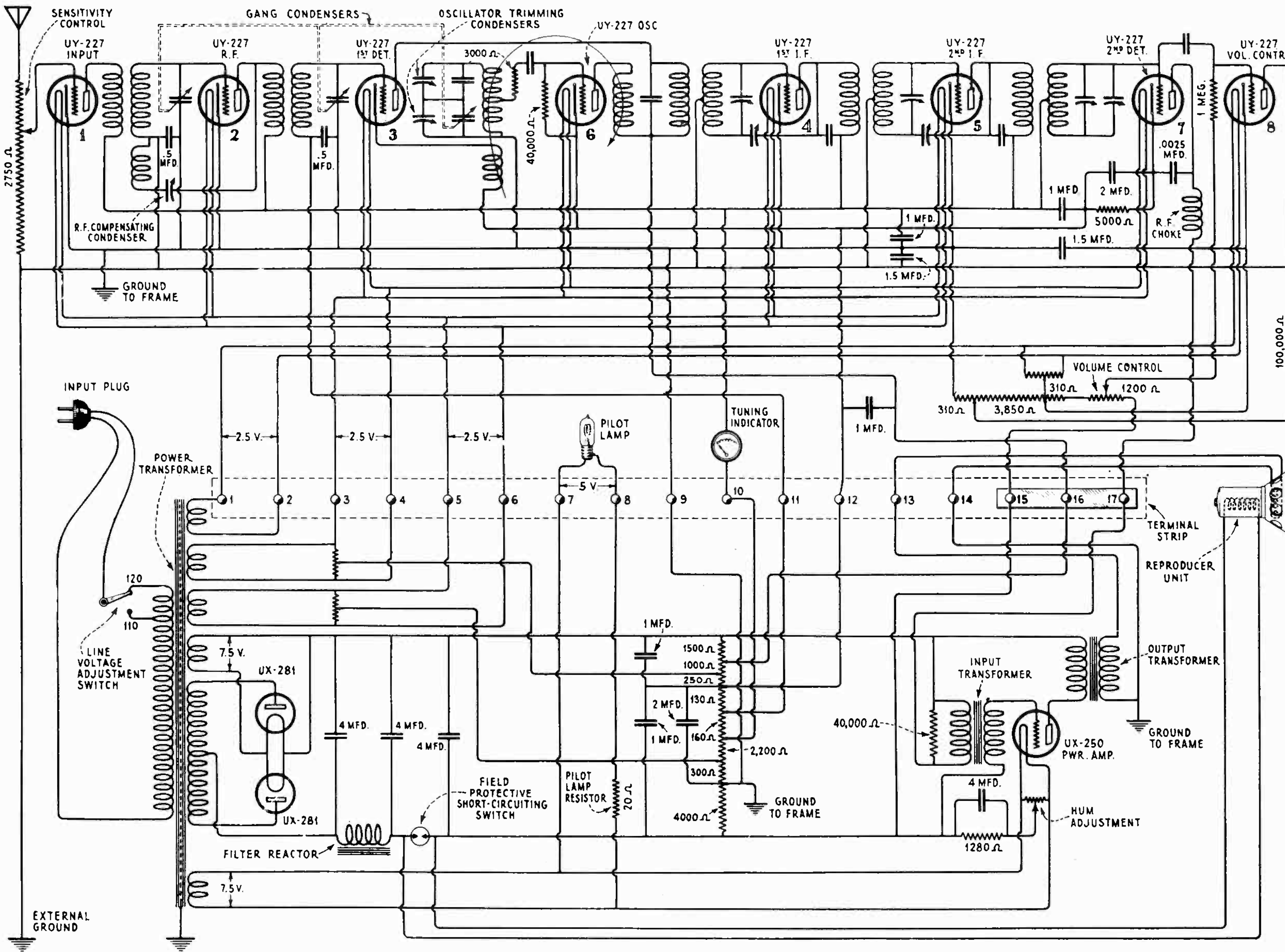


Figure 11—Schematic circuit diagram of Radiola 64

(f) Shorted 4 mfd. condenser across UX-250 bias resistance. This causes distorted reproduction and loud hum, as well as damage to Radiotron UX-250 if allowed to operate for any length of time.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part III, Section 5, and heating it in a slow oven. The terminal end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

[8] RADIOTRONS FAIL TO LIGHT WHEN OPERATING SWITCH IS "ON"

Should all Radiotrons fail to light when the operating switch is "ON," look for:

(a) House current switched off, or loose connection at convenience outlet.
(b) A.C. input plug to S.P.U. not in position.
(c) Operating switch not functioning properly.
(d) Line switch not functioning properly.
(e) Damaged power transformer in S.P.U.
(f) Burned-out filaments in Radiotrons.

The remedy for (a) (b) (c) and (d) is apparent. Any external cause (such as D.C. supply etc.) of (e) and (f) should be located and eliminated before making any replacements.

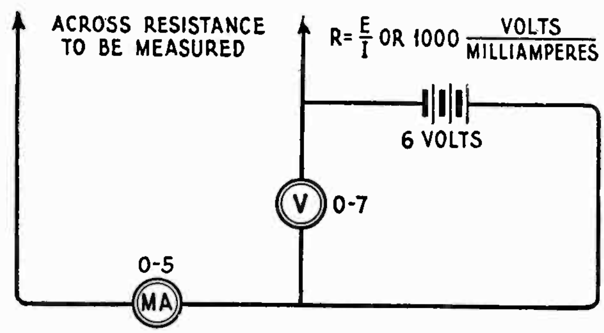


Figure 12—Schematic diagram of resistance measurement method

[9] PLATES OF RADIOTRONS EXCESSIVELY HOT

Should the plates of Radiotrons UX-281 become excessively hot, check the following:

(a) Shorted 4 mfd. filter condenser on high voltage side of field coil.
(b) Internal short in power transformer. Test for grounds to shield or to core, or short from one winding to another.

Should one Radiotron UX-281 become slightly overheated, but not show color and the other remain apparently normal, replace the one that appears normal. This tube is defective causing the other one to heat from overload.

[10] NO SIGNAL—RADIOTRONS O.K.

If the Radiotrons appear to be functioning properly and no signals are heard from the loudspeaker with the volume control at maximum, check the following:

(a) Inoperative Radiotrons. Defects other than filament failure are not apparent until the tubes are tested. Inoperative Radiotrons UX-281 may cause low voltages at the terminal strip. (See Part II, Section 25, for voltage readings.)
(b) Loose connections at S.P.U. terminal strip.
(c) Open movable coil on cone.
(d) Defective S.P.U. Check by means of continuity test.
(e) Open field coil in reproducer unit.
(f) Defective Radiotron in socket No. 8. Try removing. If defective, signals will come in at maximum intensity. A tube that does not function satisfactorily in this socket may prove O.K. in other positions.

[11] DISTORTION IN REPRODUCER UNIT

Distortion in the reproducer unit may be due to any of the following causes:

(a) Damaged Radiotron UX-250. Try one known to be in good operating condition.

(b) Cone out of alignment. Remove grille by pulling from left side and relocate cone coil by loosening center adjusting screw and shifting position of cone. The correct position is found as described in Part II, Section 20.

(c) Leads from cone coil broken away from side of cone. Make these fast with a little shellac.

(d) Defective S.P.U. Test by means of continuity test, Part II, Section 25.

(e) Loose grille, escutcheons, name plate or baffle board. Any loose part in the cabinet will cause a rattle. Tighten all loose parts.

[12] ACOUSTIC HOWL

Acoustic howl is caused by vibration of the elements in the receiver Radiotrons. This is amplified in the reproducer unit. Conditions being favorable the howl may increase in intensity and drown out the broadcast signal.

In Radiola 64 the receiver assembly shelf and the Socket Power Unit are both mounted on rubber bumpers to prevent any microphonic action. Should trouble of this kind be experienced, examine the rubber bumpers to make sure the receiver assembly shelf and the socket power unit is fully resting on rubber. If this is O.K. the Radiotrons in the receiver should be interchanged until the howl is eliminated.

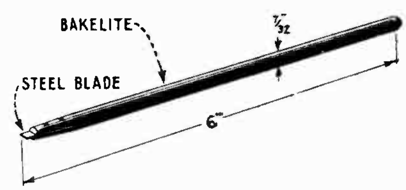


Figure 13—Dimensions of the insulated screwdriver

[13] CHECKING RESISTANCE UNITS

When checking Radiola 64 for possible trouble it is always a good plan to check the various resistance values of different resistance units. These values are shown in the schematic circuit diagram, Figure 11. A resistance bridge should be used for checking these values, or if this is not available, the following method may be used.

A milliammeter with a scale of 0-5 and a voltmeter of 0-7 is used with an applied voltage of approximately 6 volts. Figure 12 shows the hookup. The readings obtained are sufficiently accurate for checking purposes.

The resistance is calculated by Ohms law.

$$R = \frac{E}{I} \left(\begin{array}{l} \text{Where R equals ohms, E equals volts} \\ \text{and I equals amperes} \end{array} \right) \text{ or } 1{,}000 \, \frac{\text{Volts}}{\text{Milliamperes}}$$

Since the current reading is taken in milliamperes (or $\frac{1}{1000}$ ampere) it is necessary to multiply by 1,000 to get the resistance value in ohms.

This arrangement with a 0-5 milliammeter must be used for measuring the total resistance of the various units and not for the individual sections. In the latter case some of the readings would be beyond the range of the milliammeter. If it is desired to measure the resistance of the sections between taps a 0-100 milliammeter must be used.

[14] LOW VOLUME AND WEAK SIGNALS

Low volume or weak signals may be caused by:

(a) Defective antenna system. A poor antenna and ground or one in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2 and 3, should be followed if trouble of this kind is experienced.

(b) Defective Radiotrons. A defective Radiotron in any stage may cause weak signals. Before checking other causes it is a good plan to check all Radiotrons by interchanging them with ones of a similar type known to be in good operating condition. A defective Radiotron in the eighth or volume control socket may prevent full volume. Test for this by removing the volume control tube from its socket while listening to local stations, with the volume and sensitivity controls at maximum. An increase in volume with the tube removed indicates another tube should be tried in this socket. A Radiotron that does not function correctly in the volume control socket may prove satisfactory in some other socket.

(c) R.F. compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 17.

(d) Oscillator trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the Radiola may be sensitive at certain portions of the tuning scale and very insensitive at other sections. Also two tuning points may be found for the same station. Should these condensers be badly out of adjustment, only very loud local stations will be heard. The correct method for adjustment of these condensers is given in Part II, Section 18.

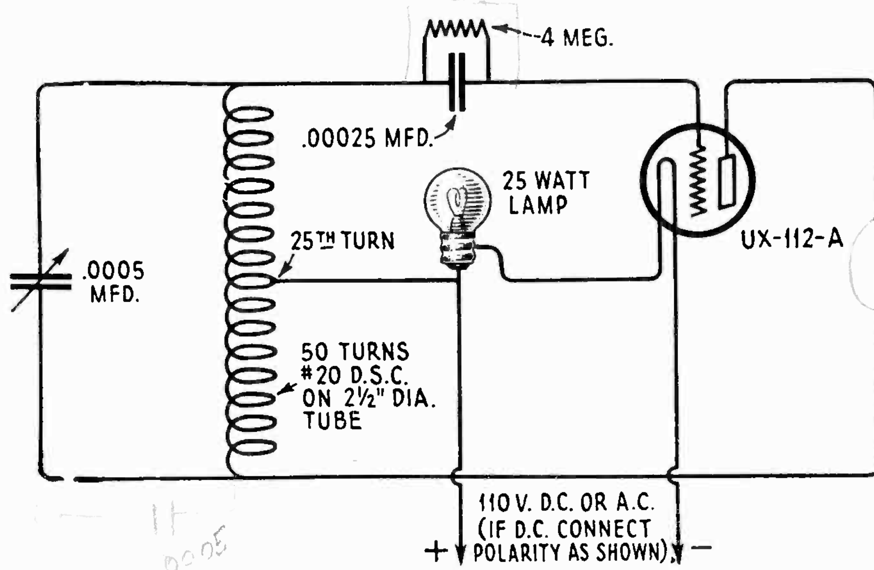


Figure 14—Socket powered modulated R.F. oscillator

(e) Intermediate transformers not correctly tuned or matched. Should the tuning condensers connected across the secondaries of the intermediate transformers be out of adjustment, weak signals and poor tuning or, in some cases no signals will result. Refer to Part II, Section 19, for the correct method of adjusting the I.F. transformers.

(f) Defective A.F. transformer. Check by means of the continuity test and make any replacement that is necessary.

(g) Low voltage from S.P.U. Check S.P.U. voltages at terminal strip with readings given in Part II, Section 25. Low voltages may be caused by a low emission rectifying tube or defective resistances in the S.P.U. or receiver. Check by means of continuity test.

(h) Open or short of various connections in receiver. Check by means of continuity tests and make any repair or replacement that is necessary.

[15] AUDIO HOWL

Audio howl may be caused by:

(a) Incorrect adjustment of R.F. compensating condenser. A compensating condenser adjusted to the verge of oscillation may cause a howl on nearby stations. Adjust as suggested in Part II, Section 17. Faint beat notes heard when listening to loud stations on frequencies of 900, 720 and 540 K.C. are not due to incorrect adjustment, and may be avoided by slight detuning until the beat disappears.

(b) Open A.F. condenser connections. An open of the A.F. by-pass condenser may cause a howl.

(c) Open by-pass condenser connections. An open of the connections to the by-pass condensers may cause a howl.

(d) Defective volume control resistance. Should there be an open or short in the volume control or in its adjacent resistances an audio howl may develop.

(e) Vibrating elements in receiver Radiotrons. A gradually developed howl may be due to the loudspeaker causing the receiver Radiotron elements to vibrate. Check as described in Part II, Section 12.

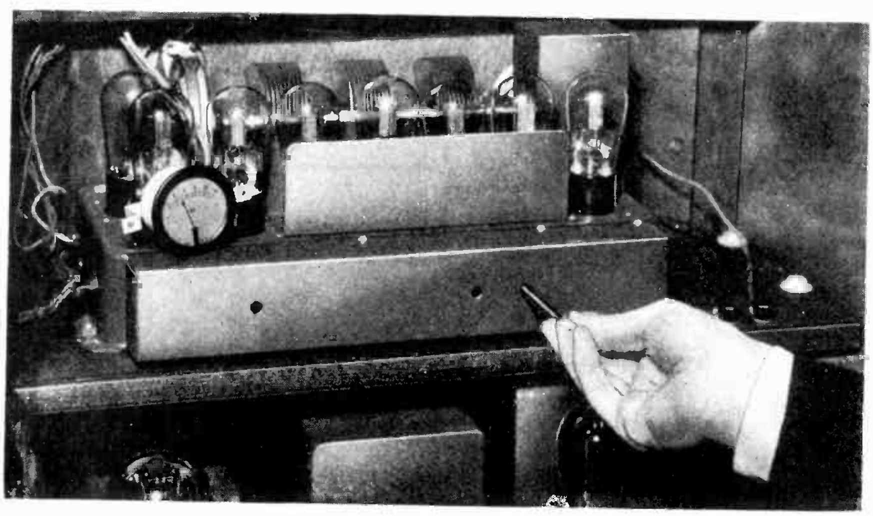


Figure 15—*Adjusting the trimming condensers*

(f) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause a howl.

(g) Defective resistance in S.P.U. or the receiver assembly. An open resistance unit may cause howl. Under such conditions it is advisable to turn the set "off" until the trouble is found, otherwise excessive voltage rise may cause further damage.

(h) Neutralizing condensers in intermediate transformers out of adjustment. These condensers being out of adjustment might cause an I.F. stage to oscillate which will result in a howl when a station is tuned in, especially at loud volume. Adjust the neutralizing condensers as described in Part II, Section 19.

(i) Open of any of the several ground leads in the Radiola. This may cause some of the circuits to go into oscillation and result in a howl when a station is tuned "in" Generally a loud hum will also be present. The several grounding leads in the Receiver Assembly and in the Socket Power Unit should be checked and any open or poorly soldered joint should be repaired.

[16] DISTORTED OR NOISY REPRODUCTION

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 second detector, audio stage and the rectifier tubes. A loud intermittent crackling noise, heard when the antenna and ground are disconnected, may be due to a defective Radiotron UX-250.

(b) High or low plate and grid voltages from the Socket Power Unit or a defective resistor in the Receiver Assembly. In the Socket Power Unit distortion may be caused by a defective Radiotron UX-281 or resistance unit.

(c) Defective A.F. transformer. Check by means of continuity test and replace if necessary.

(d) Trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the beat signal may not be exactly the frequency to which the intermediates are tuned. This will cause weak signals and distortion of those received. This condition may or may not be present throughout the tuning range of the receiver. Adjust as described in Part II, Section 18.

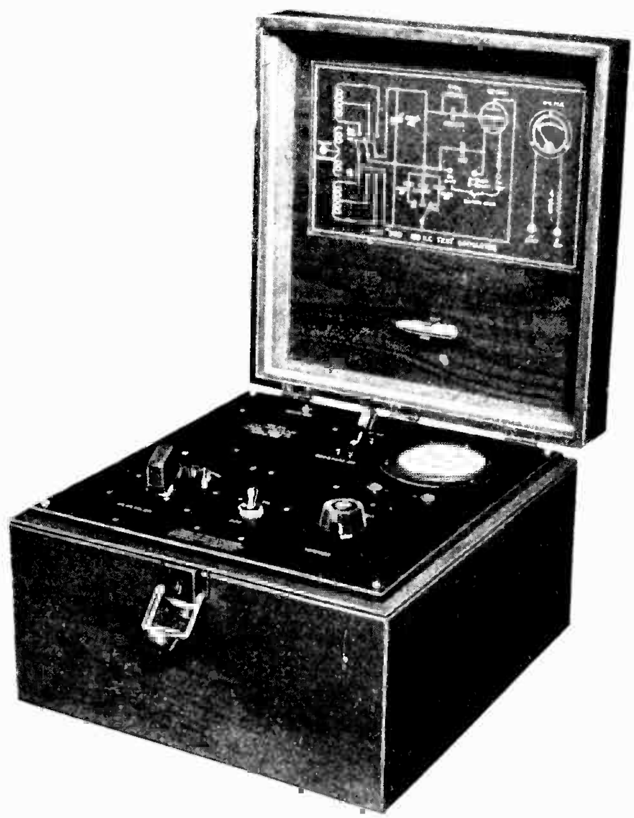


Figure 16—180 *K.C. Test Oscillator*

(e) Receiver oscillating. Should some circuit other than the oscillator be oscillating, distortion will be experienced when tuning in a station. This will be accompanied by a whistle or squeal when the carrier wave of the station is tuned in. To remedy trouble of this kind consult Part II, Section 15.

(f) Intermediate transformers out of line or not properly matched. This will have the effect of giving distorted reproduction and reduce the sensitivity of the receiver to a marked degree. Line up the entire I.F. transformer assembly as described in Part II, Section 19.

[17] ADJUSTMENT OF R. F. COMPENSATING CONDENSER

A cause of insensitivity may be a poor tube in the tuned R.F. stage or incorrect adjustment of the R.F. compensating condenser. Try changing tubes first to improve the sensitivity and if not successful adjust the compensating condenser. A step-by-step procedure for making proper adjustment follows:

(a) Procure a non-metallic screwdriver (See Figure 13).
(b) Connect a resistance of about 1.5 ohms across the cone coil leads. This will prevent damage to the cone spider should the Radiola go into oscillation.
(c) Place Radiola in operation and tune in a station, preferably at about the center of the dial scale.
(d) Locate the position of the compensating condenser. (See Figure 15).
(e) With the volume control at its maximum position and the sensitivity control set near minimum, adjust the screw of the condenser until the Radiola goes into oscillation. This will cause a whistle whenever a signal is tuned in. Then turn the screw in the opposite direction until the set just goes out of oscillation and no howl is experienced when receiving stations at any part of the scale. The condenser is now in correct adjustment.
(f) After the adjustment of the R.F. compensating condenser has been made the tube in the second socket should not be interchanged.

[18] ADJUSTMENT OF OSCILLATOR TRIMMING CONDENSERS

Two trimming condensers are provided for adjusting the oscillator circuit so that the beat note will always be 180 K.C. throughout the tuning range of the receiver.

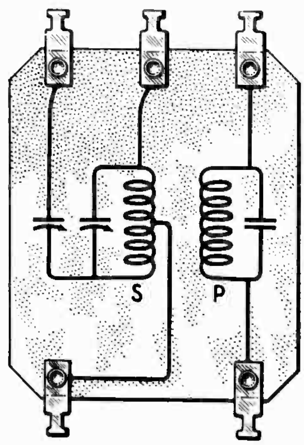


Figure 17—Internal connections of I.F. transformers

The most noticeable symptom of the oscillator trimming condensers being out of adjustment is two tuning points for the same station and insensitivity of the Radiola in some sections or throughout the tuning range. To check the adjustment of the trimming condensers as a possible cause of any noticeable insensitivity in the receiver proceed in the following manner:

(a) Procure the following equipment:

A modulated oscillator giving signals at 1,400 and 600 Kilocycles. Figure 14 shows the constants and circuit diagram of an oscillator satisfactory for this purpose which may be operated entirely from the house lighting circuit.

A non-metallic screwdriver. Such a screwdriver is shown in Figure 13.

(b) Open the rear doors of the Radiola. Remove the two wood screws that hold the tuning meter in place and release the meter lead clamp so the meter can be dropped below the baffle board and pulled out to read the scale from the rear of the Radiola.
(c) With the Radiola in operation, place the oscillator in operation at 1,400 K.C., about 15 on Radiola dial scale, close to the antenna lead, and tune the Radiola by adjusting the station selector until a deflection caused by the external oscillator is obtained in the tuning meter.
(d) Now adjust the oscillator trimming condenser on the right (Figure 15) with the non-metallic screw-driver until a maximum deflection is obtained in the tuning meter while tuning back and forth through the signal.

(e) Adjust oscillator for 600 K.C., about 80 on Radiola dial scale. Tune in the Radiola with station selector and then adjust the trimming condenser to the left for maximum deflection of the tuning meter while tuning back and forth through the signal.

(f) Now readjust at 1,400 K.C. as indicated in (c) and (d).

With this adjustment the trimming condensers are correctly adjusted for maximum efficiency, that is, so adjusted that the beat signal will be 180 K.C. throughout the tuning range.

(g) Remount tuning meter in its original position.

[19] ADJUSTMENT OF I. F. TRANSFORMERS

The three I.F. transformers used in Radiola 64 are of the air core, tuned primary and tuned secondary type. The primary condenser is of the fixed type, while the secondary is adjustable. Also in each assembly an adjustable condenser is provided for neutralizing the I.F. stage. Figure 17 illustrates the internal connections of all the I.F. transformers.

Should a transformer burn out or its primary fixed condenser change in capacity it will be necessary to replace that particular transformer. The correct procedure for making such a replacement is contained in Part III, Section 4.

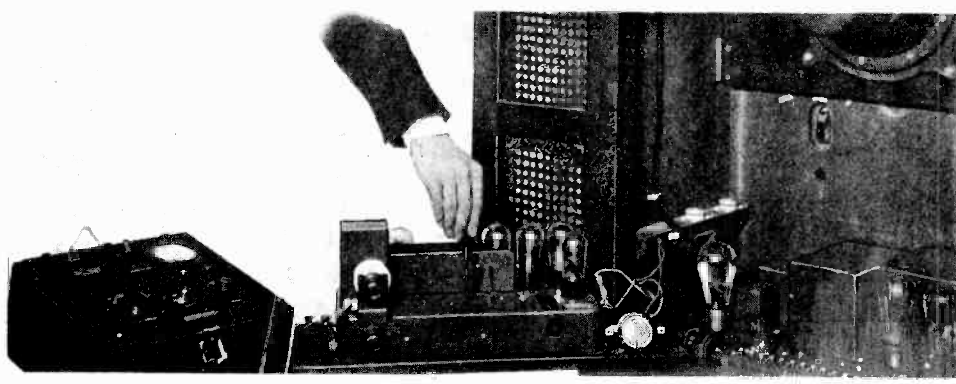


Figure 18—Adjusting the intermediate frequency transformers

A simple method of locating a shorted transformer is to use a resistance bridge or the resistance measuring method described in Part II, Section 13. The approximate transformer primary D.C. resistance is 20 ohms; secondary 100 ohms. Due to the circuit arrangement (See Figure 17) it will only be possible to get a reading of 50 ohms on the secondary as the end connection goes to the neutralizing condenser and the reading must be made at the center tap connection. This test can be made from the underside of the chassis. (See wiring diagram Figure 26).

After replacing a defective I.F. transformer or to make adjustments the following tuning and neutralizing procedure must be followed for correctly lining up the various circuits. This is of utmost importance, as the entire performance of Radiola 64 is based on the correct functioning of its intermediate stages.

The following equipment is needed:

1. A Test Oscillator (Driver). See Figure 16.
2. A coupling lead for coupling the output of the Driver to the grid coil of the first detector.
3. A non-metallic screw-driver.
4. A "dummy" Radiotron UY-227—A normal tube with one heater prong removed.

The RCA Service Division will advise RCA Distributors how to obtain this Driver and the above equipment.

Preliminary steps to be taken before adjusting the tuning, neutralizing and trimming condensers:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1. Do not remove chassis from shelf and do not disconnect cable at S.P.U. terminals.

(b) Remove main tuning condenser assembly as described in Part III, Section 3.

(c) Replace screw holding ground lead on under side of receiver assembly and make certain that ground lead makes good contact with the chassis frame.

(d) Remove the two wood screws that hold down the tuning meter in place and release meter lead clamp. Slip the meter down below the baffle board and out to a position convenient for reading.

(e) Now place the coupling coil from the Driver under the center coil of the R.F. and Oscillator assembly. This is the transformer between the tuned R.F. stage and the first detector. Replace all Radiotrons except the Oscillator (No. 6) and turn operating switch "ON."

(f) Place Driver in operation by turning switch "ON," and set switches and vernier condenser at 180 K.C. The note from the Driver will then be heard in the reproducer unit of the receiver.

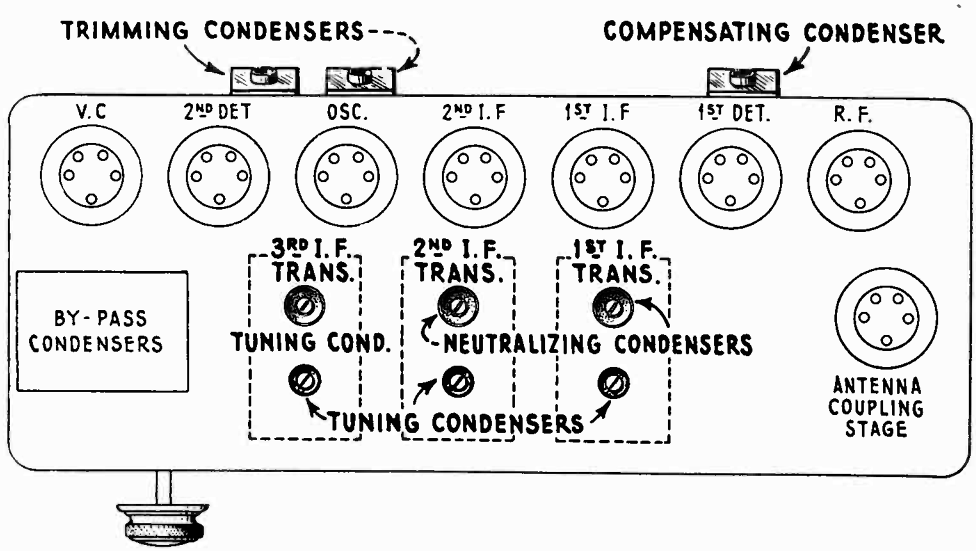


Figure 19—I.F. neutralizing and tuning condensers, oscillator trimming condensers, and R.F. compensating condenser

The I.F. transformer tuning condensers may now be adjusted (Figure 18) as follows:

(a) Adjust the tuning condensers successively on the third, second and first I.F. transformers (Figure 19) for maximum signal in the loudspeaker and maximum reading on the tuning meter. After making one adjustment on the transformers it is a good plan to repeat, as slight changes may have occurred in tuning the other circuits. No signal, or a loud howl indicates neutralizing condensers are at either extreme, and should be readjusted.

A maximum reading by adjusting all three tuning condensers indicates correct tuning of the intermediate stages.

It is now necessary to check the neutralization of the I.F. stages as follows:

(a) Leave all adjustments and apparatus in position on completion of tuning. Connect a pair of phones across the cone coil of the reproducer unit. Turn the power off while making this connection. Place dummy Radiotron in first I.F. socket. Now adjust the neutralizing condenser on the first I.F. transformer (Figure 19) for the position of minimum or no signal. This is easily identified and the adjustment is not critical.

(b) Replace the first I.F. tube and place "dummy" tube in second I.F. stage. Repeat the same adjustment as in (a) only adjusting with the neutralizing condenser on the second I.F. transformer. It will be noted that the two condensers on the third transformer are connected in parallel for tuning. This stage does not require neutralizing.

After the I.F. transformers are properly tuned and neutralized they should perform at their maximum efficiency. At this point it is a good plan to check the adjustment of the oscillator trimming condensers. Because the oscillator coil is close to the S.P.U. in the cabinet installation of the receiver assembly it is best to return the gang condenser to its position and then return the receiver assembly to the cabinet before adjusting the trimming condensers.

Adjust the trimming condensers as described in Part II, Section 18. The 600 K.C. and 1,400 K.C. positions of the test oscillator may be used for the necessary signal.

This check of the trimming condensers completes the adjustments to be made on Radiola 64 with the Driver.

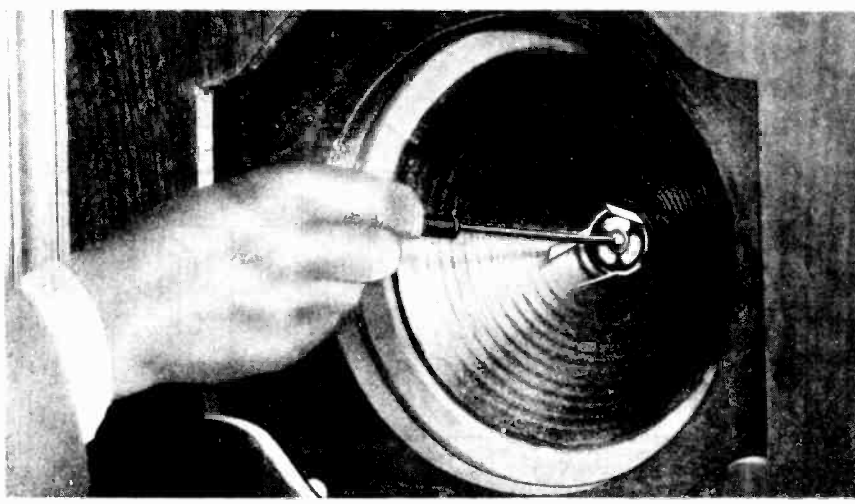


Figure 20—Adjusting the position of the cone

Due to the increased sensitivity of the receiver it may be necessary to reduce the setting of the R.F. compensating condenser to prevent the tuned R.F. stage from oscillating. This can be ascertained by tuning in stations of different wavelengths and noting if the receiver oscillates at any point throughout its tuning range. (See Part II, Section 17).

[20] CENTERING CONE OF REPRODUCER UNIT

To properly center a cone when making a replacement or one out of center proceed as follows:

(a) Remove front grille of Radiola by pulling from the left side, facing the front of the Radiola.

(b) Loosen centering screw of cone.

(c) Place three small cardboard strips, about 1½" x ¼" and the thickness of a visiting card, through the center web of the cone into the space between the pole piece and cone. This will give the cone coil the same clearance on all sides of the pole piece. Figure 20 shows this operation.

(d) Tighten the center screw and the cone will be properly centered. Remove the three pieces of cardboard and replace the grille in the cabinet.

[21] VOLTAGE SUPPLY SYSTEM

Figure 21 illustrates a schematic circuit showing the voltage dividing arrangement used in Radiola 64. As will be noted this Radiola uses the parallel feed system and the plate current drop through resistances for the volume control and power amplifier grid voltages. Other grid and cathode voltages are secured from the main voltage dividing resistance units. This system is very stable and tends to keep voltage variations in one circuit from affecting those in others. It also is a necessary arrangement for use with the automatic volume control tube.

[22] OPERATION OF AUTOMATIC VOLUME CONTROL

As the automatic volume control is a new feature, an explanation of its action may help the service man in his work. The action of this tube also has a bearing on the action of the tuning indicator which is explained in Part II, Section 23. Figure 22 shows a section of the circuit surrounding this tube. Its action to maintain a constant volume level is as follows:

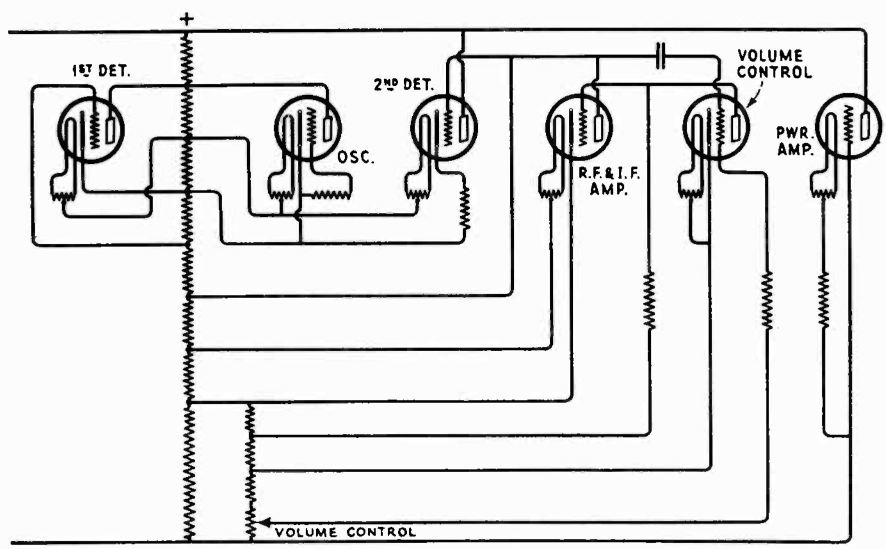


Figure 21—Schematic circuit diagram of voltage supply system

An incoming signal will swing the second detector and volume control grids exactly the same, as both grids are connected together through the condenser A. Assume the grid voltage at such a value as to increase the plate current in each tube. Neglecting the detector tube and just examining the volume control tube we find an increase of plate current will cause a greater voltage drop across resistor B than would be obtained with a normal grid voltage, such as would exist when no signal was tuned in. Examining the connections to each side of resistor B, we find that the voltage drop across it constitutes the grid bias for the two R.F. and two I.F. amplifiers. Thus a loud signal will increase the voltage drop across resistor "B" and increase the bias on the four radio frequency amplifiers. This in turn reduces the signal at the volume control grid. The volume control is merely a variable resistance for regulating the bias on the volume control tube, this in turn regulating the amount of plate current in the tube which consequently regulates the effect of the incoming signal. A setting of the volume control that will give maximum current in the plate circuit will give a maximum bias on the four radio frequency amplifiers, and a consequent minimum amount of volume. A setting giving minimum plate current and minimum bias will, therefore, give the greatest volume.

[23] OPERATION OF TUNING METER

In the foregoing explanation it is evident that practically all incoming signals will cause an increased negative bias on the radio frequency amplifying tubes. This increased bias will naturally cause a decrease in the plate current of these tubes. Placing a milliammeter in the plate circuit of these four tubes and tuning in a signal will cause a decreased reading. In Radiola 64 the milliammeter is a reversed scale instrument with a maximum rating equal to the total plate current of these four tubes. By having a reversed reading scale, turning the current on and not tuning in a station the meter will read maximum current or zero scale reading. Tuning in a station and thus registering a smaller amount of plate current the meter will give an increased reading. The amount of this increased reading will depend on the accuracy of tuning and the setting of the volume control.

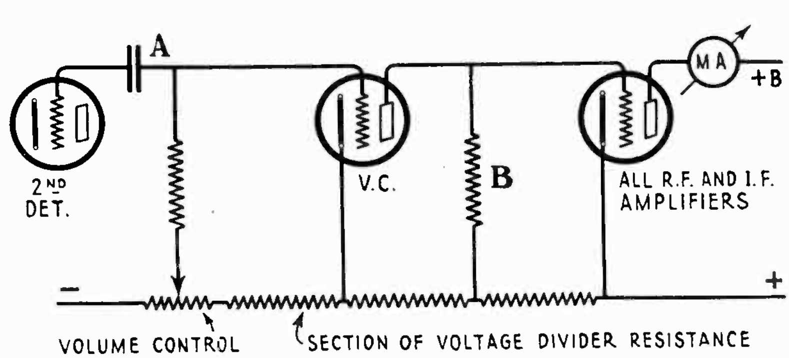


Figure 22—Schematic of automatic volume control system

[24] FILTER CONDENSER TESTS

The filter and by-pass condensers in Radiola 64 can be checked by noting the voltage readings given in Part II, Section 25. A no-voltage reading at any position will indicate a shorted condenser or an open resistance unit. The resistance unit can be checked by the continuity tests given in Part II, Section 26. After determining that the resistance units are not at fault, the individual condensers should be tested by charging them and noting their ability to retain the charge. The three high voltage 4 Mfd. condensers should be charged with any voltage up to 500—the higher the better. The rest of the condensers should not be charged with over 200 volts. After charging the condensers should be discharged by shorting their terminals with a screwdriver. The defective condenser will not hold its charge. If it is completely short-circuited a flash at the condenser terminals will occur when an attempt is made to charge it.

[25] VOLTAGE READINGS

The following table gives the correct voltages at the S.P.U. terminal strip. These readings are correct for a line voltage of 110 with the line switch at the 110-volt position and the volume and sensitivity control at zero. Variations in line voltage, tubes and individual Radiolas will make these readings only approximately correct when applied to different Radiolas. However, they are useful as a check and will indicate any defect that has a bearing on the voltage readings. In connecting the voltmeter to terminals 15, 16 and 17 it will be necessary to wind the lead from the meter around the cable plug before inserting plug in pin jack.

Precaution: Some of these voltages are sufficiently high to cause injury should a person come in contact with them. It is therefore best to turn "Off" the current while changing connections and be sure to clear all leads and the meter before turning "On" the current again.

Terminals	*Voltage*
1 to 2	2.5 A.C.
3 to 4	2.5 A.C.
5 to 6	2.5 A.C.
7 to 8	5.0 A.C. (Pilot lamp "ON")
9 to 15	150 D.C.
10 to 15	300 D.C.
11 to 15	315 D.C.
12 to 15	320 D.C.
15 to 16	400 D.C.
15 to 17	500 D.C.

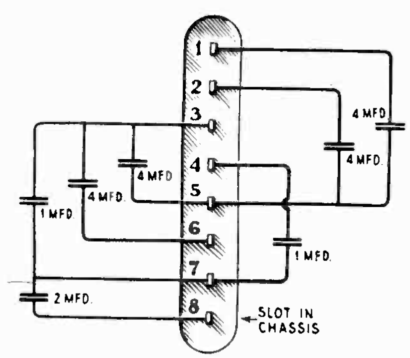


Figure 23—Internal connections of filter condensers

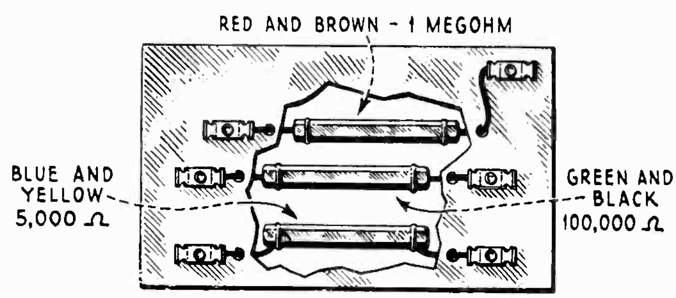


Figure 24—Arrangement of resistors on terminal board

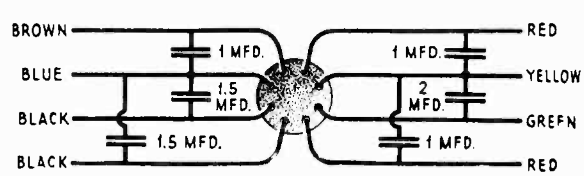


Figure 24A—Internal connections of the receiver by-pass condensers

[26] RADIOLA 64 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly, socket power unit and connecting cables of Radiola 64. Disconnect the antenna and ground leads, the cable connecting the socket power unit to the receiver and the A.C. supply cord at its outlet.

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 across the battery terminals should be used in making these tests. The receiver Radiotron sockets, numbers, lugs and S.P.U. terminals used in these tests are shown in Figure 25. The receiver wiring diagram is illustrated in Figure 26 and the S.P.U. wiring diagram in Figure 27.

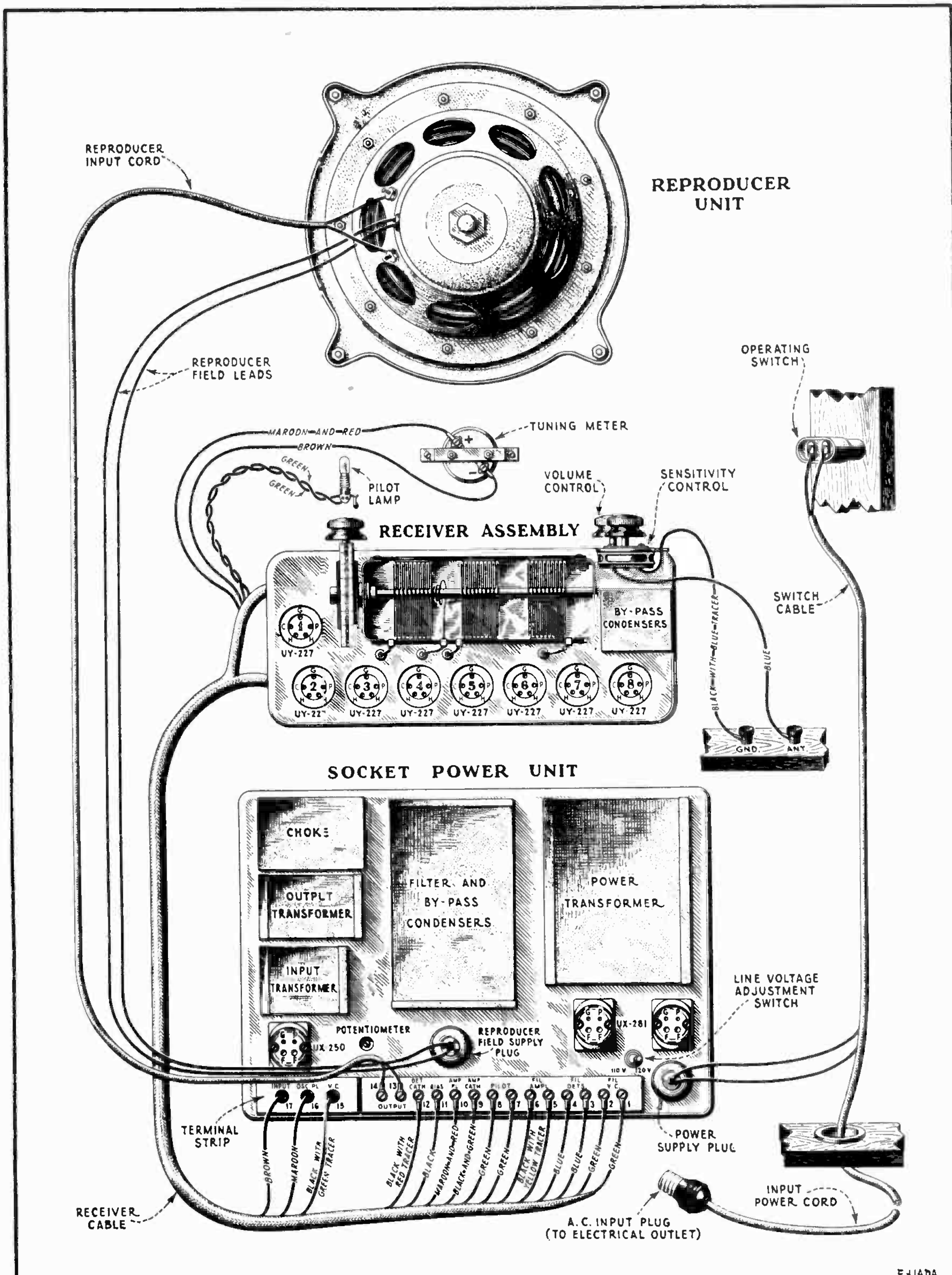


Figure 25—Reproducer, receiver and socket power units with connecting wires, terminal strip, lugs and Radiotron socket contacts

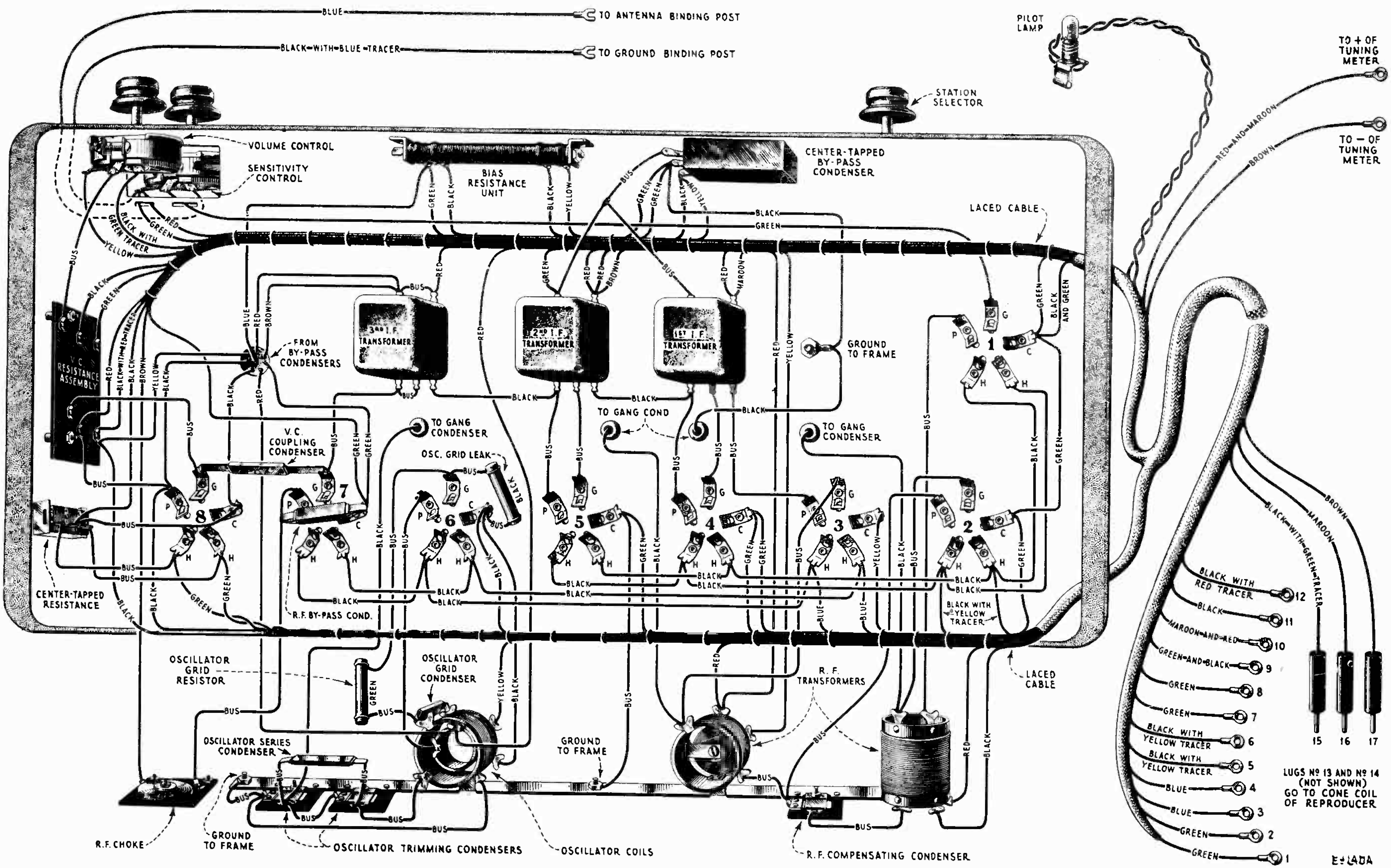


Figure 26—Receiver assembly wiring diagram

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove all Radiotrons and Disconnect Cable at S.P.U. Terminal Strip.

See Figure 25 for cable lugs, terminals and Radiotron Socket Contacts.

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna to ground binding posts	Closed	Open sensitivity control
	Antenna binding post to G1	Closed	Open control arm of sensitivity control or connections
	G1 to P8	Closed	Open contact arm of sensitivity control or connection
	G2 to P8	Closed	Open secondary of 1st R.F. transformer or connection
	G4 to P8	Closed	Open ½ secondary of 1st I.F. transformer or connection
	G5 to P8	Closed	Open ½ secondary of 2nd I.F. transformer or connection
	G3 to Lug No. 11	Closed	Open secondary of 2nd R.F. transformer
	G6 to Lug No. 12	Closed (Weak)	Open grid resistor of oscillator circuit
	G7 to Lug No. 10	Closed	Open ½ secondary of 3rd I.F. transformer
	G8 to Lug No. 15	Closed (Very weak)	Open volume control or grid resistor of volume control tube
	G7 to G8	Open	Shorted volume control coupling condenser
Cathode	Cathode 1 to frame or Lug No. 9	Closed	Open connection
	Cathode 2 to frame	Closed	Open connection
	Cathode 3 to Cathode 6	Closed	Open oscillator coupling coil
	Cathode 4 to ground	Closed	Open connection
	Cathode 5 to ground	Closed	Open connection
	Cathode 7 to Lug 12	Closed	Open connection or resistance
	Cathode 7 to Plate 7	Open	Shorted detector by pass condenser
	Cathode 8 to Lug 15	Closed	Open connection, voltage dividing resistance or volume control
Heater	Lug 1 to either heater contact socket 8	Closed	Open connection
	Lug 2 to either heater contact socket 8	Closed	Open connection
	Lug 1 to Lug 2	Closed	Open center tapped resistance unit
	Lug 3 to one heater contact of sockets 3, 6 and 7	Closed	Open connection
	Lug 4 to other heater contact of sockets 3, 6 and 7	Closed	Open connection
	Lug 5 to one heater contact of sockets 1, 2, 4 or 5	Closed	Open connection
	Lug 6 to other heater contact of sockets 1, 2, 4 or 5	Closed	Open connection
Plate	P1 to Lug No. 10	Closed	Open primary of 1st R.F. transformer
	P2 to Lug No. 10	Closed	Open primary of 2nd R.F. transformer
	P3 to Lug No. 16	Closed	Open primary of 1st I.F. transformer
	P4 to Lug No. 10	Closed	Open primary of 2nd I.F. transformer
	P5 to Lug No. 10	Closed	Open primary of 3rd I.F. transformer
	P6 to Lug No. 16	Closed	Open oscillator plate coil
	P7 to Lug No. 17	Closed	Open radio frequency choke
	P8 to Lug No. 15	Closed (Weak)	Open volume control plate resistance or voltage dividing resistance
Miscellaneous	Frame to Lug No. 15	Closed	Open voltage dividing resistance
	Lug No. 9 to Lug No. 10	Open	Shorted 1 mfd. condenser
	Lug No. 12 to Lug No. 16	Open	Shorted 1 mfd. condenser
	Lug No. 10 to Lug No. 12	Open	Shorted 1 mfd. condenser
	Lug No. 11 to frame	Open	Shorted .5 mfd. condenser

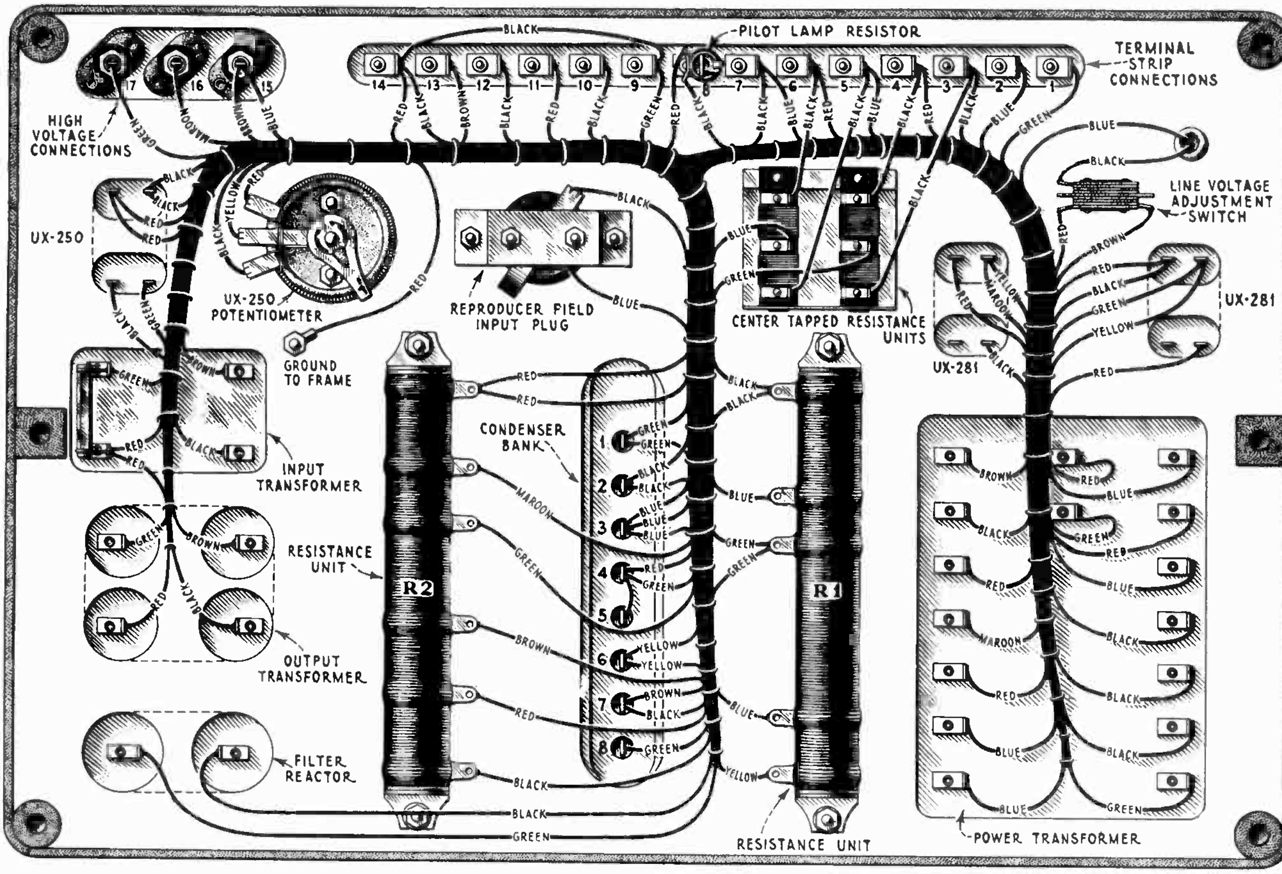


Figure 27—Wiring diagram of the socket power unit

SOCKET POWER CONTINUITY TESTS

Remove Radiotrons and disconnect leads to S.P.U. terminals, field plug and input plug.

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Filament	1 to 2	Closed	Open volume control heater winding
	3 to 4	Closed	Open detector and osc. heater winding
	5 to 6	Closed	Open amplifier heater winding
	7 to 8	Closed	Open UX-250 filament winding or pilot lamp resistance
	Across filament of UX-281	Closed	Open UX-281 filament winding
	Across filament of UX-250	Closed	Open UX-250 filament winding
Plate	Plate of one UX-281 to plate of other UX-281	Closed	Open high voltage winding of power transformer
	Plate contact of UX-250 socket to terminal No. 17	Closed	Open primary of output transformer or primary of input transformer
Grid	Grid of UX-250 socket to one side of field input plug	Closed	Open secondary of input transformer
Miscellaneous	13 to 14	Closed	Open secondary of output transformer
	Lug No. 13 to No. 14	Closed	Open cone coil of reproducer unit
	UX-281 filament field input plug	Closed	Open resistance units R1 or R2
	Across reproducer field plug	Closed	Open reproducer field coil
	Plate of either UX-281 to field input plug	Closed	Open ½ high voltage winding or filter reactor

[27] VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron socket with the receiver in operating condition should prove of value when checking with test sets such as the Weston Model 537, Type 2, or others giving similar readings. The plate currents or grid voltages shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and line voltages. Therefore the following values must be taken as approximately those that will be found under varying conditions. The numbers in column 1 indicate the tube socket numbers shown in Figure 25.

VOLUME AND SENSITIVITY CONTROLS AT ZERO

Tube No.	*Cathode to Heater Volts*	*Cathode or Filament to Grid Volts*	*Cathode or Filament to Plate Volts*	*Plate Current Milliamps*	*Filament or Heater Voltage*
1	19	31	160	—	2.5
2	19	29	160	—	2.5
3	14	8	70	.75	2.5
4	19	29	160	—	2.5
5	19	30	160	—	2.5
6	14	—	65	7.0	2.5
7	14	18	160	.25	2.5
8	—	1	65	.25	2.5
UX-250	—	65	390	52.5	7.5

VOLUME AND SENSITIVITY CONTROLS AT MAXIMUM NO STATION TUNED IN

Tube No.	*Cathode to Heater Volts*	*Cathode or Filament to Grid Volts*	*Cathode or Filament to Plate Volts*	*Plate Current Milliamps*	*Filament or Heater Voltage*
1	15	3	120	3.5	2.5
2	15	3	120	3.5	2.5
3	15	9	75	.25	2.5
4	17	14	140	6.0	2.5
5	17	15	140	6.0	2.5
6	15	—	70	7.0	2.5
7	14	24	170	—	2.5
8	—	2	75	—	2.5
UX-250	—	64	390	52.5	7.5

[28] TESTING ELECTRICAL ALIGNMENT OF TUNING CONDENSERS

Radiola 64 uses a three-gang tuning condenser, one condenser being used for the oscillator, one for the tuned radio frequency stage and one for the heterodyne detector. These condensers are accurately aligned electrically at the factory and it is important that they maintain this electrical alignment. Condensers not aligned will cause weak signals, broad tuning and generally unsatisfactory operation. The following procedure may be used for checking and aligning the condensers properly.

(a) A small tool such as illustrated in Figure 28 is necessary. This may be easily constructed from an old condenser plate, a piece of wire and a bakelite rod.

(b) Tune in a station at the upper wavelengths. Then with the condenser end of the tester, touch the rotor plates, see Figure 29, and note if an increase or decrease of signal is obtained in the loudspeaker. Should touching the rotor plates and bringing the plate closer to the stator plates increase the signal, then either that particular condenser is low in capacity or the coil it tunes is low in inductance. Should the signal decrease in volume, then the condenser and coil is either normal or high in value.

(c) After checking at the upper wavelengths, the procedure should be repeated at the lower wavelengths.

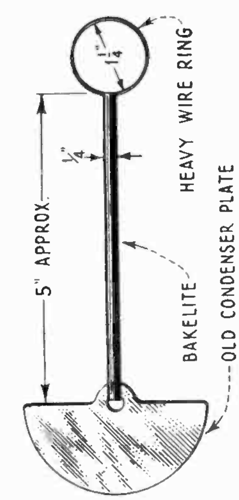


Figure 28—Tool for testing electrical alignment of gang tuning condensers

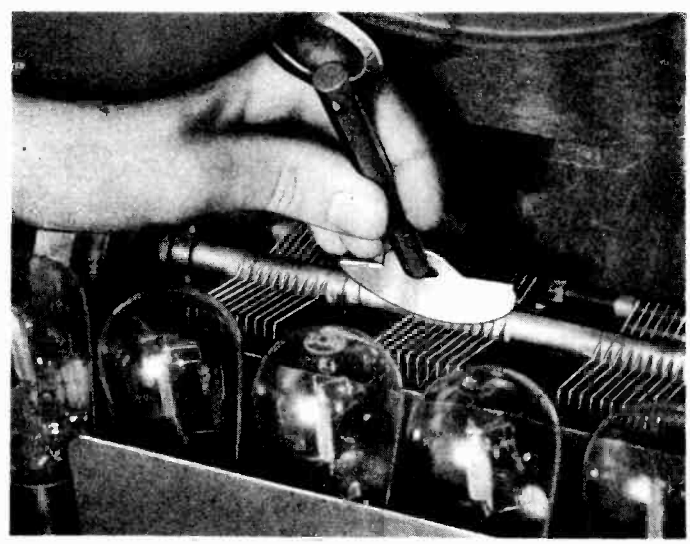


Figure 29—Checking condenser alignment in the three-gang tuning condenser assembly

To check against condensers or coils high in value the other end of the tester which has the wire ring should be placed inside of the coils or near the end of the coil. This reduces the inductance and should the coil be high in inductance or the condenser which tunes it high in capacity, the signal will increase in volume.

By thus checking each condenser and the coil it tunes, a positive check on the electrical alignment of the condensers and coils can be made. Should a circuit be found that is high, the end rotor plate of the particular condenser should be bent farther from the stator plates. The correct amount can be determined by checking as previously described. If the oscillator circuit should be out, a check must first be made of the adjustment of the trimming condensers. See Part II, Section 18.

Should it not be possible to align the circuits by bending the plates then the R.F. and oscillator is not properly matched. In this case this assembly must be replaced as described in Part III, Section 5.

PART III—MAKING REPLACEMENTS

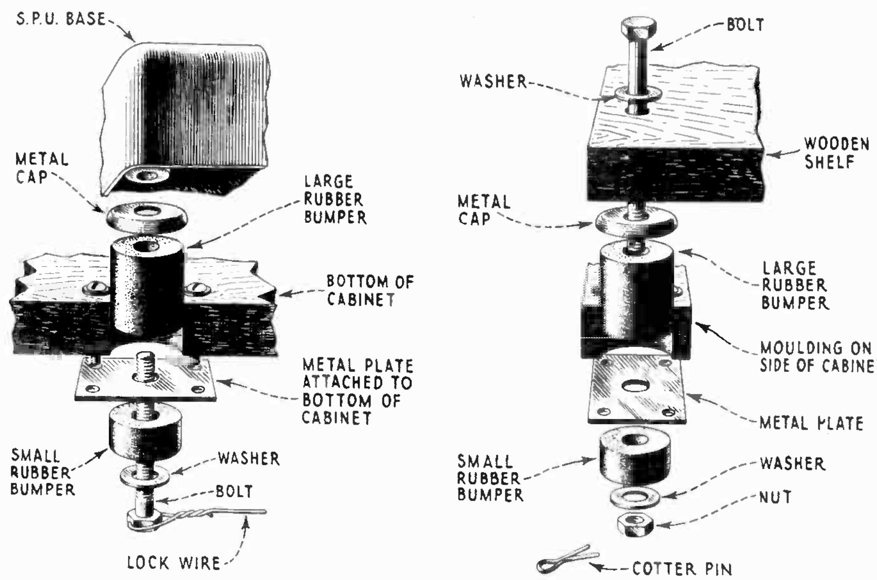
The various assemblies and parts of Radiola 64 are readily accessible and replacements can be easily made. Figures 3 and 4 illustrate the parts in the receiver assembly and Figures 5 and 6 the socket power unit. The following detailed procedure outlines the simplest methods to be used when making replacements.

[1] REPLACING VOLUME OR SENSITIVITY CONTROL

Should it be necessary to replace the volume or sensitivity control, proceed as follows:

(a) Open rear door of Radiola and remove the four cotter pins that are in the bolts holding the receiver assembly shelf to the cabinet.

(b) Remove the four nuts and rubber washers attached to these bolts. After this remove the bolts by pulling clear from the shelf. (See Figure 30.)



Mounting of socket power unit *Figure* 30 *Mounting of receiver assembly shelf*

(c) Release the two wood screws that hold the tuning meter in place. Slip the meter clear of the baffle board.

(d) Release the clamp that holds the leads of the tuning meter to the front of the Radiola.

(e) Disconnect all terminal connections at S.P.U. terminal strip.

(f) Remove the three knobs from the front of the Radiola. This is done by merely pulling them from their shafts.

The shelf with the receiver assembly may now be lifted clear (Figure 31), and the sensitivity control removed by releasing the two screws, nuts and washers that hold it in place, and unsoldering its three connections. The new one should be placed in the position occupied by the old one and the receiver assembly reassembled and returned to the cabinet in the reverse manner of that used to remove it.

The volume control is not accessible from the top of the receiver assembly, therefore it is necessary to remove the four machine screws that hold it in place and remove the shelf from the receiver assembly. Otherwise the replacement procedure is the same as that used for the sensitivity control.

[2] REPLACING CONDENSER DRIVE CABLE

(a) Remove the receiver assembly from the cabinet and from its shelf as described in Part III, Section 1. Place the receiver assembly on a table so that the cable on the grooved drums is accessible.

(b) Release the cable adjusting screw and clamp, and remove old cable from drums completely.

(c) Starting from the rear grooved drum, place eye of new cable over pin, which should be in a horizontal position and next to side of the assembly that is closest to the cable.

(d) Now pass cable over large drum. Turn the drum so the cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing the cable to the track on the other side of the drum.

(e) Follow on around other track in same direction until a point is reached where cable is directly above front grooved drum.

(f) Starting on the third groove back from the front of the drum, wind on two and a half turns and slip eye over pin. The cable is now in its correct position, although probably slack.

(g) The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the grooves are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of its controls. Care should be taken not to take up too much, as the cable may be stretched or possibly broken.

(h) Return receiver assembly to cabinet in the reverse order of that used to remove it.

[3] REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and drive are replaced as one unit as follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Remove the three screws, nuts and lock washers that hold the condenser assembly to the metal frame.

(c) Now pull the condensers as far forward as possible and unsolder the four leads connected at the rear. Releasing the condensers and pulling them forward provides ample space in which to do the unsoldering job and keeps solder material clear of the tube shield. Remove the entire assembly by tilting slightly and pulling clear.

(d) Place the new assembly in the position occupied by the old one and solder the four leads to their proper connections.

(e) Fasten the three screws, nuts and lock washers in their proper position. Make sure that the screw that holds the ground connection on the under side of the chassis makes firm contact.

(f) Return the receiver to the cabinet in the reverse order of that used to remove them.

[4] REPLACING INTERMEDIATE TRANSFORMERS

Radiola 64 has three intermediate frequency transformers, all three being exactly the same mechanically, and interchangeable electrically after the correct adjustments have been made for their particular position in the circuit. A step-by-step replacement procedure follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Remove tuning condenser assembly as described in Part III, Section 3.

(c) Unsolder the connections of the transformer being replaced. Then turn up the metal tabs on the upper side of the receiver chassis. The old transformer may now be replaced by the new one. Turn over the metal tabs to hold it in place and resolder all connections. These are shown in Figure 26. Be careful not to heat any connection more than necessary to make a good joint, as excessive heat may change the capacity of the primary fixed condenser, thus rendering the entire transformer assembly defective.

(d) Before returning the main tuning condensers to the receiver chassis it will be necessary to tune and neutralize the transformer just connected in position. The correct procedure for doing this is contained in Part II, Section 19.

(e) Then return the tuning condenser assembly in the reverse order of that used to remove it. The entire receiver may now be tested and a check made on the adjustment of the oscillator trimming condensers as described in Part II, Section 19. After all tests and adjustments are completed the receiver assembly should be returned to the cabinet in the reverse order of that used to remove it.

[5] REPLACING R. F. TRANSFORMER AND OSCILLATOR ASSEMBLY

The two radio frequency transformers and the oscillator coils are mounted on a metal strip, together with three small adjustable condensers and two fixed condensers.

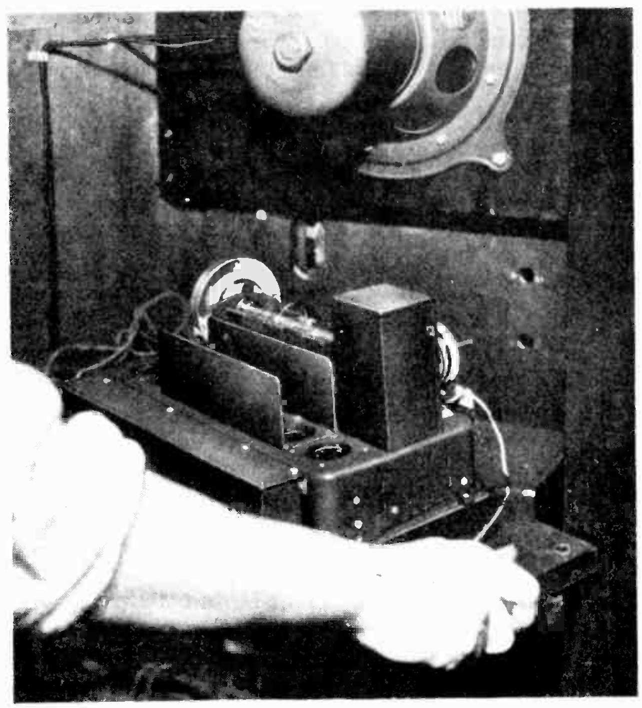


Figure 31—Removing receiver chassis and shelf from cabinet

This assembly must be replaced as a unit—the matching of the coils being an important point in the operation of the receiver. Use the following procedure:

(a) Remove receiver chassis from cabinet as described in Part III, Section 1.

(b) Turn chassis on side and unsolder all leads to the assembly being replaced.

(c) Remove the five machine screws and lock washers that hold the metal supporting strip to the receiver frame.

(d) The assembly may now be removed and the new assembly fastened in position with the five machine screws and washers previously removed.

(e) Resolder all connections in their correct position on the assembly. This is shown in Figure 26.

(f) The receiver assembly may now be returned to the cabinet in the reverse manner of that used to remove it.

[6] REPLACING RADIOTRON GANG SOCKETS

The receiver assembly of Radiola 64 uses one seven-gang UY socket and a single UY socket. These, together with their shields, are held in place by means of rivets which clamp them on the metal chassis frame. Should replacement be desirable, use the following procedure:

(a) Remove the receiver assembly from the cabinet as described in Part III, Section 1.

(b) Unsolder all connections to the particular socket or assembly being removed. The R.F. transformer assembly should be removed as a unit to provide room for replacing the six-gang Radiotron socket.

(c) Drill out the rivets holding the Radiotron socket to be replaced. The socket and shield will be released together.

(d) Remove the old Radiotron socket and fasten the new one in position by means of screws, nuts and washers. Resolder all connections and replace the R.F. assembly if removed. The correct connections are shown in Figure 00.

(e) Fasten receiver assembly in cabinet, connect cable and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[7] REPLACING BY-PASS CONDENSER BANK IN RECEIVER ASSEMBLY

At one end of the receiver assembly of Radiola 64 is located a condenser bank, these capacitors being used only in the receiver assembly circuits. Should it be desirable to replace this condenser bank, use the following procedure:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Turn chassis on side and unsolder all leads to the condenser bank being replaced.

(c) Remove the volume control resistor assembly as described in Part III, Section 1.

(d) Bend up the metal tabs that hold the condenser pack in place. It may now be removed and the new one placed in the position occupied by the old one. Turn down the tabs to secure it in place and replace the resistor assembly.

(e) Solder all connections in place (Figure 26) and return the receiver assembly to the cabinet in the reverse manner of that used to remove it.

[8] REPLACING CENTER-TAPPED BY-PASS CONDENSER

Should it be necessary to replace the center-tapped by-pass condenser in the receiver assembly, proceed as follows:

(a) Remove receiver assembly from the cabinet as described in Part III, Section 1.

(b) Unsolder the connections to the condenser.

(c) With a screwdriver bend up the metal tabs holding the condenser to the side of the receiver frame. These tabs bend easily, and when turned up make possible the removal of the condenser.

(d) The new condenser should now be fastened in place in the position formerly occupied by the old one.

(e) Resolder the connections as shown in Figure 26.

(f) Return the receiver assembly to the cabinet in the reverse order of that used to remove it.

[9] REPLACING RESISTORS USED IN VOLUME CONTROL RESISTANCE ASSEMBLY

Mounted on a small dilecto board are three resistance units used in conjunction with the volume control tube. Should replacement become necessary, proceed as follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Turn receiver assembly on the side and unsolder the connections and the leads to the resistor being replaced.

(c) Place the new resistor in the position occupied by the old one, solder its leads in place and fasten the mounting board to the side of the chassis.

(d) Return receiver assembly to the cabinet in the reverse manner of that used to remove it.

[10] REPLACING DIAL SCALES

After considerable use a dial scale may become soiled or illegible and a new scale desired. A step-by-step procedure to make replacement follows:

(a) Open rear door of Radiola 64.

(b) Turn dial so that the two screws that hold the dial in place are toward the rear.

(c) Loosen screws, washers and nuts that hold dial in place.

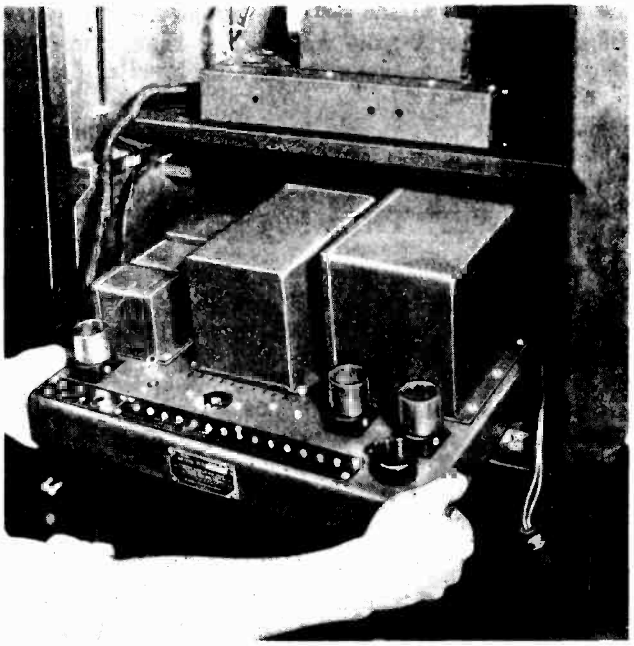


Figure 32—Removing socket power unit from cabinet

(d) The old dial may now be pulled clear and the new one placed in the position occupied by the old one. Examine dial from the front of the Radiola to see that the numbers on the dial are in their correct position.

(e) Tighten screws holding dial in place and close doors of cabinet.

[11] REPLACING POWER CABLE

A combination laced and braided cable is used in Radiola 64 for connecting the S.P.U. to the receiver assembly. Should it be necessary to replace this cable, use the following procedure:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Turn assembly bottom side up and unsolder all connections to the cable.

(c) Remove old cable and connect up the new cable as indicated in Figure 26, soldering all connections.

(d) Return assembly to cabinet in reverse order of that used to remove it.

[12] REPLACING CONE OF REPRODUCER UNIT

Should it be desirable to replace a cone, the entire reproducer unit must be removed from the cabinet. In order to do this use the following procedure:

(a) Remove the reproducer field leads by pulling the field plug from its receptacle. Release these leads from the clamps that hold them to the sides of the cabinet.

(b) Remove the two cone coil leads that are connected to the terminals on the flange of the reproducer unit.

(c) Remove the four nuts that hold the reproducer to the baffle board, at the same time supporting the reproducer by hand to prevent it falling. Place the unit in some position convenient for work.

(d) Remove the nine nuts and machine screws that hold the cone ring in place. Remove this ring.

(e) Remove the screw and washer that centers the cone. The cone may now be removed and the new one placed in the position occupied by the old one.

(f) Return the centering screw; the ring and its nine screws and nuts to position, but do not tighten. The cone should now be centered as described in Part II, Section 20 and all screws tightened.

(g) The unit should now be returned to the cabinet in the reverse manner of that used to remove it.

[13] REPLACING POWER TRANSFORMER

Should it be desirable to replace the power transformer, use the following procedure:

(a) Under the bottom of the cabinet is a wire going to the four bolts holding the S.P.U. to the cabinet. Release this wire and remove the four machine screws, rubber washers and metal washers. (See Figure 30.)

(b) Remove all connections from the S.P.U. terminal strip, the A.C. input plug and the field plug. Remove all Radiotrons.

(c) The S.P.U. may now be lifted clear of the cabinet (See Figure 32), and placed in a position convenient for work.

(d) Turn up on end and unsolder all connections to the power transformer.

(e) Remove the six machine screws, nuts and lock washers that hold the transformer in place.

(f) The old transformer may now be removed, and the new one placed in the position occupied by the old one. The machine screws, nuts, washers and all connections should be replaced (See Figure 27) and the S.P.U. returned to the cabinet in the reverse manner of that used to remove it.

[14] REPLACING S. P. U. FILTER AND BY-PASS CONDENSERS

The filter and by-pass condensers used in the S.P.U. of Radiola 64 are assembled in one metal container. Should any condenser become defective, replacement of the entire assembly will be necessary. The procedure for making this replacement is as follows:

(a) Remove the S.P.U. from the cabinet as described in Part III, Section 5.

(b) Turn the S.P.U. on its side and unsolder all connections to the condenser assembly.

(c) Remove the six machine screws, nuts and washers that hold the condenser assembly in place. Four of these also hold the two resistance units, however, their leads will hold them in place until the screws are returned.

(d) The old assembly may now be replaced and the new one placed in the position occupied by the old one.

(e) Return the machine screws, nuts and washers to their positions, thus fastening the condenser assembly and resistance units in place.

(f) Solder all connections in place. These are shown in Figure 27.

(g) Return S.P.U. to cabinet in the reverse manner of that used to remove it.

[15] REPLACING FILTER REACTOR, INPUT TRANSFORMER OR OUTPUT TRANSFORMER

Should replacement of the filter reactor, input transformer or output transformer be necessary, proceed as follows:

(a) Remove S.P.U. from cabinet as described in Part III, Section 5.

(b) Turn S.P.U. on its side and unsolder the connections to the unit being replaced. In the case of the input transformer the resistance unit soldered across its primary terminals must also be released.

(c) Remove the four machine screws, nuts and lock washers that hold the unit in place. Remove the unit and place the new one in the position occupied by the old one.

(d) Resolder all connections previously removed. In the case of the input transformer solder the resistance unit in place. The correct connections are shown in Figure 27.

(e) Return the S.P.U. to the cabinet in the reverse manner of that used to remove it.

[16] REPLACING RESISTANCE UNITS

Two large resistance units are used in the S.P.U. of Radiola 64, one having five terminals and one having six terminals. Should replacement become necessary, proceed as follows:

(a) Remove S.P.U. as described in Part III, Section 5.

(b) Turn S.P.U. on its side and unsolder all connections to the resistance unit being replaced.

(c) Release the two machine screws, nuts and washers that hold it in place. The resistance unit may now be removed from the S.P.U. base. The end brackets and washers should be removed by releasing the long bolt that holds them in place and mounted on the new resistor. The new resistor assembly should now be placed in the position occupied by the old one and the machine screws, washers and nuts used to hold it in place.

(d) Solder all connections previously removed. These are shown in Figure 27.

(e) Return the S.P.U. to the cabinet in the reverse manner of that used to remove it.

[17] REPLACING S. P. U. WIRING CABLE

A laced cable is used for wiring the S.P.U. of Radiola 64. Should replacement be necessary, proceed as follows:

(a) Remove the S.P.U. from the cabinet as described in Part III, Section 5.

(b) Turn S.P.U. on side and unsolder all connections to the laced cable.

(c) Solder the new cable in the position occupied by the old one. The correct color scheme for making these connections is shown in Figure 27.

(d) Return S.P.U. to the cabinet in the reverse manner of that used to remove it.

[18] REPLACING TUNING METER

A tuning meter is used in Radiola 64 for a visual indication of tuning accuracy. Should replacement of this meter become necessary, proceed as follows:

(a) Open rear doors and remove the two wood screws that hold the meter to the front of the cabinet.

(b) Pull the meter straight back to the baffle board and then pull straight down. There is just room to remove the meter without removing the baffle board.

(c) The two leads may now be removed from the meter by removing the screws that hold them in place. The new meter should now be attached to the leads and bracket from the old meter and slipped in the position occupied by the old one.

(d) Fasten new meter in place by returning the two wood screws to their correct position.

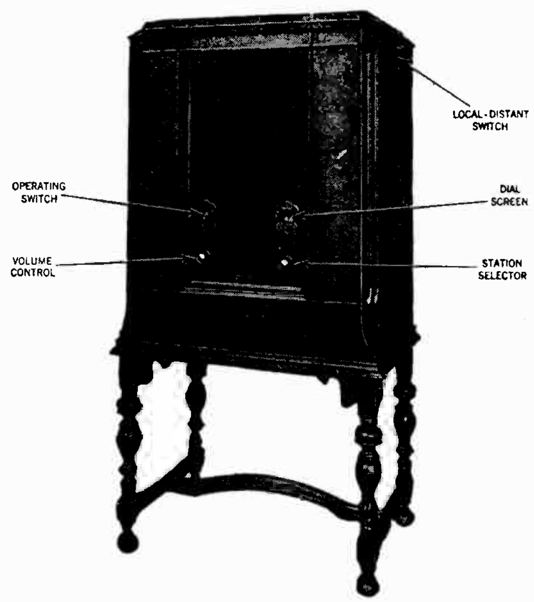
SERVICE DATA CHART

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, P. II, S. 4
	Defective power cable	Replace power cable, P III, S. 11
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 5
	Defective I.F. transformer	Replace I.F. transformer, P. III, S. 4
	Defective Input or Output transformer	Replace input or output transformer, P. III, S. 14
	Defective Oscillator coil	Replace R.F. and oscillator coil assembly, P. III, S. 5
	Defective by-pass condenser	Replace by-pass condenser, P. III, S. 7 or 8
	Defective socket power unit	Check socket power unit by means of continuity test, and make any repairs or replacements necessary, P. II, S. 26
	Open cone coil of reproducer unit	Check cone coil and if open replace cone, P. III, S. 12
Weak Signals	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 17
	Trimming condensers out of adjustment	Adjust trimming condensers, P. 11, S. 18
	I.F. transformers not correctly aligned	Align I.F. transformers correctly, P. II, S. 19
	Defective power cable	Repair or replace cable, P. III, S. 11
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 5
	Defective I.F. transformer	Replace I.F. transformer, P. III, S. 4
	Defective Input or Output transformer	Replace input or output transformer, P. III, S. 14
	Dirty prongs of Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
	Defective by-pass condenser	Replace defective by-pass condensers, P. III, S. 7 or 8
	Defective main tuning condenser	Replace defective tuning condensers, P. III, S. 3
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. II, S. 25
	Field plug not in socket	Place field plug in socket
	Defective socket power unit	Check socket power unit by means of continuity tests and make any repairs or replacements necessary, P. II, S. 26
Poor Quality	Defective Input or Output transformer	Replace input or output transformer, P. III, S. 14
	Defective by-pass condenser	Replace defective by-pass condenser, P. III, S. 7 or 8
	Dirty contact arm of volume control	Clean contact arm on volume control, P. 11, S. 1
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 17
	Defect in audio system	Check and repair any defect, P. II, S. 26
	Open grid circuit in any stage	Check circuit and repair defect
	Microphonic Radiotrons	Interchange Radiotrons
Excessive Hum	Potentiometer not adjusted	Adjust potentiometer correctly
	Open ground connection	Repair any defective connection, P. II, S. 7
	Defective center tapped resistance unit	Replace defective resistance unit
	Socket plug position	Reverse socket plug
Radiotrons Fail to Light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer, P. III, S. 13
	No. A.C. line voltage	Turn A.C. line voltage "On"

RCA
Radiola 66

SERVICE NOTES



RCA RADIOLA 66

First Edition—30M

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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 the RCA Distributors, and the 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 Distributor's 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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

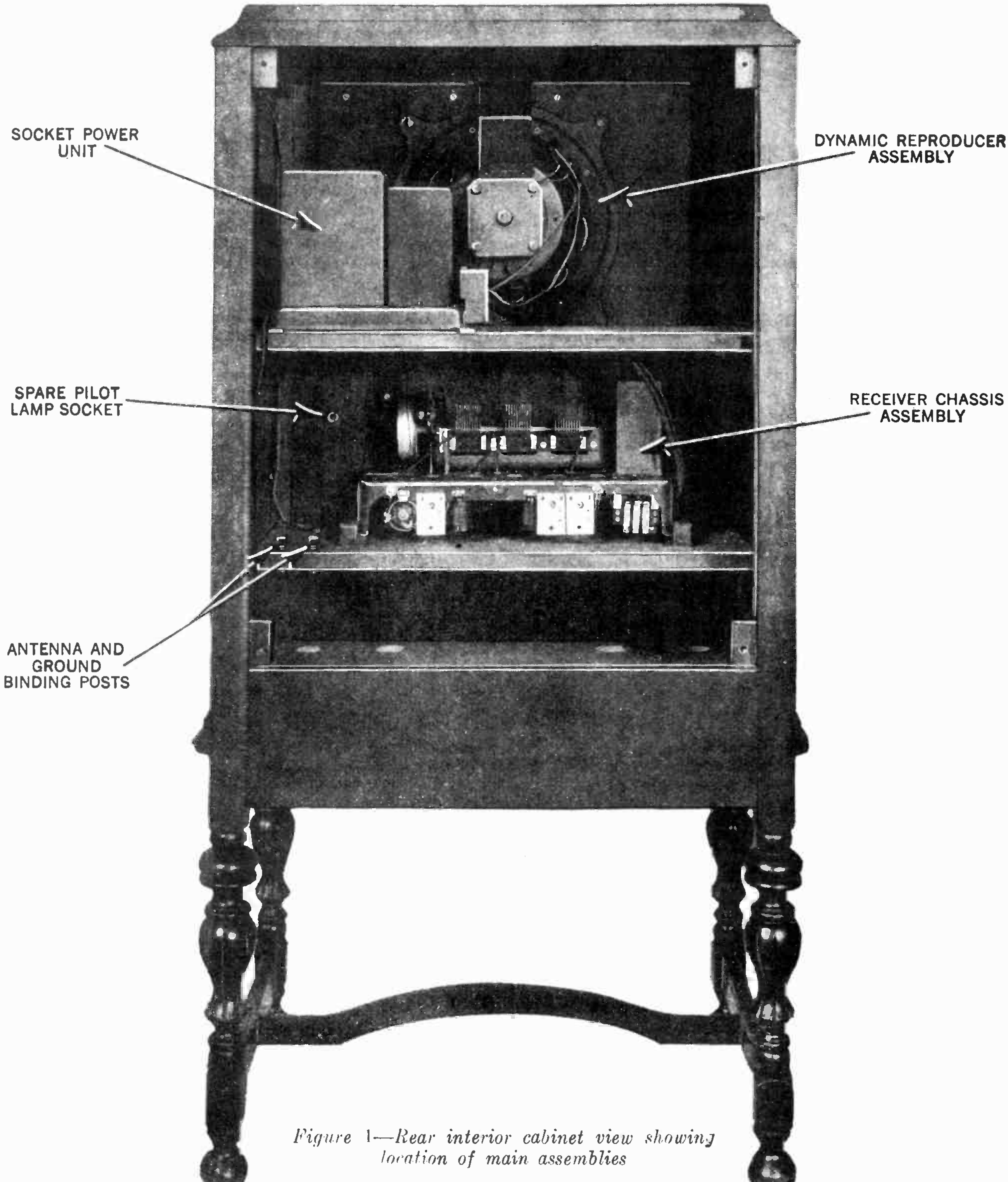


Figure 1—Rear interior cabinet view showing location of main assemblies

RCA RADIOLA 66

(105-125 Volts—50-60 Cycle A. C.—110 Watts)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 66 is a seven-tube socket powered console cabinet model radio receiver utilizing the RCA Super-Heterodyne circuit in its highest development, and employing six UY-227 Radiotrons and the newly developed power amplifier Radiotron, UX-245. The Radiotron UX-280 is used in a socket power unit for supplying all plate, grid, and cathode voltages as well as supplying a high D.C. voltage for the newly developed high voltage, low current dynamic reproducer field used in the Radiola 66. Incorporated in this receiver are the latest developments in Super-Heterodyne engineering in addition to other perfected Radiola features such as one dial control, complete A.C. operation, power detection, single audio amplification stage, with overall balance in sensitivity, selectivity and tonal quality that can best be accomplished in a Super-Heterodyne. Figure 1 illustrates a rear view showing the principal parts. Figure 2 illustrates the top view of the receiver chassis, and Figure 3 is a view of the socket power unit.

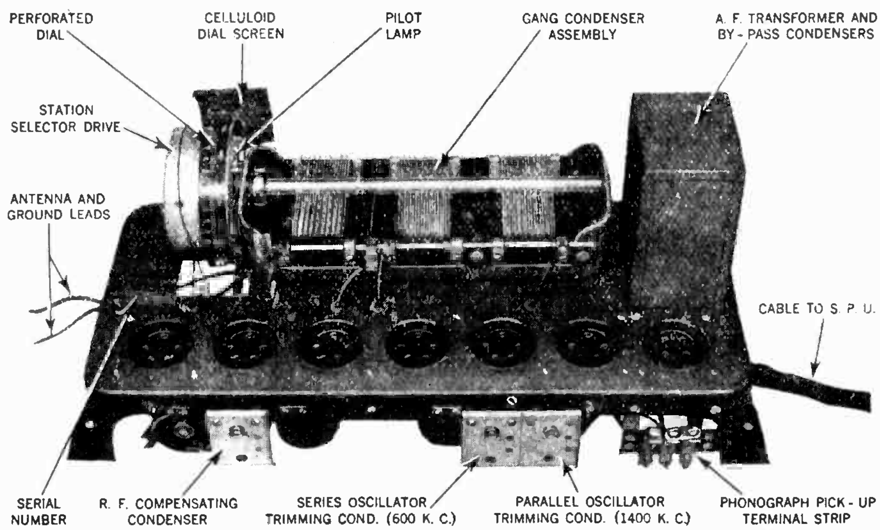


Figure 2—Top view of receiver chassis showing principal parts

Radiola 66 is designed to operate on alternating current of 105 to 125 volts, 50 to 60 cycles as used for house lighting. Connection to D.C. lines or to A.C. lines of different rating may damage this Radiola or the Radiotrons.

Radiola 66 is also made in models designed for alternating current operation of 105 to 125 volts, 25 to 40 cycles. In this model the power transformer is different from that used in the 50-60 cycle models. All other parts are identical in both models and the Service Notes apply to each equally well.

The following circuit characteristics are incorporated in the Radiola 66:

(a) The six UY-227 Radiotrons and one UX-245 Radiotron are connected in a seven-tube super-heterodyne circuit with a UX-280 Radiotron in the S.P.U. for plate, grid, and cathode voltage supply as well as high voltage, low current supply to the field of the new dynamic speaker.

The super-heterodyne circuit consists of one tuned R.F. stage; tuned first detector; two intermediate R.F. stages; an oscillator; a second, or power detector; and the single audio stage using the recently developed power amplifier Radiotron UX-245. The Radiotron sequence is shown in Figure 4.

(b) A "Local-Distant" antenna switch (see front cover) is incorporated in this receiver which permits better control of volume with less distortion, due to the natural condition of overloading on extremely loud local signals together with better selectivity on local stations. This feature with the use of a high impedance semi-tuned primary inductance of the tuned R.F. stage permits the use of a varying length of antenna without materially affecting the tuning of the receiver.

(c) The intermediate radio frequency which results from the mixing of the incoming modulated radio frequency current with that of the local oscillator is 175 K.C. The audio, or voice, modulation that is present in the radio frequency is carried on through the first detector and in the mixing is impressed on the I.F. After being

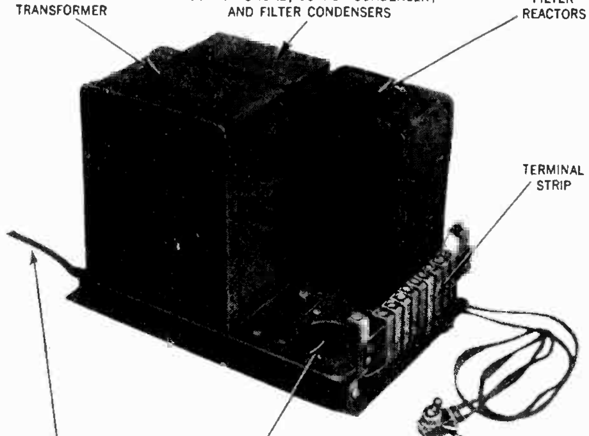


Figure 3—Socket power unit showing principal parts

amplified in two I.F. stages it is detected, or rectified, and further amplified in the audio amplifier stage using the new Radiotron UX-245. The use of 175 K.C. for the I.F. prevents serious harmonic disturbance around 550 K.C., which is a distinct asset. The super-heterodyne circuit owes its superior selectivity and sensitivity to tuned I.F. amplification, for no matter what the R.F. frequency may be to which the receiver may be tuned the most part of the over-all amplification is accomplished by the uniform amplification of the I.F. stages. These I.F. stages are also constantly neutralized for 175 K.C. Neutralization, or prevention of oscillation, is then independent of the broadcast frequency, which is practically the ideal condition for radio reception. The Radiola 66 I.F. transformers are sharply tuned to give improved over-all selectivity. The tonal quality is maintained by means of certain refinements in the circuit arrangement, especially at high frequencies.

(d) The second detector operates at 235 volts plate potential with proper grid bias. The high plate voltage used gives sufficient undistorted output to operate the single audio power stage using the UX-245 Radiotron directly from the second detector, thus eliminating any possible distortion that might be caused by an intermediate audio stage.

(e) Use of the UX-245 Radiotron with the new dynamic speaker permits an undistorted output which represents an over-all gain over previous receivers. It uses the same voltage on its filament as the UY-227, and plate and grid voltages that fall within the supply limits of a UX-280.

(f) The volume control regulates the grid bias on the tuned R.F. stage and the first I.F. stage. When loud local signals are received the "Local-Distant" switch in the local position acts very effectively in allowing better control of volume near the maximum volume control setting without over-loading the receiver. The volume, when the over-loading point is reached, will, of course, distort and drop to a small value. This is entirely natural to the over-loading condition in a vacuum tube, as is also the two peaked tuning effect, which is obtained when the dial is detuned to either side of the normal peak setting with resultant less input and hence no over-loading.

(g) The use of a high voltage, low current field in the dynamic loudspeaker employing the 8-inch cone makes a sensitive reproducer with a field that is supplied by the total D.C. voltage output of the UX-280 in the S.P.U., drawing only approximately 46 milliamperes at about 300 volts. This load together with the receiver Radiotron load is much below the load limit of the UX-280. The voltages on the plates, as well as the grid voltages of the R.F. and I.F. Radiotrons, are purposely reduced to make no over-all difference in amplification, but permitting better S.P.U. regulation and stabler operation. Proper cathode voltages are supplied to all the UY-227 Radiotrons to secure quiet operation and insure average Radiotron life. For the most part,

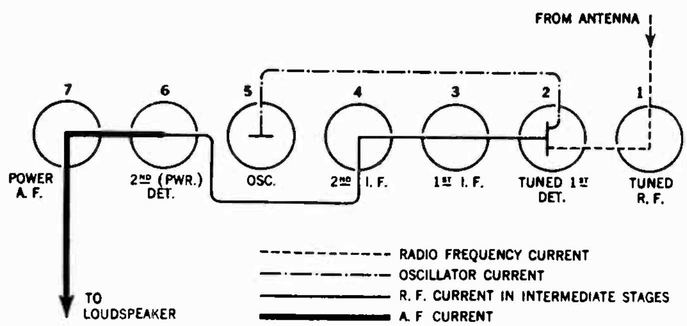


Figure 4—Radiotron sequence

the series or parallel resistance method of supplying voltages is used. The line voltage adjustment switch, common in most receivers, has been discarded to make necessary a more careful check of the supply line voltage before making any change. A tap has been provided in the power transformer primary, located under the S.P.U. for lower than 115-volt power supply to which a soldered connection can be made. This will prevent frequent change-over in the power supply and thus will lessen the application of excessive filament voltages.

Mechanical and electrical improvements in Radiola 66 not mentioned above are:—

(a) Use of "Isolantite" for I.F. transformer adjustable condenser and coil mounting, and also the R.F. compensating and oscillator trimming condenser mounting.
(b) Accessibility of I.F. adjustments. See Part II, Section 16.
(c) Electrostatic shielding between R.F. condensers of the gang tuning condenser and also between socket power unit and receiver chassis.
(d) Simplified construction of the S.P.U.
(e) Projection type of dial scale with kilocycle designation is distinctly a new feature.
(f) A terminal strip is provided for convenient use of a phonograph pick-up.

RADIOTRON SEQUENCE

Figure 4 illustrates the Radiotron sequence. Radiotron No. 1 is a stage of tuned radio frequency amplification. It is coupled to the antenna and ground by a high impedance primary inductive coil. It is tuned by the first of the gang condensers located at the right end facing the receiver from the front.

Radiotron No. 2 is the tuned heterodyne detector. It is tuned by the center of the gang condensers.

Radiotrons No. 3 and No. 4 are the first and second intermediate frequency stages respectively. These stages are tuned to a frequency of 175 K.C., giving ample distance between the two peaks of the oscillator to eliminate any possibility of stations coming in at more than one point on the tuning dial.

Radiotron No. 5 is the oscillator. It is tuned by the third of the gang condensers. Two trimming condensers are provided at the rear of the receiver assembly for adjusting the oscillator circuit to keep the beat note at the correct frequency for the intermediate frequency stages.

Radiotron No. 6 is the second detector. It operates at a plate potential of 235 volts with the proper grid bias and does not use a grid leak or condenser. Its output is sufficient to drive the power amplifier.

Radiotron No. 7 is the power amplifier. A choke and condenser arrangement couples this tube to the step-down transformer that matches the impedance of the output circuit to that of the cone coil of the reproducer unit. This arrangement gives a quality of reproduction not obtainable with the use of an output transformer alone, and prevents flow of the D.C. plate current of the UX-245 through the output transformer primary.

These various principles incorporated in Radiola 66 are illustrated in the schematic circuit Figure 6.

PART I—INSTALLATION

[1] ANTENNA (OUTDOOR TYPE)

Due to the high sensitivity of Radiola 66 the antenna length need be only 25 to 50 feet. In remote districts this length may be extended to secure improved pick-up of distant broadcasting stations. However, a natural corresponding decrease in selectivity when receiving from local stations will be experienced with the longer antenna, provided the "Local-Distant" switch is not in the local position.

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. Bring the lead-in wire from the outside through a porcelain tube insulator to the inside of the house for connection to the receiver.

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.

[2] 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 25 to 50 feet of insulated wire strung around the picture moulding or placed under a rug. In buildings with steel framework or where metal lathing is employed, satisfactory results are not always possible with this type of antenna. However, due to its sensitivity, Radiola 66 will generally give entirely satisfactory reception with an indoor antenna.

[3] SPECIAL ANTENNA INSTALLATIONS FOR NOISY LOCATIONS

In line with other receivers, when Radiola 66 is installed in some city locations, such as apartment houses, hotels and office buildings, it is possible that the level of noise compared with the signal strength of the desired station may be such that the station cannot be received without an objectionable noise background. This noise may be defined as inductive interference from electrical devices such as elevator motors, generators, violet ray machines. professional equipment, etc. It may have no apparent radio frequency peak, or it may have a broad peak. The effect of the noise may be divided into the following three general classes:

(a) Where the noise level is zero with no antenna or ground, but is equally great on either an indoor or outdoor antenna.
(b) Where the noise is equally great with the antenna and ground either connected or disconnected.
(c) Where the noise level is greater when the outside antenna is connected than when an inside antenna is used; the inside antenna, however, not giving sufficient pick-up for satisfactory reception.

In (a) where the noise level is zero with no antenna or ground connected, but equally great with either an indoor or outdoor antenna, it is at once apparent that the interference is not being brought into the receiver over the power supply lines. It has been found in such cases that an antenna five feet long inside the room picked up as much noise as when an entire outside antenna lead-in were used. This indicates that the noise is within the building and, in the case of the outside antenna, is being picked up on that portion of the lead-in that enters and goes through the building. In such cases the receiver should be located close to the point where the outside lead-in enters the building. If this is impractical the Radiola can be placed in any location and a copper braid, such as that manufactured by Belden Mfg. Co. of Chicago, Ill., placed over the inside portion of the lead-in wire. This braid is not grounded. If the noise level is still appreciable a good receiver ground with a short lead must be obtained. A long lead is not desirable, as it may pick up noise.

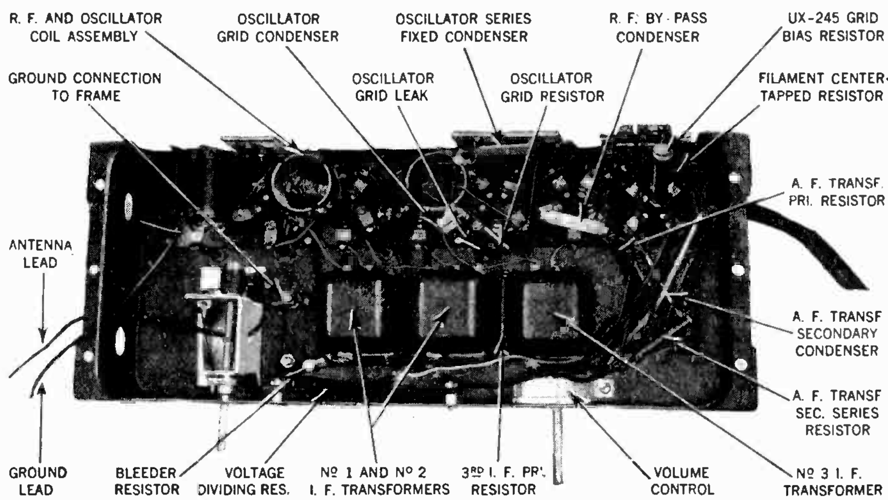


Figure 5—Sub-chassis view of receiver showing principal parts

In (b) the noise is picked up with no antenna or ground connected to the receiver. This indicates the noise is entering the receiver through the power lines. In this case filters must be placed in the power supply at the source of the noise or at the receiver, depending on conditions. If the trouble is cleared up in this manner when the antenna and ground are disconnected, but again appears with the use of the antenna system, the remedies suggested in (a) must also be applied.

In (c) the noise is greater when the outside antenna is connected than when an inside antenna is used. The use of the inside antenna, however, does not give sufficient pick-up for satisfactory reception. In this case the pick-up is probably occurring on the lead-in wire between the Radiola and the antenna. Copper braid should be placed over the entire lead-in from the receiver to the flat portion of the antenna. Also changing the direction of the antenna should be tried and the lead-in connected from the end of the antenna that gives the best results. The copper braid should not be grounded. The conditions existing in any locality must be analyzed and placed in its correct category. A little patience and experimenting will usually result in a satisfactory installation.

RCA type "A" line filters should be used where the interfering line apparatus draws up to 2.5 amperes at 110 volts A.C. or D.C. For larger apparatus drawing current from 2.5 amperes to 5.0 amperes, RCA type "B" line filter should be used.

[4] GROUND

A good ground is quite as important as a good antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be as short as possible and connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

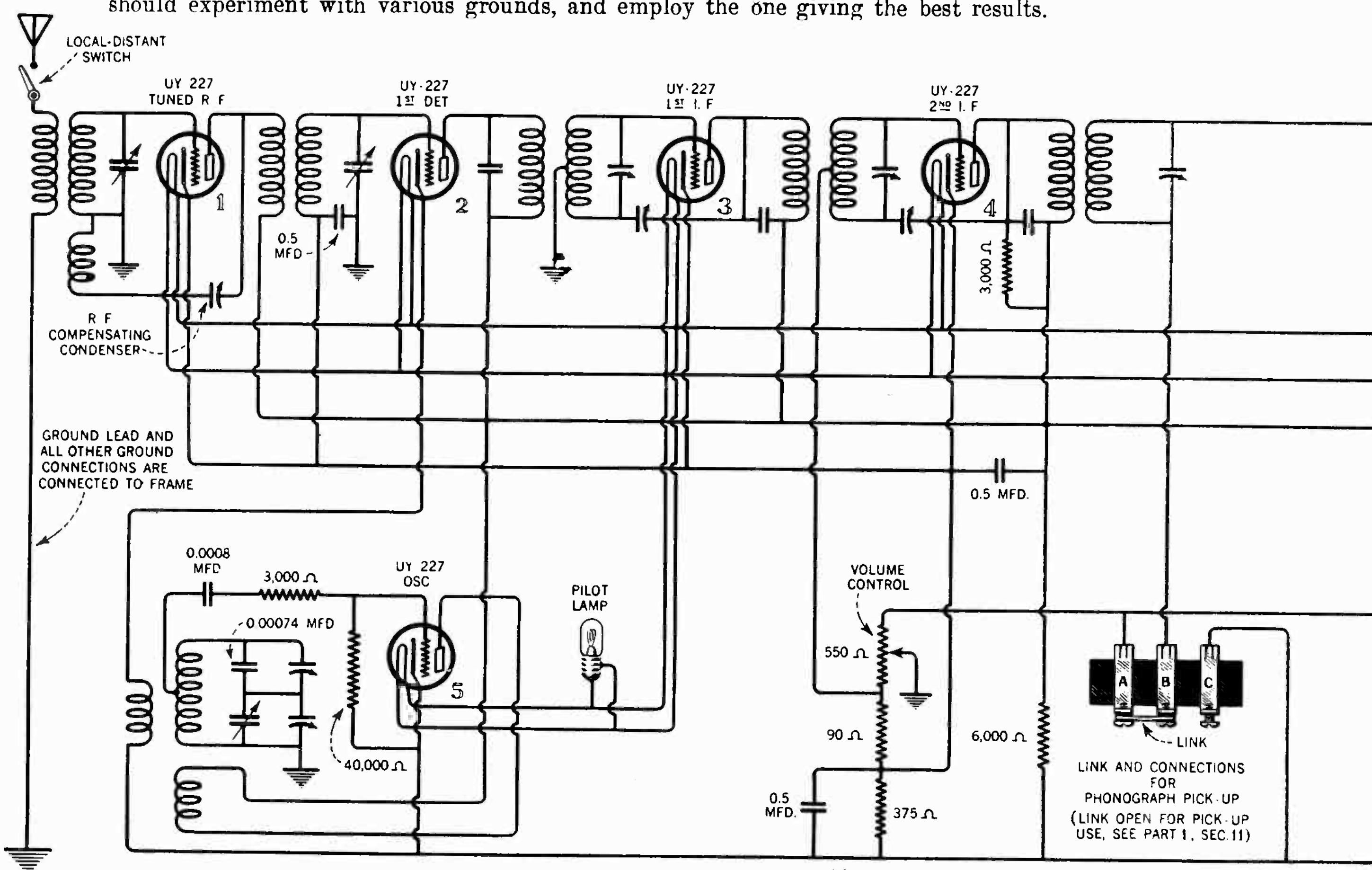


Figure 6—Schematic circuit diagram of Radiola **66**

[5] RADIOTRONS

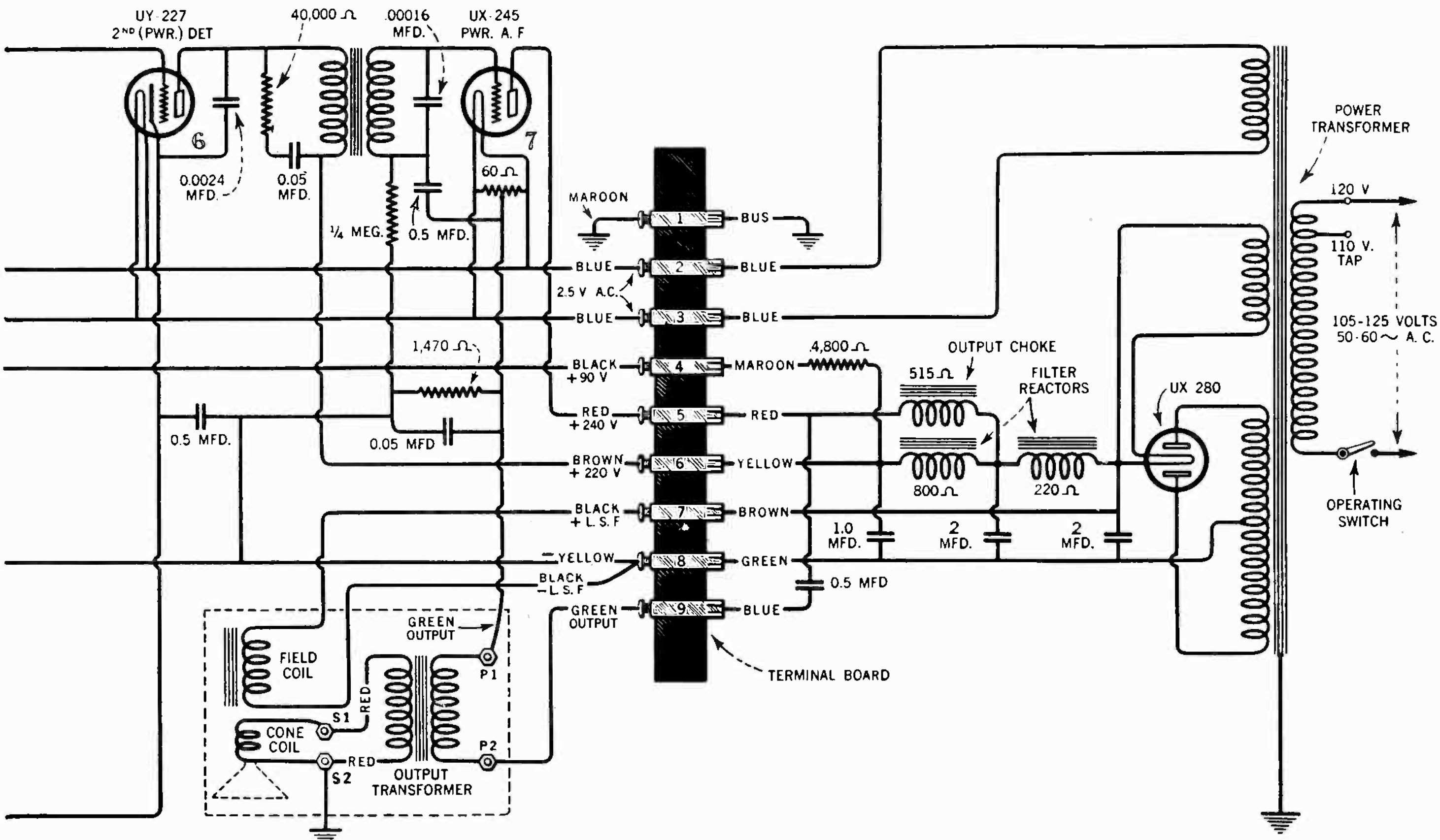
A guide shield is provided on all the receiver Radiotron sockets to facilitate the insertion of the Radiotrons. The six Radiotrons UY-227 are inserted in the five-contact sockets. The Radiotron UX-245 is placed in the four-contact socket in the receiver assembly, and the Radiotron UX-280 is placed in the socket power unit.

In placing Radiola 66 into operation, if no signals are heard when tuning to a station known to be broadcasting, examine the Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more of the same type known to be in operating condition will isolate the damaged one.

NOTE.—Socket No. 1 (Figure 4), the tuned R.F. stage, is the most critical for selection of the Radiotrons. Place in this socket the tube which gives the loudest signal and does not go into oscillation throughout the tuning range. If no tube is found that will not oscillate, a slight re-adjustment of the R.F. compensating condenser may be necessary, as described in Part II, Section 14.

Other stages somewhat critical are the oscillator and second detector, sockets No. 5 and No. 6, respectively. The remaining tubes should be interchanged until a tube is found for the oscillator that gives the loudest signal on a given station. The second detector Radiotron should be selected for its ability to handle large volume. Select the tube for this socket that will permit the volume control to be advanced and give the greatest undistorted output without overloading.

The I.F. stages, Radiotrons No. 3 and No. 4, should have tubes chosen for best amplification. When changing Radiotrons it is advisable to change one at a time, so that no unnecessary voltage unbalancing will result. Turn operating switch "Off" when changing UX-280.



including receiver assembly, socket power unit, and reproducer assembly

[6] RECEIVING LOUD LOCAL STATIONS

If excess volume control adjustment is used on local stations the signal will apparently have two peaks on the tuning dial. A further advance of the volume control will decrease the volume abruptly rather than increase it. This is entirely normal, and is caused by tube overloading. The correct method of tuning Radiola 66 on local stations is to reduce the volume control to the position where the station will be received at only one position on the station selector dial, and then adjust the volume control for the desired volume.

On some stations when tuned in with excessive volume distortion may be experienced. The remedy is to reduce the volume control until the distortion disappears. The "Local-Distant" switch serves a distinct purpose here also. See Part I, Section 8.

If a steady whistle occurs with a powerful local (not a heterodyne between two stations which is a natural condition and impossible to eliminate), it can usually be eliminated or reduced by slightly detuning the station selector. Interference from long wave stations is eliminated in most cases by the new antenna semi-tuned inductance.

This tuning procedure should be explained to the Radiola owner when an installation is made.

[7] ADJUSTMENT FOR LOW LINE VOLTAGES

A lead is provided under the S.P.U. for use when Radiola 66 is connected to lines, the voltage of which never exceeds 115 volts. A good plan is to allow the lead to remain as connected in manufacture unless unsatisfactory operation is experienced. Should it be determined by measuring the line voltage at intervals with a good A.C. voltmeter (as incorporated in Weston Test Set No. 537) that the line voltage never exceeds 115 volts adjustment may be made as follows:

(a) Remove S.P.U. as described in Part IV, Section 15.

(b) Connected to the operating switch will be found two soldered connections, one of which has a transformer lead (black with red tracer), connected to the switch. Unsolder this connection and tape up the transformer lead so that it will not ground or short to other parts.

(c) A black and red transformer lead will be found taped up and not used. Untape this lead. Clean the end for soldering and solder this lead to the switch connection from which the black with red tracer transformer lead has been removed.

(d) Replace S.P.U. in reverse manner.

The 110-volt tap of the transformer is now properly connected and the Radiola may be used on 105-115 volt lines with maximum efficiency. Figure 25 illustrates the changes to be made.

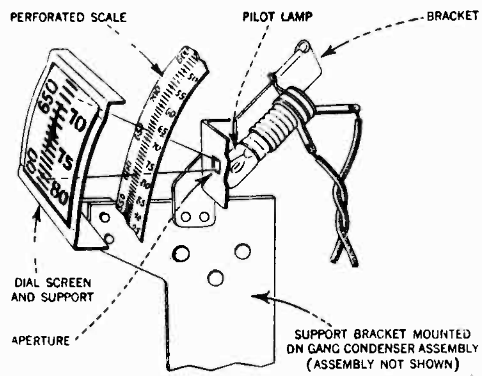


Figure 7—Dial screen, tuning scale and pilot lamp

[8] "LOCAL-DISTANT" SWITCH

A switch is provided in Radiola 66 termed the "Local-Distant" switch. This is an antenna switch, which disconnects the antenna from the receiver when in the local position. When closed it permits distant reception due to the proper normal antenna connection. The purpose of this switch is to prevent the strong carrier of a powerful local station from overloading the tubes, thereby causing distortion and also permit better radio frequency selectivity for local stations close to each other in kilocycle assignment. Keep the switch, as a general rule, at the local position unless sufficient pick-up is not obtained, when the switch may be thrown to the distant position. The "Local-Distant" switch may be located by referring to the illustration on the front cover page.

[9] JERKY ACTION OF STATION SELECTOR

Should operation of the station selector be stiff or jerky a little oil dropped on each condenser bearing will effectively remedy this condition. When experiencing this trouble it is also well to check the cable tension spring to make sure that suitable tension is being applied to the condenser drive cable.

[10] INSTALLATION OF PILOT LAMP

A projection type of dial lighted by a small concentrated filament lamp is used in Radiola 66. The lamp is mounted so that its rays pass through the pierced scale of the dial and then project the scale divisions on an amber window on the front of the cabinet. It is therefore important to mount the lamp so that its rays will pass through the correct openings to fully illuminate the scale readings on the window. Figure 7 shows the general arrangement of the pilot lamp and dial.

To install the pilot lamp proceed as follows:

Turn the station selector counter-clockwise to its extreme position so that the pilot lamp mounting will be accessible. Remove the socket clamp from its bracket and screw the lamp firmly into the socket. Replace the socket clamp on its bracket.

Now turn the power "On" at the operating switch. With the station selector in the extreme counter clockwise position adjust the socket clamp on its brackets until the zero mark on the scale projected on the dial screen is about $\frac{1}{4}$ inch below the index pointer.

To replace a bulb, pull the socket back from its position and remove the old bulb. Place the new one in the socket and screw in tightly. The socket is then pushed down until the front window is properly illuminated. There may be a slight variation in the centering of the filaments of various lamps which might tend to throw the light too much to one side of the window. If this happens pull the socket out and bend the metal arm that holds the socket to one side until the rays of the lamp properly illuminate the scale window. Now tune in a station, the dial setting of which is known. If the dial setting for the station tuned in is different from that formerly obtained pull the lamp back or push it forward until the dial reads the same as that previously obtained for that station. The lamp itself may be out of focus due to excessive or too little solder on the base tip connection. This can be remedied by replacing the lamp with the spare provided, taking away a little solder with a hot soldering iron.

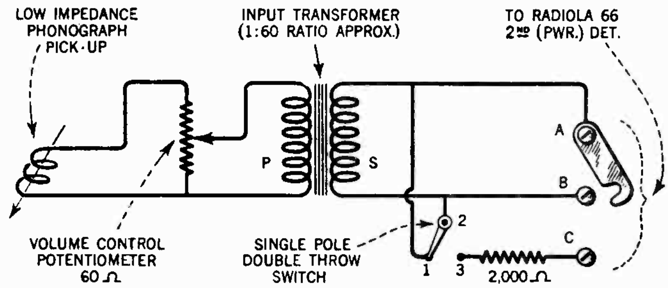


Figure 8—Schematic circuit diagram of phonograph pick-up connections

[11] PHONOGRAPH PICK-UP

Connecting lugs for a phonograph pick-up are provided and are shown specifically in the schematic diagram Figure 6. The proper arrangement of parts and connections for a low impedance type pick-up are schematically shown in Figure 8. If a high impedance type pick-up is used, as is most generally found in the open market, the 1 to 60 step-up input transformer as shown in Figure 8 should be changed to a 1:3 input transformer (Audio transformer RCA part number 5805), or that recommended by the individual manufacturer. The volume control potentiometer should also be changed to that recommended by the manufacturer. It is important to have the resistor connected as shown to the single-pole double-throw switch for changing over from the audio amplifying system for phonograph operation (close switch from contact 2 to contact 3), to that of radio reception (close switch from contact 2 to contact 1). Contacts and switch arrangements, as well as the necessary 2000-ohm resistor, are shown in Figure 8. For phonograph operation the Radiola 66 volume control should be at extreme minimum setting as well as "Local-Distant" switch in "Local" position. If a high pitched audio frequency whistle occurs with some types of phonograph pick-ups it is advisable to ground the lower end of the primary of the input transformer (end closest to letter P of diagram shown above) and pick-up suspension arm.

[12] LOCATION OF RADIOLA IN ROOM

As with other musical instruments, the location of Radiola 66 in the room should be chosen with care. Various positions should be tried until the most desirable reproduction is obtained. If this position is outside the radius of the connection cord to the A.C. outlet, an extension cord can be used.

[13] KNOBS

Radiola 66 uses an improved type of push knob on the station selector and volume control shafts. This knob is removed by simply pulling it off the shaft, and replaced by pushing it on. Very little trouble should be experienced, as no set screws or other parts that might give trouble are used. Spacers are provided on the shaft to keep the knobs at proper distance from the tapestry grill, and if removed, should be carefully replaced.

PART II—SERVICE DATA

[1] ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna; or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

[2] RADIOTRON SOCKETS

The sockets used in Radiola 66 are a six-gang UY socket assembly and two single UX sockets. One of the UX sockets is used in the socket power unit and is of the same design as that used in the receiver assembly.

The bakelite Radiotron guide shields used in the receiver assembly will prevent any possible shock from contact with high voltages in the socket when inserting the Radiotrons.

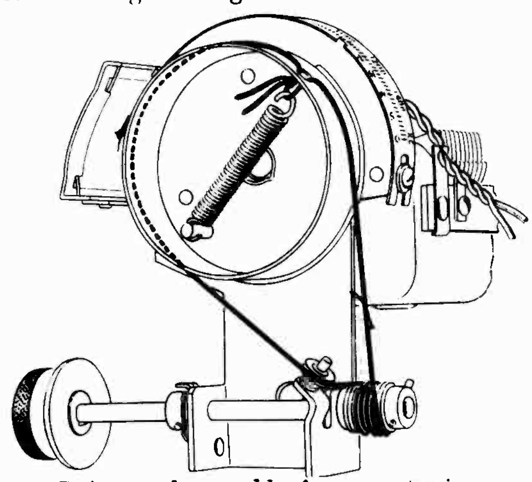


Figure 9—Drive cord assembly for gang tuning condensers

The prongs of the tubes fit into this shield opening very snugly and require only a twist until the prongs find the correct holes into which they fit. This is especially helpful when inserting the five-prong tubes into their sockets.

[3] RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuits sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

[4] LOOSE VOLUME CONTROL

A loose volume control arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the chassis from the cabinet as described in Part IV, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame, after unsoldering connections to its three terminals.

[5] BROKEN CONDENSER DRIVE CORD

The main tuning condensers are controlled by the station selector knob, the motion of which is transmitted by means of a rugged fish line to the drum on the end of the tuning condensers. Should this cord become broken, and a new one not be available, a temporary repair may be made by tying the two ends together by means of a square knot and then replacing the cord in its correct position as shown in Figure 9. The shortening caused by the knot can be compensated for by untying the knot at the tension spring end and using a part of the spare length. The tying of the knot at the ends of the cord should be the last operation, because the correct amount of tension can then be obtained at the tension spring. Figure 9 shows the arrangement of the drive cord over the drums. This should be followed when replacing the cord. See Part IV, Section 5.

[6] RADIOTRONS FAIL TO LIGHT WHEN OPERATING SWITCH IS "ON"

Should all Radiotrons fail to light when the operating switch is "ON", look for:

(a) House current switched off; loose connection at convenience outlet; or open A.C. input leads.
(b) A.C. input plug to S.P.U. not in position.
(c) Operating switch not functioning properly.
(d) Line voltage tap not connected.
(e) Damaged power transformer in S.P.U.
(f) Burned-out filaments in Radiotrons not lighting.

The remedy for (a), (b), (c), (d), and (f) is apparent. Any external cause, such as D.C. supply, etc., of (e) should be located and eliminated before making replacements.

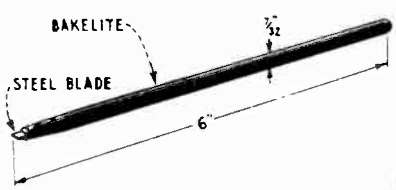


Figure 10—Dimensions of the non-metallic screw driver

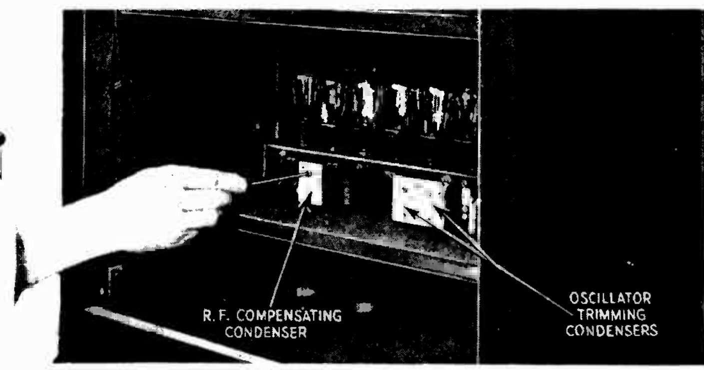


Figure 11—Method of adjusting compensating and oscillator trimming condensers in cabinet

[7] PLATES OF RADIOTRON UX-280 EXCESSIVELY HOT

Should the plates of Radiotron UX-280 become excessively hot, check the following:

(a) Shorted 2 mfd. filter condenser on high voltage side of filter reactor.
(b) Internal short in power transformer. Test for grounds to shield or to core, or short from one winding to another.

[8] NO SIGNAL—RADIOTRONS O. K.

If the Radiotrons appear to be functioning properly and no signals are heard from the loudspeaker with the volume control at maximum, check the following:

(a) Inoperative Radiotrons. Defects other than filament failure are not apparent until the tubes are tested. Inoperative Radiotron UX-280 may cause low voltages at the terminal strip, or at the Radiotron sockets. (See Part III, Sections 2 and 3, for voltage readings.)
(b) Antenna grounded or shielded, or some defectively grounded part.
(c) Open R.F. coils; I.F. transformers defective, etc. Check receiver wiring by inspection for poorly soldered joints, or grounds due to excessive soldering. Then resort to continuity tests and ground tests as outlined in Part III, Sections 5 and 9, to determine defective wiring, or open connections.
(d) Loose connections at S.P.U. terminal strip.
(e) Open movable coil on cone or defective output transformer on reproducer frame. (See Part III, Section 7.)
(f) Defective S.P.U. Check by means of continuity test.
(g) Open field coil in reproducer unit.

[9] HUM

If a pronounced hum develops during operation check the following:

(a) Low emission Radiotron UX-280. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(b) Defective center tapped resistance. A short or open of this resistance will cause a loud hum and imperfect operation of the Radiola.

(c) Any open of the several grounding connections in the Radiola or voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part III, Sections 5 and 6.

(d) An open filter condenser in the S.P.U. may cause a hum. Check by testing condensers as outlined in Part III, Section 8.

(e) Shorted filter reactor will cause excessive hum. Check by resistance test. Part III, Section 6.

(f) A.C. induction may cause hum due to misplaced leads.

(g) Open by-pass condensers may cause excessive hum.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part IV, Section 16, and heating it in a slow oven. The open end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

[10] LOW VOLUME

Low volume may be caused by:

(a) Defective antenna system or defective "Local-Distant" switch when in "Distant" position. A poor antenna and ground in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2, 3 and 4, should be followed if trouble of this kind is experienced.

(b) Defective Radiotrons. A defective Radiotron in any stage may cause weak signals. Before checking other causes it is a good plan to check all Radiotrons by interchanging them with ones of a similar type known to be in good operating condition.

(c) R.F. compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 14. Open or shorted plate winding will prevent regeneration. Refer to continuity tests, Part III, Sections 4 and 5.

(d) Oscillator trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the Radiola may be sensitive at certain portions of th tuning scale and very insensitive at other sections. Also two tuning points may be found for the same station. Should these condensers be badly out of adjustment. only very loud local stations will be heard. The correct method for adjustment of these condensers is given in Part II, Section 17.

(e) Intermediate transformers not correctly tuned or matched or in themselves defective. Should the tuning condensers connected across the secondaries of the intermediate transformers be out of adjustment, weak signals and poor tuning or, in some cases no signals will result. Refer to Part II, Section 16, for the correct method of adjusting the I.F. transformers.

(f) Defective A.F. transformer. Check by means of the continuity test (also Part II, Section 19) and make any replacement that is necessary. (See Part IV, Section 7.)

(g) Low voltage from S.P.U. Check voltages at terminal strip or sockets with readings given in Part III, Sections 2 and 3. Low voltages may be caused by a low emission rectifying tube or defective resistances in the S.P.U. or receiver. Check by means of continuity test.

(h) Open, short or ground of various connections in receiver. Check by means of continuity tests or ground tests and make any repair or replacement that is necessary.

[11] AUDIO HOWL

Audio howl may be caused by:

(a) Incorrect adjustment of the R.F. compensating condenser. A compensating condenser adjusted to the verge of oscillation may cause a howl on nearby stations. Adjust as suggested in Part II, Section 14. Faint beat notes heard when listening to loud stations on frequencies of 875 and 700 are not due to incorrect adjustment, and may be usually avoided by slight detuning until the beat disappears.

(b) A howl may be caused by natural heterodyning of two stations close in frequency. Distortion will also be produced. This, of course, is no fault of the receiver.

(c) Open A.F. condenser connections. An open of the A.F. condenser may cause a howl.

(d) Open by-pass condenser connections. An open of the connections to the by-pass condensers may cause a howl.

(e) Defective volume control resistance. Should there be an open or short in the volume control or in its adjacent resistances an audio howl may develop.

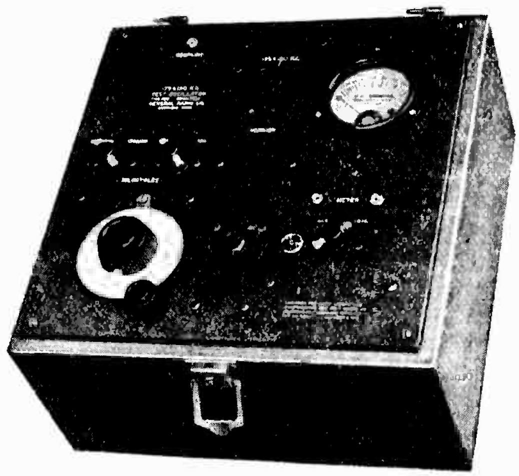


Figure 12—175 K.C. test oscillator

175 K.C. AND 180 K.C. TEST OSCILLATORS

The General Radio Co. of Cambridge, Mass., can supply the new 175 K.C. Test Oscillator as illustrated. This oscillator, Type 360, has an output meter that may be connected directly to the output terminals in any of the Radiola 60 series. The broadcast band oscillator completely covers the range of 550-1500 K.C. by means of a calibrated variable condenser. A pilot lamp is incorporated in the set and all necessary leads and tools are supplied.

The General Radio Co. will undertake to add the necessary parts to the 180 K.C. Test Oscillator, Type 320, that most distributors have used for service on the Radiola 60 series, to provide for the 175 K.C. drive which is necessary with Radiola 66. Type 320, 180 K.C. Test Oscillator should be forwarded to the General Radio Co. to have these changes made at a nominal cost.

(f) Vibrating elements in receiver Radiotrons. A gradually developed howl may be due to the loudspeaker causing the receiver Radiotron elements to vibrate. Check as described in Part II, Section 12.

(g) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause a howl.

(h) Defective resistance in S.P.U. or the receiver assembly. An open resistance unit may cause howl. Under such conditions it is advisable to turn the set "off" until the trouble is found, otherwise excessive voltage rise may cause further damage.

(i) Neutralizing condensers in intermediate transformers out of adjustment. This may cause oscillation in the I.F. stages which can be conveniently determined by removing Radiotron No. 1 and listening for the familiar oscillation sound when tuned to a loud local station with volume control at maximum setting. This I.F. oscillation will result in a howl when a station is tuned in, especially at loud volume. Adjust the neutralizing condensers as described in Part II, Section 16.

(j) Open of any of the several ground leads in the Radiola. This may cause some of the circuits to go into oscillation and result in a howl when a station is tuned "in". Generally a loud hum will also be present. The several grounding leads in the Receiver Assembly and in the Socket Power Unit should be checked and any open or poorly soldered joint should be repaired.

(k) Pilot lamp socket being grounded may cause a howl or excessive hum.

[12] ACOUSTIC HOWL

Acoustic howl is caused by vibration of the elements in the receiver Radiotrons. This is amplified in the reproducer unit. Conditions being favorable the howl may increase in intensity and drown out the broadcast signal.

In Radiola 66 the receiver assembly, after the shipping blocks are removed, is mounted on rubber cushions to prevent any microphonic action. Should trouble of this kind be experienced, examine the rubber cushions in the cushion brackets to make sure the receiver assembly is fully resting on rubber. If this is O.K. the Radiotrons in the receiver should be interchanged until the howl is eliminated.

[13] DISTORTION IN REPRODUCER UNIT ONLY

Distortion in the reproducer unit may be due to any of the following causes:

(a) Cone out of alignment. Refer to Part II, Section 22.

(b) Leads from cone coil broken away from side of cone. Make these leads fast with a little shellac.

(c) Loose grill, grill cloth protector, or baffle board. Any loose part in the cabinet will cause a rattle. Tighten all loose parts.

(d) Foreign material in core space.

(e) Defective output transformer. Check continuity and resistance, Part II, Section 21.

[14] ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The radio frequency compensating condenser should not be touched unless it is definitely ascertained that no other failure exists as a possible cause of receiver insensitivity, which is the most noticeable indication of the need for adjusting, providing different tubes have been tried as pointed out in Part I, Section 5.

An oscillating condition of the receiver may be caused by improper adjustment of this condenser.

A step by step procedure for making proper adjustment follows:

(a) Procure a long, thin, non-metallic screwdriver (See Figure 10).

(b) Place Radiola in operation in usual manner and tune in a weak station, preferably at the middle or upper wavelengths. If only a loud signal is available, place "Local-Distant" switch in "Local" position.

(c) Locate the position of the compensating condenser (See Figure 11).

(d) With the volume control at the position of maximum setting adjust the screw of the condenser until the Radiola goes into oscillation. This will cause a whistle whenever a station is tuned "in." Then turn the screw in the opposite direction until the set just goes out of oscillation and no howl is experienced when receiving loud local stations. Now tune in stations throughout the range of the receiver and note whether oscillations occur. If they do, it will be necessary to reduce the setting slightly. This is the correct adjustment for the radio frequency compensating condenser.

[15] DISTORTED REPRODUCTION CAUSED BY OTHER THAN REPRODUCER UNIT

Under normal conditions Radiola 66 will deliver a strong signal of excellent quality to the loudspeaker. The high sensitivity of Radiola 66 makes it undesirable to operate the set at full volume when receiving from nearby broadcasting stations. If the normal reproduction is poor, test the output from the receiver. A pair of phones may be used for this purpose. Poor quality or distortion may be due to any of the following causes, other than natural over-loading as explained in Part I, Section 6:

(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 second detector, audio stage and the rectifier tube.

(b) High or low plate and grid voltages from the Socket Power Unit or a defective resistor in the Receiver Assembly. In the Socket Power Unit distortion may be caused by a defective Radiotron UX-280 or resistance unit.

(c) Defective A.F. transformer. See Part II, Section 19. Check by means of continuity test and replace if necessary.

(d) Trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the beat signal may not be exactly the frequency to which the intermediates are tuned. This will cause weak signals and distortion of those received. This condition may or may not be present throughout the tuning range of the receiver. Adjust as described in Part II, Section 17.

(e) Receiver oscillation. Should some circuit other than the oscillator be oscillating, distortion will be experienced when tuning in a station. This will be accompanied by a whistle or squeal when the carrier wave of the station is tuned in. To remedy trouble of this kind see Part II, Section 11.

(f) Intermediate transformers out of line or not properly matched or in themselves defective. This will have the effect of giving distorted reproduction and reduce the sensitivity of the receiver to a marked degree. Line up the entire I.F. transformer assembly as described in Part II, Section 16.

(g) Natural heterodyne between stations caused by being close in frequency. This is, of course, no fault of the receiver.

(h) Open by-pass condensers may cause distortion. Check larger ones by method outlined in Part III, Section 8. Smaller capacities should be replaced, if suspected, unless a capacity bridge is available.

(i) Defective connections. Check by continuity and ground tests as outlined in Part III, Sections 5, 6 and 9.

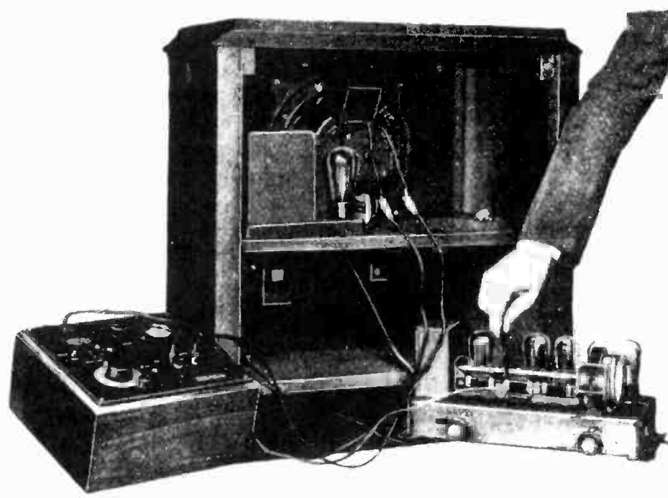


Figure 13—Method of adjusting I.F. tuning condensers and neutralizing condensers

While this and other adjustments may be made with the receiver chassis in the cabinet, better accessibility is obtained by removal from the cabinet.

[16] ADJUSTMENT OF I.F. TRANSFORMERS

The three I.F. transformers used in Radiola 66 are of the air core, tuned primary and tuned secondary type. The primary condenser is of the fixed type, while the secondary is adjustable. Also in I.F. transformers No. 1 and No. 2 an adjustable condenser is provided for neutralizing the I.F. stage. Figure 23 illustrates the internal connections of all the I.F. transformers.

Should a transformer burn out or its primary fixed condenser change in capacity it will be necessary to replace that particular transformer. The correct procedure for making such a replacement is contained in Part IV, Section 10.

A simple method of locating a shorted transformer is to use a resistance bridge or the resistance measuring method described in Part III, Section 7. The approximate transformer primary D.C. resistance is 20 ohms; secondary 100 ohms. Due to the circuit arrangement (See Figure 6) it will only be possible to get a reading of 50 ohms on the secondary as the end connection goes to the neutralizing condenser and the reading must be made at the center tap connection. This condition is true only of I.F. transformers No. 1 and No. 2. I.F. transformer No. 3 has no center tap in its secondary, and therefore can be measured for the full secondary resistance of approximately 100 ohms.

After replacing a defective I.F. transformer, or to make adjustments, the following tuning and neutralizing procedure must be followed for correctly lining up the various circuits. This is of utmost importance, as the entire performance of Radiola 66 is based on the correct functioning of its intermediate stages.

The following equipment is needed:

1. A Test Oscillator (Driver). See Figure 12.
2. A coupling lead for coupling the output of the Driver to the grid or stator of the first detector gang condenser (See Figure 13).
3. A non-metallic screw-driver.
4. A "dummy" Radiotron UY-227—A normal tube with one heater prong removed.

Preliminary steps to be taken before adjusting the tuning, neutralizing and trimming condensers:

(a) Remove receiver assembly as described in Part IV, Section 1, but leave all connecting lugs connected to the S.P.U. terminal strip (the terminal strip cover and insulator should be removed). Place the receiver in the position shown in Figure 13.

(b) Disconnect red leads from output transformer to cone coil binding posts (See Figure 22). To these should be clipped the meter terminal leads as shown in Figure 13. If it is desired to tune to resonance by ear as well as by sight of the meter (the latter, of course, should be used at all times for accurate settings), do not disconnect the red leads, but clip the meter leads to the cone coil binding posts on the loudspeaker frame. The switch under the meter of the "Driver" should be thrown to the dynamic ("Dyn") position. If a General Radio 180 K.C. "Test Driver," altered for 175 K.C., is used, the brown lead from the receiver should be released from Terminal No. 6 and the 0-2 D.C. milliammeter of the "Test Driver" inserted in series with correct polarities. If a separate meter is used a 0-5 D.C. milliammeter should be used, or a 0-2 D.C. milliammeter with 15,000 ohms in series.

(c) Now clip the coupling lead from the "Driver" on the center stator of the R.F. and oscillator gang condenser assembly. This places the output of the "Driver" into the I.F. stages through the first detector (See Figure 13). This connection is recommended for neutralizing with phones, as will be explained later. For the tuning procedure if too much pick-up is obtained the lead with the coupling coil should be placed under the center coil of the R.F. and oscillator assembly.

(d) Replace all Radiotrons except the oscillator, No. 5, and turn operating switch "On."

(e) Place "Driver" in operation by switching "On," and set switches and vernier condenser at 175 K.C. The note from the driver will then be heard in the loudspeaker if connected.

The I.F. transformer tuning condensers may now be adjusted as follows:

(f) Adjust the tuning condensers successively on the first, second and third I.F. transformers (Figure 14), for maximum signal in the loudspeaker and maximum reading on the milliammeter. If pointer should go off milliammeter scale reduce the volume control. After making one adjustment on the transformers it is a good plan to repeat, as slight changes may have occurred in tuning the other circuits. No signal, or a loud howl, indicates neutralizing condensers are out of adjustment and they should be readjusted. If meter swings abruptly off scale it is usually a good indication that the I.F. stages are in an oscillating condition. No further tuning should be attempted until the I.F. stages are correctly neutralized. A maximum reading, without the last mentioned condition, indicates correct tuning of the intermediate stages.

It is now necessary to check the neutralization of the I.F. stages as follows:

(g) Leave all adjustments and apparatus in position on completion of tuning, but substitute a pair of phones for the loudspeaker by disconnecting the red leads (black meter leads of "Driver" also), and connect the phone tips to these terminals by a clip or handy fastener for a good temporary connection. If greater response is desired in the phones, they may be connected to the green (See Figure 22), output transformer leads when removed from their binding posts. This connection is not generally satisfactory, as the A.C. hum for phones at this point is rather high to determine a good minimum neutralizing point. This connection may also be used for the meter of the "Driver" in the tuning procedure. with meter switch thrown to magnetic speaker position ("Mag"). Proceed then by placing the dummy Radiotron in first I.F. socket. Now adjust the neutralizing condenser on the first I.F. transformer for the position of minimum or no signal. This is easily identified and the adjustment is not critical.

(h) Replace the first I.F. tube and place "dummy" tube in second I.F. stage and adjust the neutralizing condenser on the second I.F. transformer for position of minimum or no signal as described in the preceding paragraph (g). Figure 23 illustrates the internal connections of the I.F. transformers. The third transformer does not require neutralizing.

(i) It is good policy to re-check the tuning of the I.F. transformer stages after neutralization. See paragraph (f).

After the I.F. transformers are properly tuned and neutralized they should perform at their maximum efficiency. It is a good plan to check the adjustments of the two oscillator trimming condensers (See Figure 11) at this point. The correct method for doing this is indicated in Part II, Section 17.

Due to the increased sensitivity of the receiver it may be necessary to reduce the setting of the R.F. compensating condenser to prevent the tuned R.F. stage from oscillating. This can be ascertained by tuning in stations of different wavelengths and noting if the receiver oscillates at any point throughout its tuning range. (See Part II, Section 14.)

[17] ADJUSTMENT OF OSCILLATOR TRIMMING CONDENSERS

Two trimming condensers are provided for adjusting the oscillator circuit so that the beat note will always be 175 K.C. throughout the tuning range of the receiver.

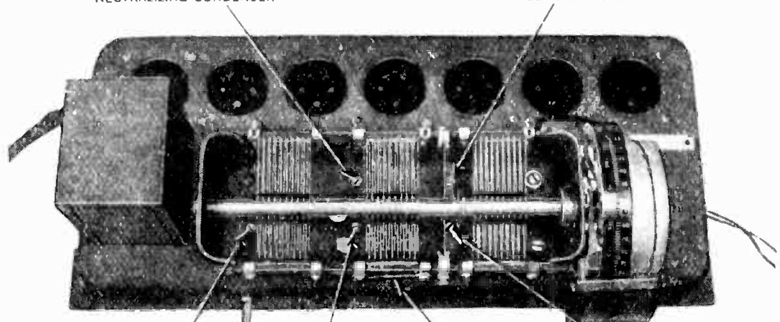


Figure 14—Condenser adjusting screws for I.F. transformers

The most noticeable symptom of the oscillator trimming condensers being out of adjustment is insensitivity of the Radiola in some sections or throughout the tuning range. To check the adjustment of the trimming condensers as a possible cause of any noticeable insensitivity in the receiver proceed in the following manner, making sure the I.F. stages are in correct adjustment (See Part II, Section 16).

(a) Procure the following equipment. A modulated oscillator giving signals at 1,400 and 600 Kilocycles. The Test Oscillator shown in Figure 12 is suitable for this purpose as it covers the broadcast band of frequencies 550-1,500 K.C.

A long thin non-metallic screwdriver. Such a screwdriver is shown in Figure 10 with its dimensions.

With the test oscillator shown, the two red output leads of the receiver chassis that normally go from the secondary of the output transformer to the cone coil (See Figure 22) should be removed and connected to the output or meter terminals of the oscillator with the clips provided and meter switch thrown to dynamic ("Dyn") position. If the test oscillator is not used, a 0-5 D.C. milliammeter or a 0-2 D.C. milliammeter with 15,000 ohms in series should be connected in series with the brown lead that connects to lug No. 6 (See Figure 22) on the terminal strip. This places the meter in series with the plate supply of the second detector and serves as a very good resonance indicator, as does also the other mentioned method. The speaker cone coil may be connected at any or all the time if the connection assists in any way in tuning to the modulated output of the test oscillator.

(b) Place the Radiola in operation with receiver raised by blocks or the rubber cushion supports provided, in order to simulate the conditions when mounted on the cabinet shelf. Then place the oscillator in operation at 1,400 K.C., and with the coupling lead twisted around the antenna lead, tune the Radiola by adjusting the station selector until a maximum deflection caused by the external oscillator is obtained in the meter, or resonance indicator. Always adjust the volume control so that the deflection is not beyond the scale of the meter.

(c) Now adjust the oscillator trimming condenser on the right, facing rear of Radiola (Figure 15) with the long, thin, non-metallic screwdriver until a maximum deflection is obtained in the milliammeter. The station selector should be moved slightly as adjustment is being made in order to keep correct tuning position, which is indicated by maximum deflection.

(d) Adjust oscillator for 600 K.C. Tune in the Radiola again carefully, but now for 600 K.C. with station selector and then adjust the trimming condenser to the left for maximum deflection of the milliammeter while tuning through signal.

(e) Now readjust at 1,400 K.C. as indicated in (b) and (c).

With this adjustment the trimming condensers are correctly adjusted for maximum efficiency, that is, so adjusted that the beat signal will be 175 K.C. throughout the tuning range.

(f) If the above fails to line up the trimming condensers, bearing in mind that the right trimmer is more critical than the left trimmer for usual correct adjustment, look for defective oscillator series condenser, or defective oscillator coil assembly. A two-peak effect of meter reading may be due to tuning through a broadcast station frequency that is being picked up. If the speaker is connected this can readily be determined.

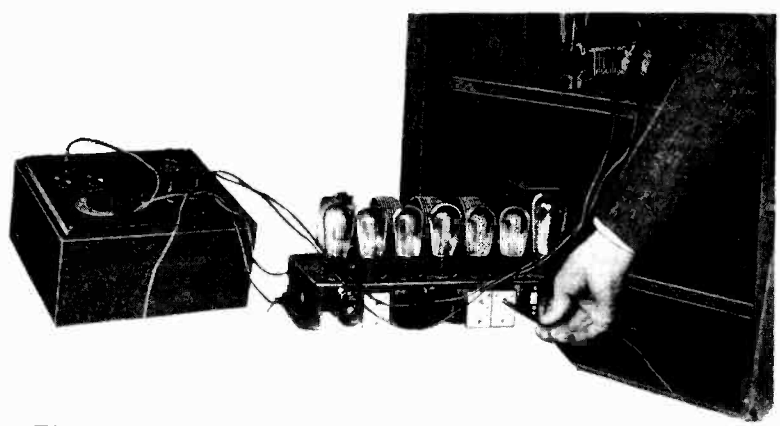


Figure 15—Method of adjusting oscillator trimming condensers

[18] TESTING ELECTRICAL ALIGNMENT OF TUNING CONDENSERS

Radiola 66 uses a three-gang tuning condenser, one condenser being used for the oscillator, one for the tuned radio frequency stage and one for the heterodyne detector. These condensers are accurately aligned electrically at the factory and it is important that they maintain this electrical alignment. Condensers not aligned will cause weak signals, broad tuning and generally unsatisfactory operation. The following procedure may be used for checking and aligning the condensers properly.

(a) A small tool such as illustrated in Figure 17 is necessary. This may be easily constructed from an old condenser plate, a piece of wire and a bakelite rod.

(b) Tune in a weak station or loud local with minimum volume control setting at the upper wavelengths. Then with the condenser end of the tester, touch the rotor plates, see Figure 16, and note if an increase or decrease of signal is obtained in the loudspeaker. Should touching the rotor plates and bringing the plate closer to the stator plates increase the signal, then either that particular condenser is low in capacity or the coil it tunes is low in inductance. Should the signal decrease in volume, then the condenser and coil is either normal or high in value.

(c) If it is desired to use the Test Oscillator to provide a signal, and its meter used to show the response, instead of broadcast signal as outlined in (b), this may be readily accomplished by connecting and using the Test Oscillator shown in Figure 12, and outlined in Part II, Section 17. Decrease in signal strength by using the tool mentioned above will be shown by a decrease in meter reading, after signal of oscillator has been properly tuned in.

(d) After checking at the upper wavelengths, the procedure should be repeated at the lower wavelengths.

To check against condensers or coils high in value the other end of the tester which has the wire ring should be placed inside of the coils or near the end of the coil. This reduces the inductance and should the coil be high in inductance or the condenser which tunes it high in capacity, the signal will increase in volume.

By thus checking each condenser and the coil it tunes, a positive check on the electrical alignment of the condensers and coils can be made. Should a circuit be found that is high, the end rotor plate of the particular condenser should be bent farther from the stator plates. The correct amount can be determined by checking as previously described. If the oscillator circuit should be out, a check must first be made of the adjustment of the trimming condensers. See Part II, Section 17.

Should it not be possible to align the circuits by bending the plates or the gang condenser adjuster (See Figure 16), then the R.F. and oscillator coil assembly is not properly matched. In this case this assembly must be replaced as described in Part IV, Section 2.

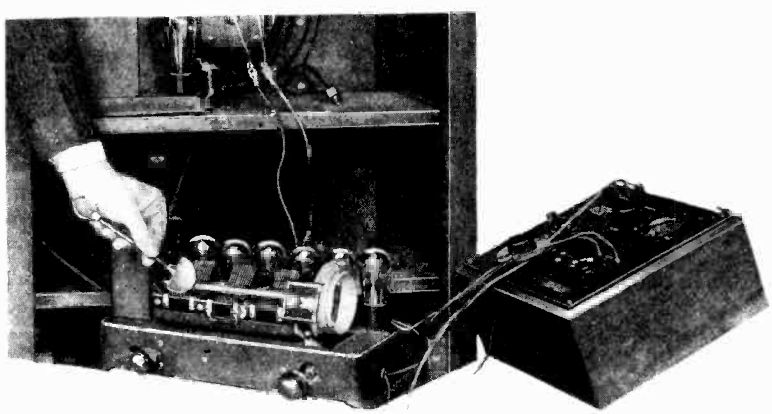


Figure 16—Aligning gang tuning condensers

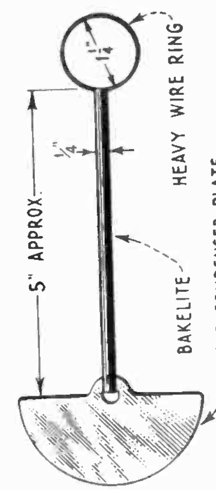


Figure 17—Aligning tool

[19] AUDIO TRANSFORMER AND RECEIVER BY-PASS CONDENSERS

Figure 20 shows the internal connection to external lugs of the single audio transformer and by-pass condensers as well as the correct color coding of the external leads with their correct internal connections.

(a) The transformer windings may be checked by the methods described in Part III, Section 7.

The primary resistance is about 1,000 ohms.

The secondary resistance is about 5,200 ohms.

(b) The by-pass condensers may be checked by the method outlined in Part III, Section 8. Although this method does not give any knowledge as to the exact capacity, it is a valuable, though rough, service check.

[20] OUTPUT CONDENSER, OUTPUT CHOKE, AND FILTER CONDENSERS

Figure 21 shows the internal connections to external lugs of the output condenser, output choke, and filter condensers, together with their respective values.

These should be checked by the methods outlined in Part III, Sections 7 and 8.

An open output condenser or an open or shorted choke will cause weak and distorted reproduction. A defective filter condenser is indicated by excessively hot plates, possibly showing color, in Radiotron UX-280. Shorted output condenser will cause distortion.

[21] REPRODUCER UNIT

Radiola 66 uses a new type eight-inch dynamic reproducer rendering excellent quality of reproduction. The field coil is a high-voltage, low-current type, being supplied from the UX-280 in the S.P.U. This field is efficient in operation and marks a distinct advance in dynamic reproducer design.

A check on the continuity of the cone coil or field can be made by disconnecting them from all other terminals and testing for continuity. An open of either coil will indicate a defect which must be remedied by replacing the entire cone or the field coil.

The output transformer also can be tested for continuity by applying methods as outlined in Part III, Sections 4 and 7. The connections for the above parts of the reproducer assembly are clearly shown in Figure 22.

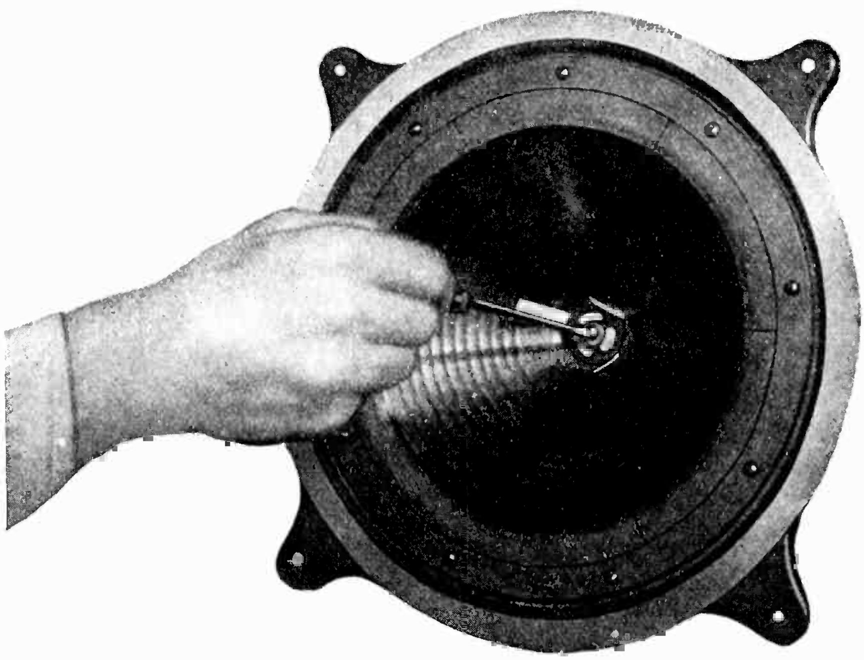


Figure 18—*Centering cone*

Testing the resistance of the cone coil should show approximately 10 ohms for normal condition. Similarly the output transformer primary resistance is 350 ohms, and secondary is 16 ohms. The field coil drain is about 46 milliamperes at 300 volts D.C.

[22] CENTERING CONE OF REPRODUCER UNIT

To properly center a new cone or one out of center use the following procedure:

(a) Remove reproducer unit from cabinet as outlined in Part IV, Section 13.
(b) Loosen center screw of cone, but do not remove it.
(c) Insert three cardboard strips about the thickness of a visiting card, 1½" x ¼" in size, through the center web of the cone into the space between the pole pieces and the cone (Figure 18). This will give the cone coil the same clearance on all sides of the pole piece.
(d) Tighten the center screw holding the web of the cone and remove the three strips. The cone is now properly centered.
(e) Replace reproducer unit in reverse order.

PART III—ELECTRICAL TESTS

[1] VOLTAGE SUPPLY SYSTEM

Figure 19 shows the method of obtaining the plate, grid, cathode and heater voltages and the high voltage field current from the main source. However, in order to give the service man a complete continuity picture of the voltage circuits it is not abridged, but drawn actually as it is found in the Radiola 66, so that the tracing of voltages and currents are actually done, through the various component parts affected, as shown schematically in a straight line manner.

By study of this schematic, the reason for no plate voltage on one I.F. socket with all others O.K. is readily apparent, namely, the primary coil of the I.F. in question must be open. A shorted primary condenser in an I.F. transformer means eliminating the resistance of the primary coil. These conditions as well as effects on voltages from shorted bias resistor condensers, etc., can be determined with study of this voltage supply schematic. The correct values of resistors, condensers, etc., are shown in the ordinary schematic diagram Figure 6

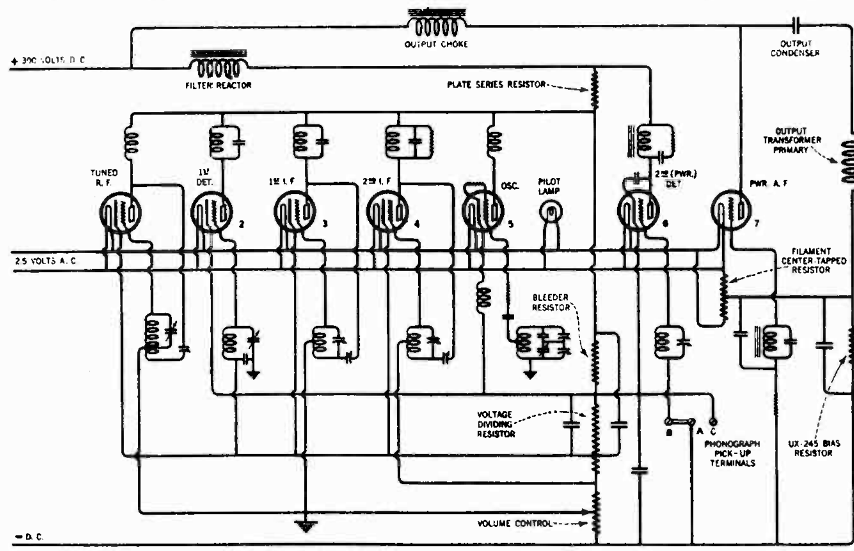


Figure 19—Schematic circuit diagram of the voltage supply system

[2] VOLTAGE READINGS AT TERMINAL STRIP

Use D.C. voltmeter with a 0-300 volt scale and at least 1,000 ohms per scale volt such as incorporated in Weston Model 537, Type 2, test set. Line volts—120 A.C.—Tap at 120 volt connection.

Terminals	*Volts*	*Terminals*	*Volts*
8 to 7	310	8 to 5	275
8 to 6	265	8 to 4	120

Use a 0-5 volt A.C. voltmeter for the following reading: Terminal 2 to 3, 2.7 volts A.C.

[3] VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron socket with the receiver in operating condition should prove of value when checking with test sets such as the Weston Model 537, Type 2, or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and line voltages. Therefore the following values must be taken as approximately those that will be found under varying conditions. The numbers in column 1 indicate the tube socket numbers shown in Figure 22.

VOLUME CONTROL AT ZERO

120-Volt Line. Tap at 120-Volt Connection

Tube No.	Cathode to Heater (D.C.) Volts	Cathode or Filament to Grid (D.C.) Volts	Cathode or Filament to Plate (D.C.) Volts	Plate (D.C.) Milliamps	Filament or Heater (A.C.) Volts
1	—26	—20	+100	0	2.35
2	—17	— 9	+ 95	1.6	2.35
3	—26	—20	+100	0	2.35
4	—26	— 3	+100	7.3	2.35
5	—16	0	+ 90	8.7	2.35
6	—17	—29	+235	0.7	2.35
7	—	—16*	+225	31†	2.40

VOLUME CONTROL AT MAXIMUM
120-Volt Line. Tap at 120-Volt Connection

Tube No.	Cathode to Heater (D.C.) Volts	Cathode or Filament to Grid (D.C.) Volts	Cathode or Filament to Plate (D.C.) Volts	Plate (D.C.) Millamps	Filament or Heater (A.C.) Volts
1	—24	—3.0	+ 81	4.5	2.35
2	—17	—7.0	+ 77	1.5	2.35
3	—24	—3.0	+ 80	5.0	2.35
4	—24	—3.0	+ 81	4.9	2.35
5	—16	0	+ 75	6.6	2.35
6	—16	—29	+228	0.7	2.35
7	—	—16*	+225	30.5†	2.40

*The reading of 16 volts as herein found is correct. Actually this indicates a bias voltage of about 44 volts on the grid of the UX-245. The actual lower reading is due to the ¼ megohm (250,000 ohms) resistor naturally affecting the scale of the voltmeter.

†This reading is just off the scale of the 0-30 milliammeter used in the Weston 537, Type 2, test set. The 0-150 M. A. scale should be used in case of readings in excess of 30.

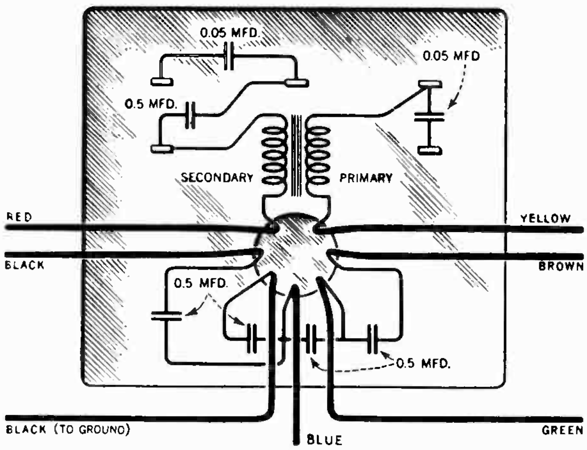


Figure 20—Internal connections of audio transformer and by-pass condensers

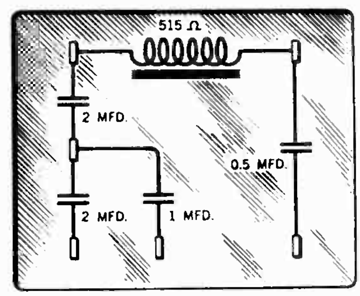


Figure 21—Internal connections of output choke, output condenser and filter condensers

[4] METHODS FOR CONTINUITY TESTS

In making a continuity test whether it be for the complete receiver, S.P.U., or individual parts, as the internal connections and windings of the A.F. transformer shown in Figure 20, or checking the continuity of the I.F. transformers by referring to Figure 23 for schematic representation, the following procedure is recommended:

Disconnect the antenna and ground leads; the cable connecting the socket power unit to the receiver and loudspeaker, and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series, or preferably a voltmeter with sufficient voltage to give a full scale deflection when connected across the battery terminals should be used in making these tests, for example, a 0-50 volt meter with a 45 volt "B" battery. The receiver Radiotron socket contacts, numbers and lugs used in these tests are shown in Figure 22. The receiver continuity wiring diagram is illustrated in Figure 23. The S.P.U. terminal numbers are shown in Figures 6 and 24. The voltage supply schematic (Figure 19) will also be a help in studying continuity.

Test leads should be of the flexible insulated type with partially insulated testing tips, so that false readings will not be obtained through contact with the hands. Similarly the hands should not touch the chassis or component parts.

The contacts of the test equipment should be placed across the terminals or leads indicated in the following test table under the column marked "Terminals." If the results are negative the cause of such negative effect will be found in the last column under the heading, "Incorrect Effect Caused By." The second column indicates the correct effect. The third column indicates the approximate correct resistance in ohms of most of the circuits tested.

The R.F. and oscillator coil winding lugs are coded (P) representing primary, (S) secondary, (S') secondary center-tapped, and (T) tertiary or oscillator plate coil. Refer to Figure 23.

To test for grounded conditions refer to Part III, Section 9.

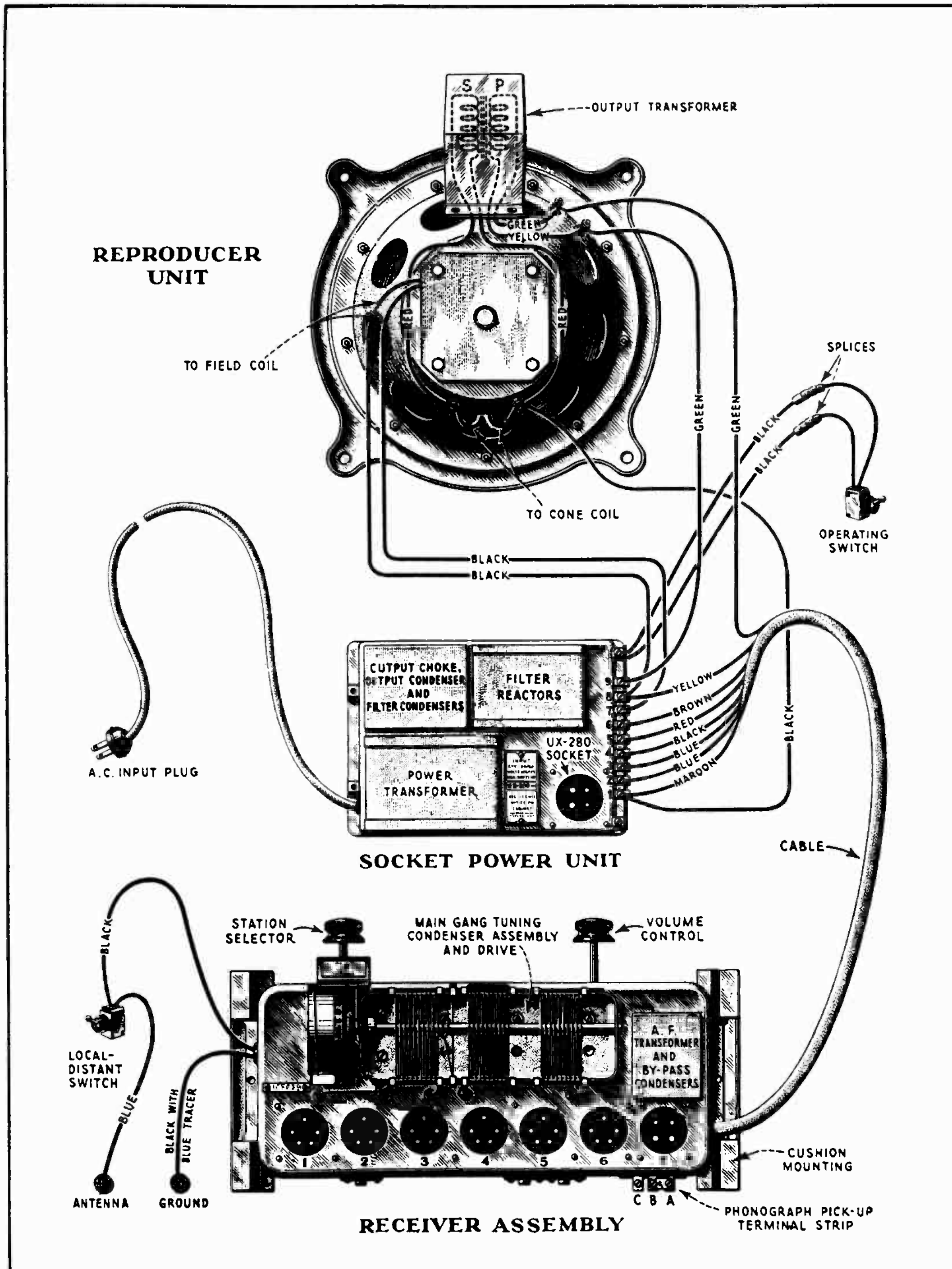


Figure 22—Radiola 66 cable connections, socket contacts, reproducer unit, socket power unit and receiver assembly

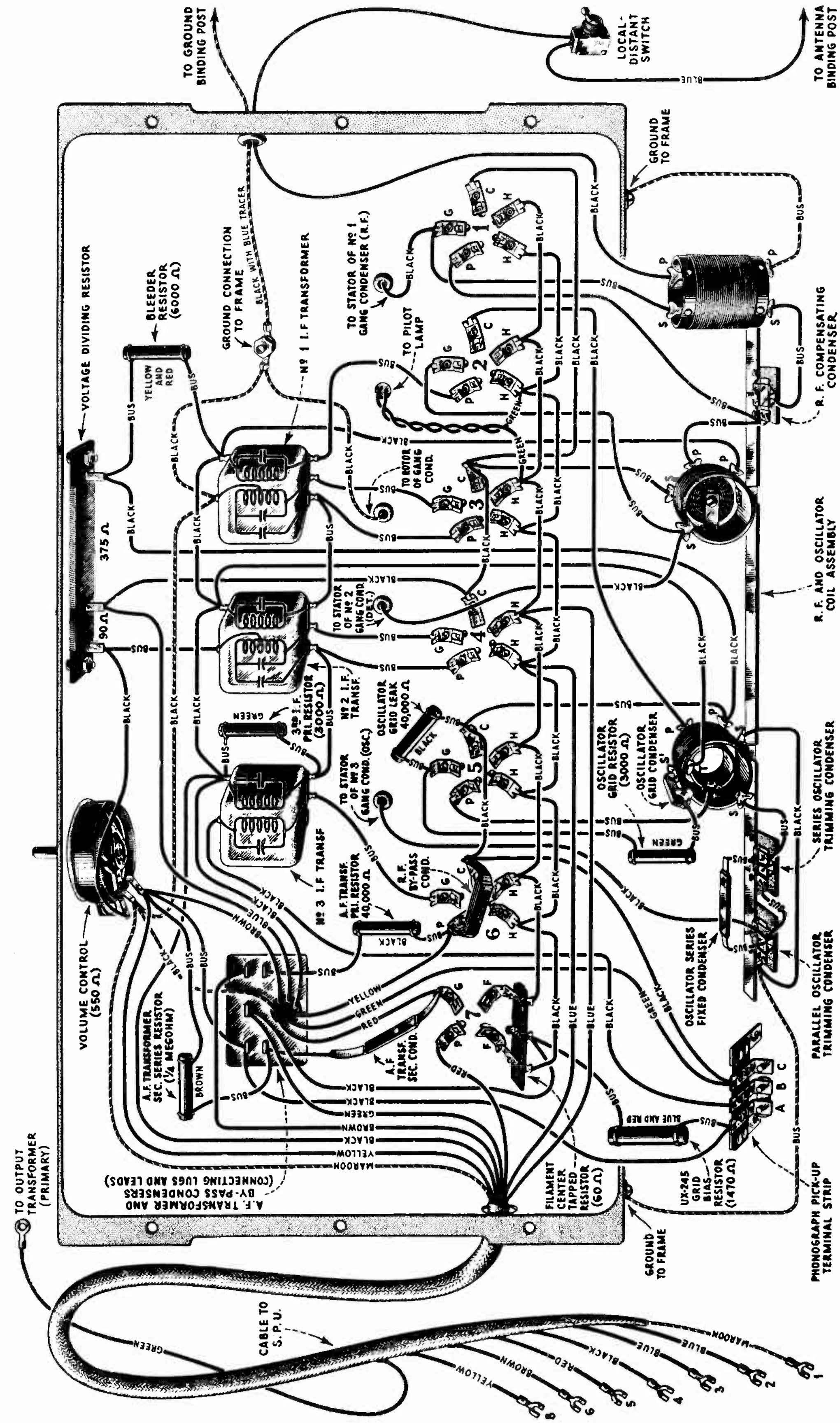


Figure 23—Continuity wiring diagram of receiver sub-chassis

[5] RECEIVER ASSEMBLY CONTINUITY TESTS

Remove all Radiotrons and disconnect cable at terminal strip. Remove all ground connections. Remove pilot lamp. See Figure 22 for cable lugs, terminals, and Radiotron socket contacts. For convenience coloring of lugs as well as numbers are shown. Code—Maroon (M), Black (Bla), Blue (Blu), Red (R), Brown (Br), Yellow (Y), Green (G).

First—Inspect all connections to observe any apparent faulty connection, rosin soldered joint, grounded or shorted lugs. Any connection removed or insulated as outlined below should be replaced before the next successive test.

Circuit	Terminals	Correct Effect	Resistance in ohms (Approx.)	Incorrect Effect Caused by
Antenna	Antenna post to ground post switch in "Distant" position	Closed	40	Open antenna inductance, or open "Local-Distant" switch
Grid	G1 to ground or Lug No. 1 (M)	Closed	5	Open secondary of 1st R. F. transformer, or open connection
	G2 to Cl	Closed	5	Open secondary of 2nd R. F. transformer, or open connection
	G2 to ground {Insulate volume control arm. See P. III, S. 9.	Open	—	Shorted 0.5 mfd. condenser
	G3 to ground	Closed	50	Open one-half secondary of 1st I. F. transformer
	G4 to Lug 8 (Y)	Closed	600	Open one-half secondary of 2d I. F. transformer or open volume control
	G4 to C4	Closed	140	Open one-half secondary of 2d I. F. transformer, or 90-ohm portion of voltage dividing resistor
	G5 to C5	Closed (Weak)	40000	Open grid leak or connection
	G5 to ground {Insulate volume control arm. See P. III, S. 9.	Open	If 3000	Shorted oscillator grid condenser
	G6 to terminal A or Lug 8 (Y) (Link closed)	Closed	100	Open secondary of 3rd I. F. transformer or open connection
	G7 to Lug 8 (Y)	Closed (Weak)	255,000	Open secondary of A. F. transformer, ¼ megohm resistor, or connection
Plate	P1 to ground {Insulate volume control arm. See P. III, S. 9.	Open	—	Shorted compensating condenser, or grounded 1st detector primary, or connection
	P1 to Lug 4 (Bla)	Closed	44	Open primary of 2nd R. F. transformer or connection
	P2 to Lug 4 (Bla)	Closed	20	Open 1st I. F. transformer primary coil, or connections
	P3 to Lug 4 (Bla)	Closed	20	Open 2d I. F. transformer primary, or connections
	P6 to Lug 6 (Br)	Closed	1050	Normal
			If 1023	A. F. Primary condenser shorted
			If 40000	A. F. primary condenser shorted and primary winding open
			If Open	A. F. primary winding open
	P5 to Lug 4 (Bla)	Closed	1.5	Open plate coil (Tertiary) of oscillator or connections
	P4 to Lug 4 (Bla)	Closed	20	Normal
			If 3000	Open primary coil of 3rd I. F. transformer (Resistance O. K.)
			If 0	Shorted primary condenser
			If Open	Open primary of 3rd I. F. transformer and resistor
Cathode and Filament	Cathodes 1, 3 and 4 to terminal "C"	Closed	375	Open connection, or 375-ohm section of the voltage dividing resistor. If low resistance then 0.5 mfd. condenser is shorted.
	Cathodes 2, 5 and 6 to Terminal "C"	Closed	—	Open pick-up winding of oscillator coil, or connections
	One filament contact of Socket 7 to Lug 8 (Y)	Closed	1500	Open one-half of center tapped resistor, or UX-245 bias resistor, or shorted condenser (across biasing resistor) if resistance is low
	Other filament contact of Socket 7 to Lug 8 (Y)	Closed	1500	Open other half of center tapped resistor, or UX-245 bias resistor, or shorted condenser (across biasing resistor) if resistance is low
	UNSOLDER ONE END OF FILAMENT CENTER TAPPED RESISTOR			
	Lug 2 (Blu) to one filament contact Socket 7	Closed	—	Open connections
	Lug 3 (Blu) to other filament contact Socket 7,	Closed	—	Open connections
	Lug 2 (Blu) to one heater contact of Sockets 1, 2, 3, 4, 5 and 6	Closed	—	Open connections
	Lug 3 (Blu) to other heater contact of Sockets 1, 2, 3, 4, 5 and 6	Closed	—	Open connections
Misc.	G3 to P3 (Disconnect bleeder resistor)	Open	—	Shorted 1st I. F. neutralizing condenser
	G4 to P4 (Disconnect bleeder resistor)	Open	—	Shorted 2nd I. F. neutralizing condenser
	G7 to output transformer Lug (G)	(Closed) (Weak)	257.000	Open resistors, or if closed strong, shorted 0.5 mfd. condenser
	Terminal "C" to Lug 8 (Y) (Open connection between volume control and voltage dividing resistor)	Open	—	Shorted 0.5 mfd. condenser
	P6 to C6	Open	—	Shorted 0.5 mfd. condenser
	C2 to C5	Closed	—	Open oscillator pick-up coil
	Lug No. 4 (Bla) to Terminal "C"	Closed	6000	Open bleeder resistor

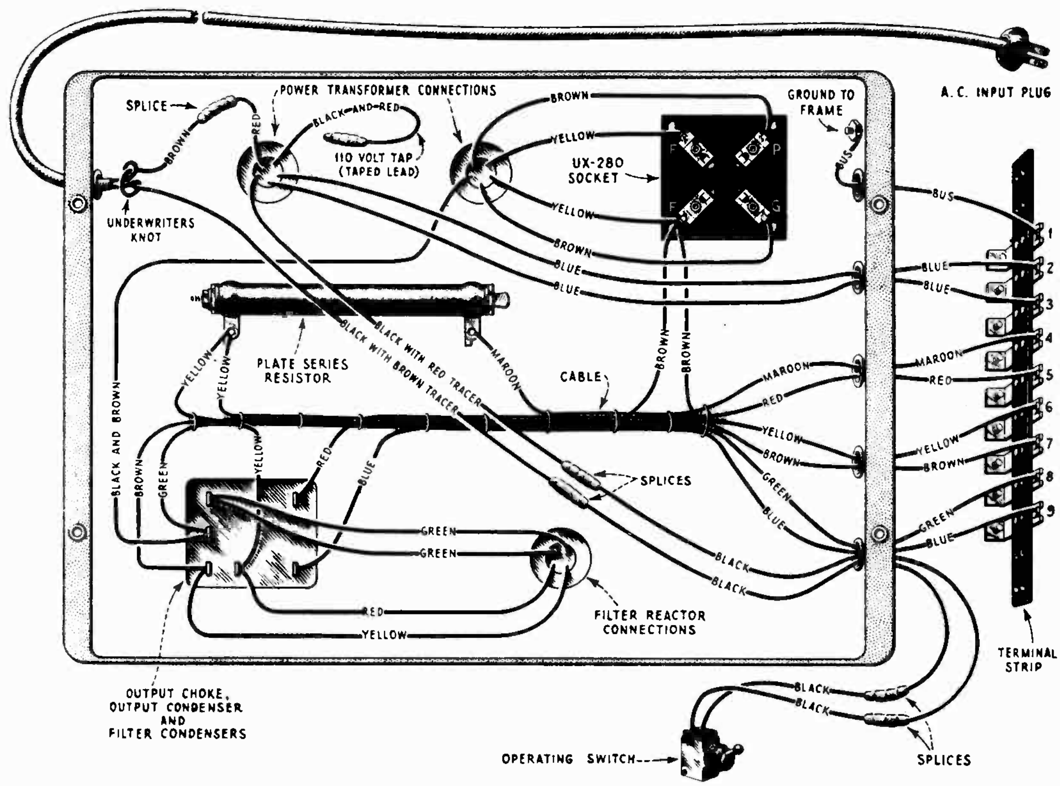


Figure 24—Continuity wiring diagram of socket power unit

[6] SOCKET POWER UNIT CONTINUITY TESTS

Remove Radiotron UX-280—Disconnect Cable at Terminal Strip

Refer to Figure 24

Terminals	Correct Effect	Resistance in ohms (Approx.)	Incorrect Effect Caused by
G to P of UX-280 socket	Closed	240	Open high voltage winding of power transformer
Across filament contacts of UX-280 socket	Closed	—	Open UX-280 filament winding of power transformer
Terminal 2 (Blu) to Terminal 3 (Blu)	Closed	—	Open 2.5 volt filament winding
Terminal 4 (M) to Terminal 6 (Y)	Closed	4800	Open resistor
Terminal 5 (R) to Terminal 7 (Br)	Closed	735	Open output choke one filter reactor or connections
Terminal 5 (R) to Terminal 6 (Y)	Closed	1315	Open output choke, other filter reactor, or connections
Terminal 1 to ground	Closed	—	Open connection
Terminal 7 (Br) to Terminal 8 (G)	Open	—	Shorted one or more filter condensers
Terminal 9 (Blu) to Terminal 5 (R)	Open	—	Shorted output condenser
Across A. C. input plug terminals (operating switch on)	Closed	—	Open primary winding of power transformer, defective switch, or connection

[7] CHECKING RESISTANCE VALUES

The values of the various resistance units of RCA Radiola 66 are shown in the schematic diagram, Figure 6. 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:

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

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 III, Sections 5 and 6.

[8] TESTING BY-PASS CONDENSERS

Proper testing of the 2 mfd., 1 mfd., ½ mfd., or 0.25 mfd. condensers is accomplished by charging them with a handy D.C. voltage, as from "B" batteries connected to give 90 to 157½ volts. If sparking occurs as the charge is applied the condenser is shorted. After a few seconds wait, a strong spark (the strength of the spark being greater, of course, for the 2 mfd. than the .25 mfd.), should appear when the condenser is discharged by shorting the terminals with a screwdriver. If no spark appears the condenser is probably open. If a slight spark occurs the condenser is probably leaky. A condenser having one side normally grounded, as shown in the schematic Figure 6, and tested with the unit in the receiver, if the opposite terminal is defectively grounded, the test will show a false short.

Smaller by-pass condensers as used in the Radiola 66, in the order of .05 or .0024 mfd. or less, cannot be successfully tested by the above method except for a shorted condition. For other suspected defects, if unable to measure the capacity, simple trial replacement is the best method.

[9] TESTING FOR GROUNDED PARTS IN RECEIVER ASSEMBLY

Grounded parts may cause various effects, as weak signals or no signals, wrong or no voltages at Radiotron sockets, etc.

The correct and necessary ground leads in the receiver are shown in Figure 6.

In testing for grounds that occur due to defective wiring or assembly, it is necessary to remove all the correct grounding connections in order to discover the wrong grounded part. This can readily be done by temporarily freeing the grounded leads to the frame as indicated by the broken line in the wiring diagram Figure 23, and insulating the rotating arm of the volume control by slipping a bit of paper between the arm contact and the resistance strip.

Testing for a ground then may be accomplished by using the continuity testing methods—preferably the method using a D.C. voltmeter with a battery in series. A defective ground will be truly indicated by a closed continuity test between the frame (ground) and a terminal of the suspected unit.

PART IV—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 66 are readily accessible and replacements can be easily made. Figure 5 is a sub-chassis view of the receiver. The following detailed procedure outlines the simplest method to be used in making replacements:

[1] REPLACING THE VOLUME CONTROL

(a) Remove the knobs on the volume control and station selector. These are of the push type, and they are removed by simply pulling them off the shafts. Between each knob and the cabinet will be found a metal spacer. These spacers must also be removed. To replace, merely push the knob on to the shaft, first matching the knob socket with its flat spring to the shaft, after replacing spacers.

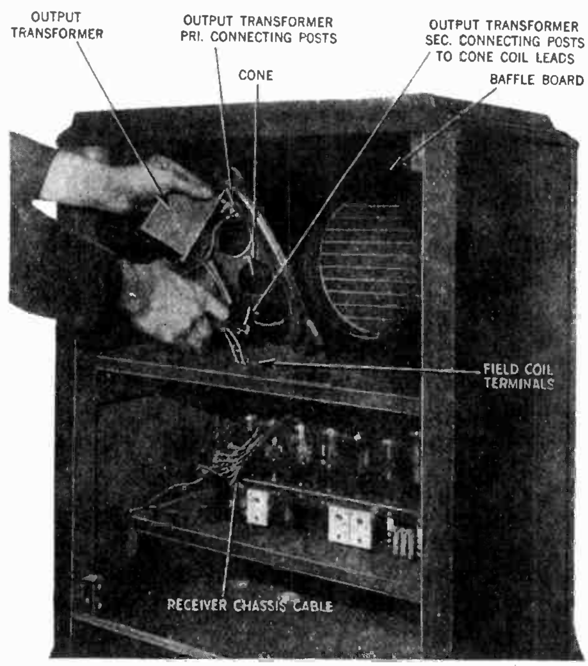


Figure 25—Removing reproducer from cabinet

(b) Remove rear grill by removing the wing nuts holding it in place.

(c) Remove the shield and insulating cover that are over the terminal strip. Then remove all cable connections to strip as well as connection to output transformer.

(d) Carefully remove the clamps that hold the cable and antenna wire to the side of the cabinet.

(e) Remove the antenna and ground wires from their binding posts, and "Local-Distant" Switch.

(f) Pull cable, antenna and ground leads from the shelf until all leads are clear.

(g) Remove the rear two screws and loosen the front two screws that hold the receiver cushion supports to the shelf.

(h) The receiver assembly may now be lifted clear of the supports and removed from the cabinet. See Figure 26.

(i) Place the volume control up and remove the two screws and nuts that hold it in place. The soldered connections must also be removed from the three terminal lugs.

(j) Remove the old volume control and fasten the new one in position by means of the two machine screws and nuts, and resolder the connections. The correct connections of these leads are shown in Figure 23.

(k) Return receiver assembly to cabinet and replace all cables and leads in the reverse manner of that used to remove them and be sure receiver assembly rests on rubber supports properly.

(l) Test Radiola and if O.K. return shield and insulator to their original position.

[2] REPLACING R.F. TRANSFORMER AND OSCILLATOR ASSEMBLY

The two radio frequency transformers and the oscillator coils are mounted on a metal strip, together with three small adjustable condensers and two fixed condensers.

This assembly must be replaced as a unit—the matching of the coils being an important point in the operation of the receiver. Use the following procedure:

(a) Remove receiver chassis from cabinet as described in Part IV, Section 1.

(b) Turn chassis on side and unsolder all leads to the assembly being replaced.

(c) Remove the three machine screws and lock washers that hold the supporting strip to the receiver frame.

(d) The assembly may now be removed and the new assembly fastened in position with the three machine screws and washers previously removed.

(e) Resolder all connections in their correct position on the assembly. This is shown in Figure 23.

(f) The receiver assembly may now be returned to the cabinet in the reverse manner of that used to remove it.

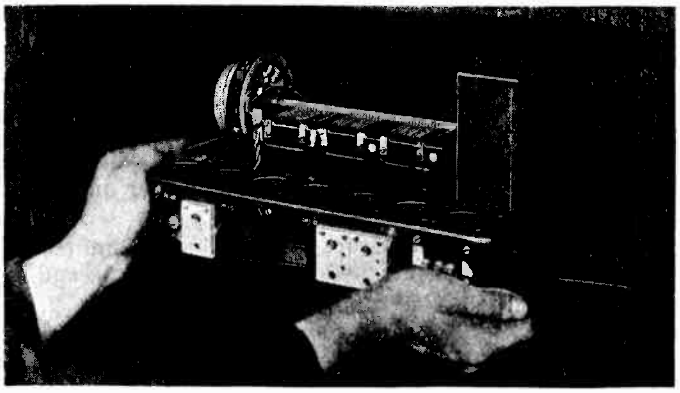


Figure 26—Removing receiver chassis from cabinet

[3] REPLACING RADIOTRON GANG SOCKETS

One socket assembly on the receiver chassis is of the gang variety, the other being a single unit. Both are held in place, together with their shields, by means of rivets which clamp them on the metal chassis frame. Use the following procedure when replacing these sockets:

(a) Remove the receiver assembly from the cabinet as described in Part IV, Section 1.

(b) Unsolder all connections to the particular socket or assembly being removed. The R.F. transformer assembly should be removed as a unit to provide room for replacing the six-gang Radiotron sockets.

(c) Drill out the rivets holding the Radiotron sockets to be replaced. In the case of the single UX or the gang UY the shield overlaps and will be held in place by the socket not removed.

(d) Remove the old Radiotron socket and fasten the new one in position by means of screws, nuts and washers. Resolder all connections and replace the R.F. assembly if removed. The correct connections are shown in Figure 23.

(e) Fasten receiver assembly in cabinet, connect cable and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[4] REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and drive are replaced in one unit as follows:

(a) Remove receiver assembly from cabinet as described in Part IV, Section 1.

(b) Remove pilot lamp and lead wires from condenser assembly. Remove the three screws, nuts and lock washers that hold the condenser assembly to the metal frame.

(c) Now pull the condensers as far forward as possible and unsolder the four leads connected at the rear. Remove the entire assembly by tilting slightly and pulling clear.

(d) Place the new assembly in the position occupied by the old one and solder the four leads to their proper connections.

(e) Fasten the three screws, nuts and lock washers in their proper position. Make sure that the screw that holds the ground connection on the under side of the chassis makes firm contact. Replace pilot lamp socket and lead wires.

(f) Return the receiver to the cabinet and replace all connections in the reverse order of that used to remove them.

[5] REPLACING CONDENSER DRIVE CORD

Considerable use may wear and break the condenser drive cord.

(a) To replace this cord it will be necessary to remove the gang condenser assembly and drive as explained in Part IV, Section 4.

(b) By following the diagram in Figure 9 tie the two ends of the new cord together to form a square knot; the finished looped length should be 10¾ inches approximately.

(c) Set the station selector so it will be at the minimum (all rotor plates out) position against the stop. This position should not be allowed to change or slip in the following procedure:

(d) Place cord with knot near the hole on the drum, holding the cord with the fingers of the left hand.

(e) By following the drive cord arrangement shown in Figure 9 the cord may be replaced. The cord should be started in the first groove left of center on the drive cord worm as viewed in Figure 9.

(f) When properly threaded, and with the drum still in its minimum position, the portion of the cord near the hole in the drum should be pulled through, and caught with the spring. This will hold the cord in its proper tension.

(g) Rotate station selector to insure cord knot has been set to run clear.

(h) Replace gang condenser and drive assembly in the reverse manner removed.

[6] REPLACING R.F. COMPENSATING AND OSCILLATOR TRIMMING CONDENSERS

The R.F. compensating and oscillator trimming condensers may require replacement. The R.F. compensating condenser and the series oscillator trimming condenser are identical, electrically and mechanically, but the parallel oscillator trimming condenser, located at the right end when viewed from rear, is different electrically.

To replace use the following procedure:

(a) Unsolder connections from unit to be removed.

(b) Remove the two small machine screws, fiber washers and nuts holding unit to R.F. and Oscillator Coil Assembly metal support.

(c) Mount the new unit in reverse manner, soldering connections correctly as shown in Figure 23.

NOTE.—Care should be used in tightening the bolts holding the "Isolantite" mounting, as uneven or excessive pressure may break the "Isolantite." "Isolantite" has very desirable electrical qualities and should be handled with care to prevent breakage. Be sure to replace the fibre washers removed in (b) above.

[7] REPLACING THE AUDIO TRANSFORMER AND BY-PASS CONDENSERS

Radiola 66 employs one audio transformer and necessary by-pass condensers, located at the left side of the receiver assembly facing the front of the Radiola. Should a replacement become necessary use the following procedure:

(a) Remove receiver assembly as described in Part IV, Section 1.

(b) Place the receiver chassis on its side and unsolder all connections to the audio transformer and by-pass condenser leads and lugs.

(c) Now turn up the six tabs that hold the transformer in place and remove it. The new one is then fastened in position.

(d) Resolder the leads from the new transformer and by-pass condensers to their correct points of connection as indicated in Figure 23.

(e) Fasten the receiver assembly in the cabinet in the reverse order of that used to remove it.

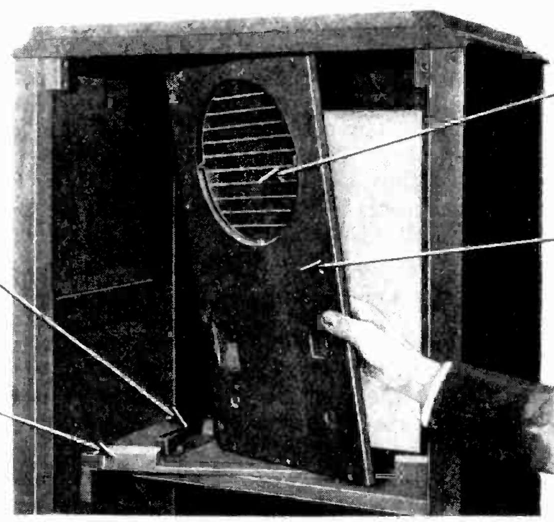


Figure 27—Removing grill panel from cabinet

[8] REPLACING PERFORATED DIAL SCALE

A step-by-step procedure to make replacement follows:

(a) Open rear grill of Radiola 66.

(b) Turn dial so that the two screws that hold the dial in place are toward the rear.

(c) Loosen screws, washers and nuts that hold dial in place.

(d) The old dial may now be pulled clear and the new one placed in the position occupied by the old one. Examine dial screen with pilot lamp lighted from the front of the Radiola to see that the numbers on the dial are in their correct position.

(e) Tighten screws holding dial in place after adjusting image correctly as outlined in Part I, Section 10. Replace rear grill.

[9] REPLACING POWER CABLE

A laced cable is used in Radiola 66 for connecting the S.P.U. to the receiver assembly and the reproducer unit. Should it be necessary to replace this cable use the following procedure:

(a) Remove receiver assembly from cabinet as described in Part IV, Section 1.
(b) Turn assembly bottom side up and unsolder all connections to the cable.
(c) Remove old cable and connect up the new cable as indicated in Figure 23, soldering all connections.
(d) Return assembly to cabinet in reverse order of that used to remove it.

[10] REPLACING INTERMEDIATE TRANSFORMERS

Radiola 66 has three intermediate frequency transformers. No. 1 and No. 2 are similar mechanically and electrically, but No. 3 is different. See Figure 23. These transformers are mounted on "Isolantite" support board which has very desirable electrical qualities and therefore should be protected against all damage as mentioned in Part IV, Section 6.

A step-by-step replacement procedure follows:

(a) Remove receiver assembly from cabinet as described in Part IV, Section 1.
(b) Remove tuning condenser assembly as described in Part IV, Section 4.
(c) Unsolder the connections of the transformer being replaced. Then turn up the metal tabs on the upper side of the receiver chassis. The old transformer may now be replaced by the new one. Turn over the metal tabs to hold it in place and resolder all connections. These are shown in Figure 23. Be careful not to heat any connection more than necessary to make a good joint, as excessive heat may change the capacity of the primary fixed condenser, thus rendering the entire transformer assembly defective.
(d) After returning the main tuning condensers to the receiver chassis in the reverse order used in removal, it will be necessary to tune and neutralize the transformer just connected in position. The correct procedure for doing this is contained in Part II, Section 16.
(e) The entire receiver may then be tested and a check made on the adjustment of the oscillator trimming condensers as described in Part II, Section 17. After all tests and adjustments are completed the receiver assembly should be returned to the cabinet in the reverse order of that used to remove it.

[11] REPLACING TAPPED RESISTANCE UNIT IN RECEIVER ASSEMBLY

A tapped resistance unit in the receiver assembly of Radiola 66 provides the various grid and cathode voltages. To replace this tapped resistance unit proceed as follows:

(a) Remove receiver assembly as described in Part IV, Section 1.
(b) Unsolder all connections to the tapped resistance unit.
(c) Remove the two screws, nuts and washers that hold the resistance unit in place. This will release the unit and the new one can be fastened in place with the screws, nuts and washers previously removed.
(d) Solder all the leads to their correct connections. (See Figure 23.)
(e) Return receiver assembly to cabinet in the reverse order used to remove it.

[12] REPLACING MISCELLANEOUS PARTS IN RECEIVER ASSEMBLY

The parts such as the UX-245 grid bias resistor, center tapped filament resistor, oscillator resistor, second detector plate to cathode by-pass condenser, etc., may be easily removed by unsoldering the connections of the parts themselves.

By observing the wiring diagram in Figure 23 and the photograph in Figure 5, location and wiring of any particular part is readily ascertained for purposes of removal and replacement.

[13] REPLACING CONE OF REPRODUCER UNIT

To replace a cone, remove the entire reproducer unit from the cabinet, using the following procedure:

(a) Remove S.P.U. from upper shelf as outlined in Part IV, Section 15.
(b) Disconnect cable lead to output transformer primary.
(c) Remove the four bolts that hold the reproducer to the baffle board, at the same time supporting the reproducer by hand to prevent it falling. Place the unit in position convenient for work.

(d) Remove the nine nuts and machine screws that hold the cone ring in place. Remove this ring and washers.

(e) Remove the screw and washer that centers the cone. The cone may now be removed and the new one placed in the position occupied by the old one.

(f) Return the centering screw, the ring, washers and nine screws and nuts to position, but do not tighten. The cone should now be centered as described in Part II, Section 22, and all screws tightened.

(g) The unit should now be returned to the cabinet in the reverse manner of that used to remove it.

[14] REPLACING OUTPUT TRANSFORMER

Should it be desirable to replace the output transformer, use the following procedure:

(a) Remove complete reproducer unit as outlined in Part IV, Section 13.

(b) Disconnect output transformer leads from their respective parts on the reproducer frame.

(c) Unscrew the three small bolts and nuts holding the transformer to frame and the unit will be free from the reproducer.

(d) Replace and connect in the reverse manner (See Figure 22).

[15] REPLACING FILTER CONDENSERS. OUTPUT CONDENSER, AND OUTPUT CHOKE

The filter condensers, output condenser and output choke are enclosed as a unit in a metal container. Should replacement be necessary, use the following procedure:

(a) Remove the shield and all connections from the Socket Power Unit terminal strip.

(b) Remove the four machine screws that hold the S.P.U. to the cabinet. The S.P.U. may now be lifted clear of the cabinet.

(c) To prevent damaging the series plate resistor remove it as described in Part IV, Section 18.

(d) Unsolder all connections to the unit being replaced.

(e) Bend up the tabs that hold the unit to the S.P.U. base. Remove the old unit and fasten the new one in position by bending the tabs down so that it is held tightly to the S.P.U. base.

(f) Replace and solder all connections. The correct connections are shown in Figure 24.

(g) Return the S.P.U. to the cabinet in the reverse order of that used to remove it. Replace all connections and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[16] REPLACING POWER TRANSFORMER OR FILTER REACTOR

The power transformer and filter reactors are both held in place by means of tabs which form a part of their case, being turned over on the under side of the S.P.U. base. A step-by-step replacement procedure follows:

(a) Remove S.P.U. from cabinet as described in Part IV, Section 15.

(b) To prevent damaging the series plate resistor remove it as described in Part IV, Section 18.

(c) Unsolder all connections to unit being replaced.

(d) Bend up the tabs that hold the unit to the S.P.U. base.

(e) The old unit may now be removed and the new one placed in position. Bend over the tabs on the new one so that it is fastened tightly to the S.P.U. base.

(f) Solder all connections as shown in Figure 24.

(g) Fasten the S.P.U. in the cabinet in the reverse order of that used to remove it.

[17] REPLACING TERMINAL STRIP ON S.P.U. OR RECEIVER ASSEMBLY

Should the terminal strip on the S.P.U. or phonograph pick-up terminal strip require replacement use the following procedure:

(a) Remove the S.P.U. or receiver assembly from cabinet as described in Part IV, Section 1 and Section 15.

(b) Unsolder all leads to the terminal strip.

(c) Release two screws holding strip to S.P.U. base, or receiver assembly.

(d) The strip may now be removed and replaced by a new one.

(e) Fasten new strip in position by means of two machine screws, lock washers and nuts previously removed.

(f) Solder all leads to terminal strip. The color scheme and correct connections are shown in Figures 23 and 24.

(g) Return S.P.U. or receiver assembly to cabinet in the reverse order, and connect cable properly (See Figure 22).

[18] REPLACING MISCELLANEOUS PARTS IN S.P.U.

The plate supply resistor and UX-280 socket in Radiola 66 may require replacement. The following general outline will apply to these units:

(a) Remove S.P.U. from cabinet as described in Part IV, Section 15.

(b) Unsolder leads from defective unit.

(c) The series plate supply resistor may be easily removed by removing the nut and lock washer holding the resistor to the brackets (riveted to S.P.U. base) by a threaded rod. The UX-280 socket should be removed by drilling out the rivets and replaced as is explained in Part IV, Section 3.

(d) Solder leads to new unit as indicated in Figure 24.

(e) Return S.P.U. to cabinet in reverse order of that used to remove it.

[19] REPLACING FRONT GRILL PANEL OR CLOTH

Should it be necessary to replace the front grill panel or cloth the procedure below should be followed:

(a) Remove S.P.U. as outlined in Part IV, Section 15.

(b) Remove reproducer unit as outlined in Part IV, Section 13.

(c) Remove receiver assembly as outlined in Part IV, Section 1.

(d) Remove upper shelf by removing the wood screws holding shelf to cabinet. Save screws and keep separate, as different length screws are used in this procedure.

(e) Remove reproducer baffle board by removing the wood screws holding it in place.

(f) Remove lower baffle support (See Figure 27) by removing wood screws holding unit.

(g) The front grill panel or board, which carries the grill cloth, grill cloth protector, and escutcheons, may now be removed after removing the wood screws holding it in place.

(h) New cloth may be replaced by using clamps or tacks to hold it in place temporarily while glue is applied to frame and the cloth lined up square and smoothed out to make a permanent job.

(i) Replace front grill panel in reverse manner.

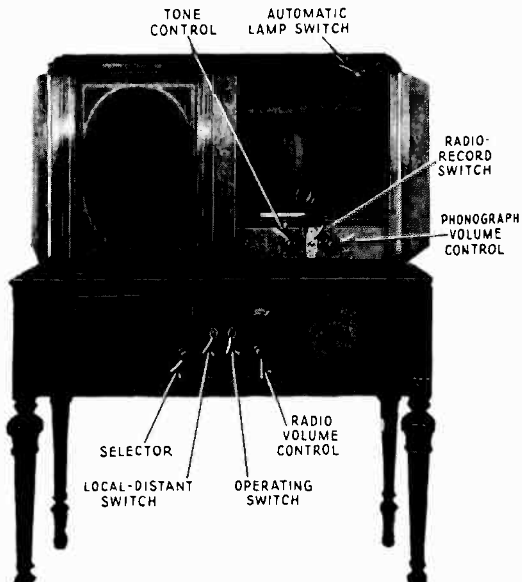
SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no reception, low volume, 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 Reception	Defective operating switch	Repair or replace switch
	Loose volume control arm	Tighten volume control arm, P. II, S. 4
	Defective power cable	Replace power cable, P. IV, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. IV, S. 2
	Defective I.F. transformer	Replace I.F. transformer, P. IV, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. IV, S. 7
	Defective Oscillator coil	Replace R.F. and oscillator coil assembly, P. IV, S. 2
	Defective by-pass condensers	Replace by-pass condensers, P. IV. S. 7
	Defective socket power unit	Check socket power unit by means of continuity test, and make any repairs or replacements necessary, P. III, S. 6
	Defective output transformer	Replace output transformer, P. IV, S. 14
	Open cone coil of reproducer unit	Check cone coil and if open replace cone, P. IV, S. 13
Low Volume	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 14
	Trimming condensers out of adjustment	Adjust trimming condensers, P. II, S. 17
	I.F. transformers not correctly aligned	Align I.F. transformers correctly, P. II, S. 16
	Defective power cable	Repair or replace cable, P. IV, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. IV, S. 2
	Defective I.F. transformer	Replace I.F. transformer, P. IV, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. IV, S. 7
	Dirty prongs of Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
	Defective by-pass condensers	Replace defective by-pass condensers, P. IV, S. 7
	Defective main tuning condenser	Replace defective tuning condensers, P. IV, S. 4
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. III, S. 2
	Defective socket power unit	Check socket power unit by means of continuity tests and make any repairs or replacements necessary, P. III, S. 6
Poor Quality or Noisy Reception	Defective A.F. transformer	Replace A.F. transformer, P. IV, S. 7
	Defective by-pass condenser	Replace defective by-pass condenser, P. IV, S. 7
	Dirty contact arm of volume control	Clean contact arm on volume control, P. II, S. 4
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
	Volume control advanced too far	Reduce setting of volume control, P. I, S, 6
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 14
	I.F. Neutralizing condenser out of adjustment	Align and adjust I.F. transformers correctly. P. II, S. 16
	Defect in audio system	Check and repair any defect, P. II, S. 11
	Open grid circuit in any stage	Check circuit and repair defect, P. III, S. 5
	Microphonic Radiotrons	Interchange Radiotrons
Excessive Hum	Defective center tapped resistance unit	Replace defective resistance unit, P. IV, S. 12
	Socket plug position	Reverse socket plug
	Line voltage low	Solder line tap for low line voltage, P. I, S. 7
	Defective S.P.U.	Check S.P.U. by continuity tests, P. III, S. 6
Radiotrons Fail to Light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer, P. IV, S. 16
	No. A.C. line voltage	Turn A.C. line voltage "On"

RCA
Radiola 67

SERVICE NOTES



RCA Radiola 67

First Edition—30M

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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 Department 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 Department 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

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

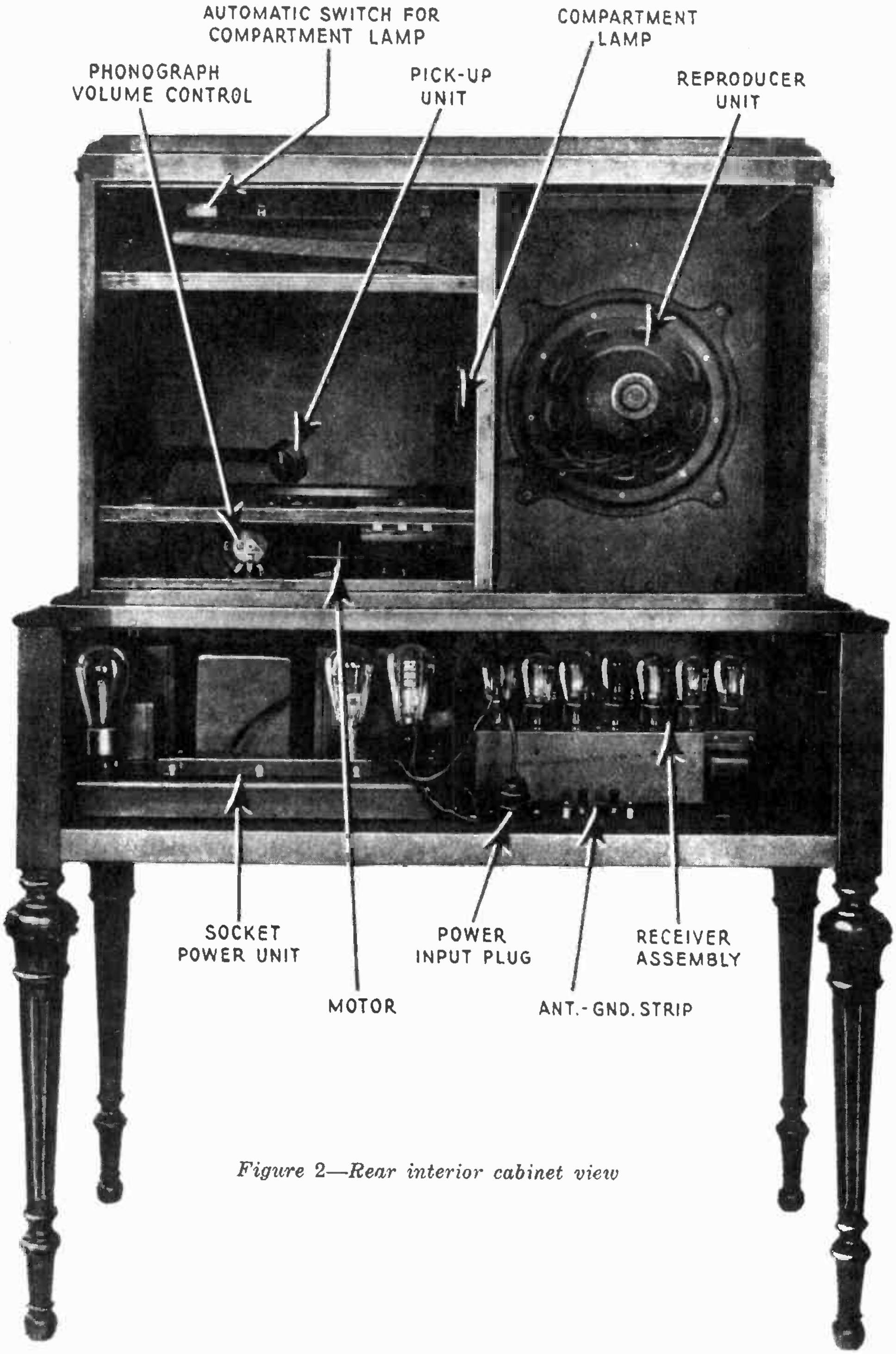


Figure 2—Rear interior cabinet view

RCA RADIOLA 67

Service Notes

Prepared by RCA Service Department

ELECTRICAL SPECIFICATIONS

Rating	Voltage, 105 to 125 volts—Frequency 50 to 60 cycles
Rating (Also Available)	Voltage, 200 to 250 volts—Frequency 50 to 60 cycles
Rating (Also Available)	Voltage, 105 to 125 volts—Frequency 25 to 40 cycles
Power Consumption	335 watts (total)
Power Consumption of Phonograph Motor	35 watts
Power Consumption of Phonograph Compartment Lamp	15 watts
Recommended Antenna Length	30 to 60 feet
Type of Circuit	Superheterodyne with Automatic Volume Control
Types and Number of Radiotrons	UY-227—7
	UX-250—1
	UX-281—2
Number of Radio Frequency Stages	1
Type of First Detector	Tuned Input (Grid Bias)
Number of Intermediate Frequency Stages	2
Type of Second Detector	Power (Grid Bias)
Number of Audio Stages—Radio	1
—Phonograph	2
Type of Rectifier	Full Wave
Type of Loudspeaker	Dynamic
Type of Loudspeaker Field	Series 100-volt, 100 M.A.
Type of Phonograph Pick-up	Flexible—Low Impedance—Needle Diameter .035 to .070 inches
Type of Phonograph Motor	Induction Disc

PHYSICAL SPECIFICATIONS

Height	56 inches
Depth	21 inches
Width	40 ½ inches
Weight (Receiver complete with phonograph ready for operation)	225 pounds
Weight (Packed for Shipping)	375 pounds
Packing case dimensions	24 in. x 46½ in. x 60½ in.

INTRODUCTION

The Radiola 67 is a combination electric phonograph and sensitive superheterodyne receiver designed to be energized from an AC house lighting supply. It is housed in a walnut console cabinet embellished with burl maple panels and rosewood trimmings. The instrument is entirely self-contained except for the power supply cord, ground and antenna, which should be a single-wire indoor or outdoor type from 30 to 60 feet in length.

The radio receiver, although fundamentally similar to the Radiola 64, has several new features and improvements. The automatic volume control and resonance indicator are retained, but visual tuning is facilitated by the addition of a "silent tuning switch" which is actuated by pressing inward on the station selector knob. The intermediate frequency transformers (shown in Figure 9) have been improved electrically by incorporating shunt resistors in the primary circuits which makes it possible to preserve the advantage of critical coupling under all conditions and thus eliminate the possibility of "double -peak" tuning. The increased plate voltage at the second detector provides—even with signals having low percentage modulation—sufficient audio excitation to load the UX-250 power Radiotron. The plate voltage now applied to the UX-250 although increased only 12 per cent as compared with the Radiola 64, augments the maximum undistorted power output of this stage by 40 per cent making available a sound volume well in excess of normal requirements.

No specific mention above has been made of the following electrical and mechanical improvements which were first incorporated in the Radiola 66 and which have been retained in this model:

(a) Local-distant switch
(b) Use of "Isolantite" mounting in I. F. transformers, R. F. compensating condenser, and oscillator trimming condensers
(c) Improved accessibility of I. F. adjustments
(d) Electrostatic shield between R. F. gang tuning condensers
(e) Projection type of dial scale with kilocycle marking
(f) Use of 175 K. C. for mid-band I. F. frequency.

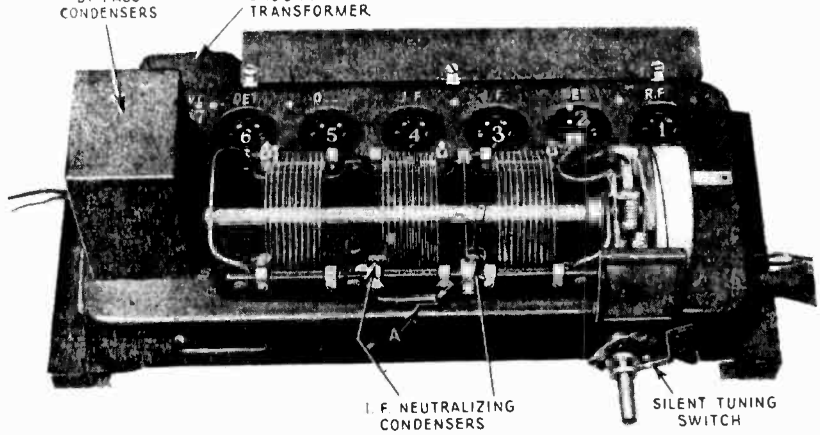


Figure 3—Top view of receiver chassis

The tone quality control—the knob of which is indicated in the cover illustration—provides for tone balance of both the radio and phonograph output and permits the operator who has a preference for low tones to accentuate the bass register by rotating the control knob in a counter-clockwise direction. In the extreme clockwise position the tone quality control circuit is open and normal reproduction with natural high-pitched tones and overtones is achieved.

A simple and easily operated means of transition from broadcast to phonograph reproduction is provided by the "Radio-Record" switch which is of the double-throw, telephone key-type, arranged to lock in either position. For phonograph reproduction the switch is thrown to the "Record" position which connects the pick-up impedance matching transformer to the grid of the second detector, simultaneously reducing the bias so that this tube acts as an audio amplifier. At the same time, the bias of the volume control tube is reduced which results in cutting off the plate current flow in the radio and intermediate frequency amplifier Radiotrons rendering the receiver inoperative. In the "Radio" position, the phonograph transformer secondary is short-circuited and the proper bias voltages are provided for receiver operation.

The phonograph is driven by an induction-disc motor controlled by a fly-ball governor. The rugged mechanical construction of the phonograph motor and the simplicity of the motor circuit reduce the service requirements of this unit to a minimum. The motor switch may be operated manually, but provision is also made to open the motor supply circuit automatically and apply a friction brake to the turntable at the finish of the record—if eccentrically grooved (Victor) records are used.

The phonograph pick-up represents the latest advance in the art. The low impedance coil design with the balanced type armature results in substantially uniform reproduction of all frequencies. The flexible mounting reduces needle pressure and decreases record wear.

An added convenience is provided in the phonograph compartment lamp which is automatically switched on when the doors of this compartment are opened.

Frequent reference will be made to Service Notes covering Radiola 64 and Radiola 66, as many of the adjustments necessary in servicing the Radiola 67 have been covered in detail therein. Also, a thorough description of the mechanical details of the phonograph will be found in the Radiola 47 Service Notes.

The Radiola 67 Service Notes can be applied in their entirety to the 200 to 250-volt (60 cycle) model of this set, inasmuch as this model differs from standard only in the primary of the power transformer.

The 25 to 40 cycle (105 to 125-volt) set has certain changes in the socket power unit which are explained in detail on page 11. With the additional information there noted this book will apply fully to the "25 cycle" Model 67.

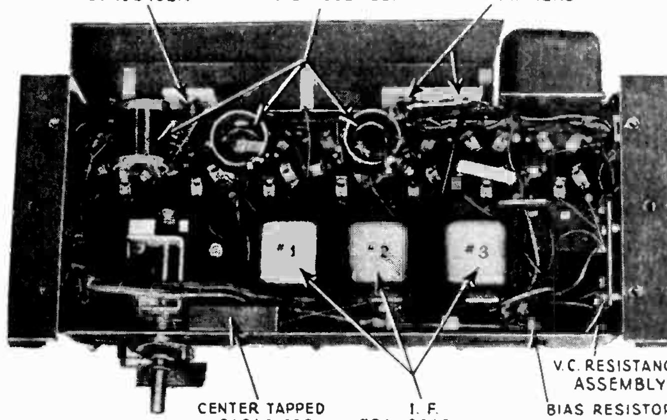


Figure 4—Sub-chassis view of receiver

PART I—INSTALLATION

Information covering the unpacking and setting up of the Radiola 67 is given in the Instruction Book which accompanies the set.

Particular emphasis, however, should be laid on the following:

(a) Care should be used in removing the set from the packing case and in moving it about on the floor. It should be lifted bodily rather than slid along the floor where the legs might catch in crevices or obstructions. Although the legs will support the weight of the set with a reasonable factor of safety, they must not be carelessly subjected to bending stresses.

(b) In addition to removing the wooden cradle, reproducer "U" clamp and block, and receiver chassis blocks, the paper wedges must be removed from the phonograph motor.

(1) KNOBS

The Station Selector Knob is secured to the shaft by means of a set-screw. This must be loosened or removed before attempting to pull off the knob. Failure to observe this precaution may result in damage to the flexible drive mechanism.

The remaining three wooden knobs are of the "push-pull" type and can be pulled off readily.

(2) ANTENNA (Indoor or Outdoor)

Refer to R-66 Service Notes, pp. 8—9

Note. Under certain conditions of noise pick-up, it has been recommended that copper braid be placed over the lead-in. Lead-in wire covered with metallic braid is now available in the market (see July "Town Crier," vol. VII, No. 10, p. 15).

(3) GROUND

Refer to R-66 Service Notes p. 10.

(4) RADIOTRONS

Figure 5 shows diagrammatically the Radiotron sequence in the Radiola 67. Information concerning the selection of Radiotrons for the various sockets is given in the R-66 Service Notes pp. 10-11. It should be noted further that a low emission UX-250 Radiotron will produce weak signals and distortion. Occasionally a low emission or very gassy UX-250 tube will cause a "popping" sound in the reproducer which in extreme cases may damage the cone.

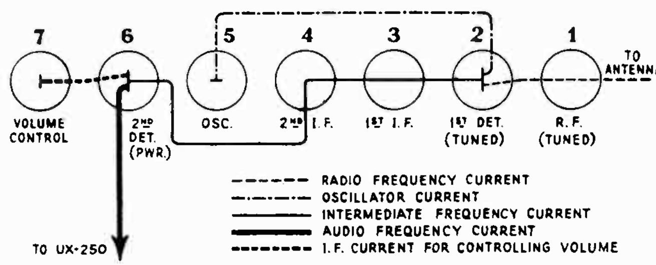


Figure 5—Radiotron sequence

(5) RECEIVING STRONG LOCAL STATIONS

Refer to R-66 Service Notes p. 11.

(6) "LOCAL-DISTANT" SWITCH

Refer to R-66 Service Notes p. 12.

(7) LOW LINE VOLTAGE ADJUSTMENT

Refer to R-64 Service Notes p. 10.

(8) JERKY ACTION OF SELECTOR

Refer to R-66 Service Notes p. 12.

(9) PILOT LAMP INSTALLATION

Refer to R-66 Service Notes pp. 12-13.

(10) PHONOGRAPH

Refer to R-47 Service Notes.

PART II—SERVICE DATA

(1) ANTENNA SYSTEM FAILURES

Refer to Radiola 66 Service Notes, p. 14.

(2) RADIOTRON SOCKETS AND PRONGS

Refer to Radiola 66 Service Notes, p. 14.

(3) BROKEN CONDENSER DRIVE CORD

Refer to Radiola 66 Service Notes, pp. 14-15.

(4) NO SIGNAL, OR LOW VOLUME

The trouble may be due to a poor contact in the "Radio-Record" switch or in the "Silent Tuning Switch" (See Par. 6 below). These switches should be operated a few times in an effort to restore the electrical contact; this failing, the switches should be inspected for mechanical defects or broken connections.

For routine tests and data, refer to Radiola 66 Service Notes pp. 15-16.

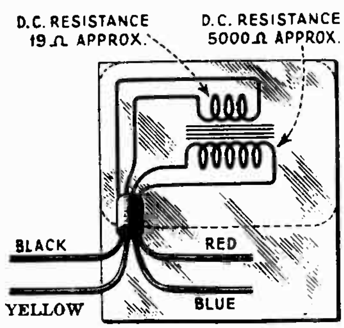


Figure 6—Internal connections of phonograph input transformer

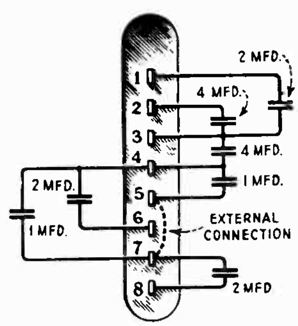


Figure 7—Internal connections of SPU filter condensers

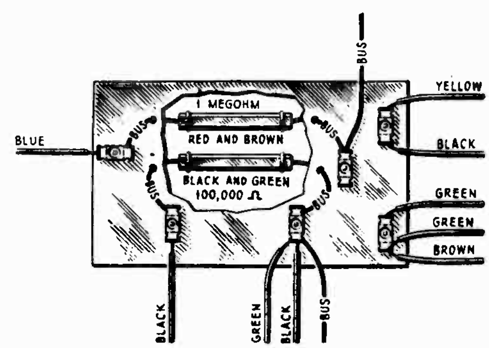


Figure 8—Connections of volume control resistors

(5) HUM OR HOWL (Audio or Acoustic)

Refer to Radiola 66 Service Notes, pp. 16-17-18.

It should be noted also that the filter reactor (indicated in Figure 15) has a definite polarity which depends on the direction of winding in the audio transformers. This reactor is properly connected at the factory, but should either an audio transformer or reactor become defective, there is a possibility that the replacement unit may be wound in the reverse direction. If hum is noted, it is only necessary to reverse the leads (black and green), at the reactor. It is recommended that the receiver be placed in operation and a listening test made before the S. P. U. is secured to the cabinet.

(6) "SILENT TUNING" SWITCH

This switch is operated—as noted in the Introduction—by pressing inward on the Station Selector Knob. Its purpose is to prevent an increase in noise level during tuning intervals between stations—the noise would otherwise be increased due to the action of the automatic volume control. It also provides a means of reducing the sound volume to a whisper and thus direct the attention of the operator to the use of the resonance indicator in tuning. Because of the action of the Automatic Volume Control, aural tuning of the Radiola 67 is not recommended as it is virtually impossible to secure the optimum adjustment by ear.

At first sight, it may appear from an inspection of the schematic circuit diagram, which reveals that this switch operates electrically by short-circuiting the voice coil of the reproducer, that its use would result in zero sound output. This is not the case, however, since the switch points and current path—lead and chassis ground return—have a resistance which—though low—is still appreciable in comparison to that of the voice coil.

The mechanical construction of the switch is such that the Station Selector Knob will return outward to its normal position when released, allowing the switch contacts to open. Friction developing in the switch mechanism due to foreign matter or other causes may prevent the contacts from opening, resulting in signals of low volume.

(7) ADJUSTMENT OF R. F. COMPENSATING CONDENSER, OSCILLATING TRIMMING CONDENSERS, and I. F. TUNING and NEUTRALIZING CONDENSERS.

Refer to Radiola 66 Service Notes, pp. 18-19-20-21-22.

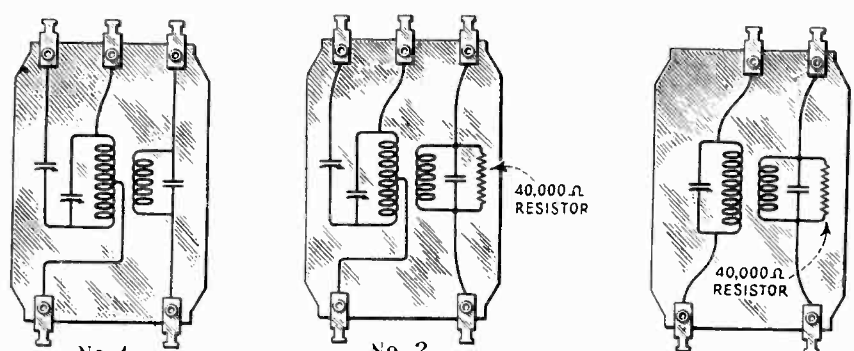


Figure 9—Internal connections of I. F. transformers

It should be noted that the automatic volume control will operate to defeat accurate adjustments unless the volume control potentiometer is in the maximum or extreme clock-wise position. In making adjustments of the oscillator trimming condensers or I. F. transformer tuning condensers, it is recommended that the "Local-Distant" switch be put in the "Distant" position and the Antenna-Ground binding posts be short circuited with a short piece of wire. The coupling lead or coil from the test oscillator should be brought just close enough to give a good readable deflection of the test-set resonance indicating meter. In tuning the intermediate transformers, the volume control tube should NOT be removed as its effective grid-to-cathode capacity—which is by no means negligible in comparison with the total capacity in the third I. F. transformer secondary circuit—affects the adjustment of this stage.

(8) DISTORTED REPRODUCTION

Refer to Radiola 66 Service Notes, p. 18.

This effect may also be caused by a defective output coupling device (see Figure 20). The continuity of the reactor (Terminals 1 and 2), and of the output winding of the transformer (Terminals 4 and 5) should be checked. If these are O. K. the 2 mfd. condenser should be tested by connecting a D.C. voltmeter (0—150 volt scale) in series with a 90-volt "B" battery to Terminals 2 and 3. The voltmeter should read zero after giving a slight kick; a steady reading indicates a shorted condenser.

If radio signals have a pronounced "flutter," the condensers in the receiver chassis condenser pack (See Figure 12) should be tested by the method described in Part III, Section 4.

If the reproduction is faulty only when the phonograph is in operation, an inspection of the phonograph volume control resistor should be made to determine whether the movable arm is making proper contact—the location of this unit is indicated in Figure 1. The contacts of the "Radio-Record" Switch should also be examined. A continuity test of the phonograph input transformer (See Fig. 3 for location) should be made.

Internal connections and approximate D.C. resistance values are indicated in Figure 6.

If none of the above units are faulty, the pick-up should be examined or an O. K. pick-up substituted for the one under suspicion. Methods for testing and adjusting the pick-up are covered fully in the Radiola 47 Service Notes.

A soft iron keeper should be placed across the poles of the pick-up permanent magnet before its removal. Failure to observe this precaution, will result in a loss of magneto-motive force which will impair the sensitivity of the unit.

(9) 25-40 CYCLE RADIOLA 67

This model differs from the 50-60-cycle set in four details:

(a) A 25-40 cycle power transformer is used. The voltages and position of the terminals are standard, however.

(b) A 25-40 cycle motor is used in the phonograph. Information pertaining to the service of the 50-60 cycle motor (See Radiola 47 Service Notes) applies without modification to this unit.

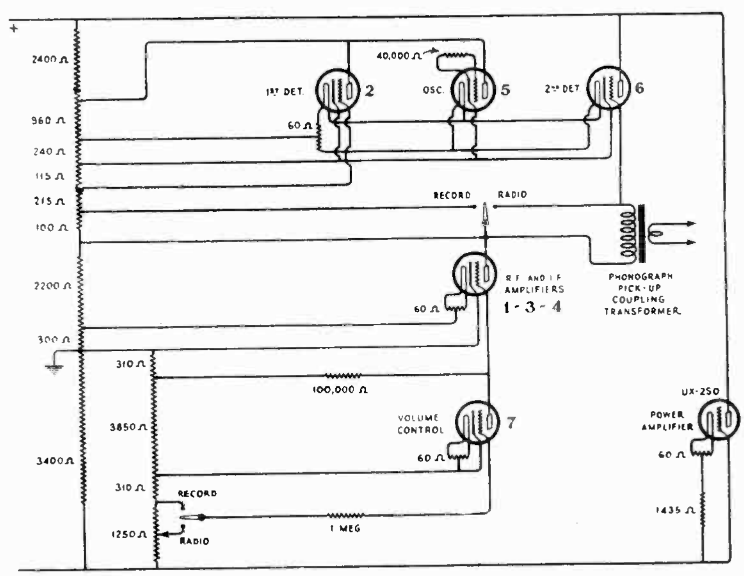


Figure 10—Schematic circuit diagram of voltage supply system

(c) A 1 mfd. condenser—contained in can affixed to vertical cabinet partition—is connected in parallel to the first (2 mfd.) filter condenser.

(d) A 3 mfd. condenser—contained in can referred to in Paragraph (c)— is connected from the mid-point (arm) of the UX-250 filament potentiometer to the high side of the reproducer field coil.

In servicing the SPU of a 25-40 cycle Model Radiola 67, it is recommended that the two additional condensers just described be disconnected at the SPU capacitor pack and tested. Radiola 67 (50-60 cycle) Service Notes and wiring diagrams will then apply in their entirety.

In reconnecting, it should be noted that the green and black leads from the external 1 mfd. condenser (See Paragraph (c) Section 9) should be connected to Terminals 1 and 3, respectively, of the SPU capacitor pack (See Figure 23). Also the black and yellow leads from the external 3 mfd. condenser (See Paragraph (d), Section 9) should be connected to Terminals 3 and 6, respectively of the SPU capacitor pack. There is only one black lead to the two external condensers and it is common to both.

SERVICE DATA CHART
Referring to Radio Reception

Indication	Cause	Remedy
No Reproduction	Defective Radiotrons	Replace with O.K. tubes
	No supply voltage	Examine fuses and power supply cord
	Defective operating switch	Replace
	" Radio-record switch	Clean contacts. Replace if necessary
	Silent tuning switch (stuck or defective)	Free by pulling forward on selector knob. Replace if defective
	Shorted condenser (plate to cathode No. 2 detector)	Replace
	Shorted condenser in output coupling device	Replace. (See page 23) Sec. 8
	Defective vol. control or No. 7 Radiotron	Test by removing tube No. 7. Replace defective unit
	Loose connections at SPU terminal strip	Tighten
	Defective parts in SPU, receiver or reproducer	Check by continuity tests and replace the defective part.
Low Volume	Defective or inadequate antenna	See R-66 Service Notes, p. 14
	Defective "local-distant" switch	Replace. See R-66 Service Notes, p. 12
	Defective Radiotrons	Replace
	R. F. compensating condenser out of adjustment	Adjust. See R-66 Service Notes, p. 18
	I. F. tuning condensers out of adjustment	Retune and re-neutralize. See Part II. Sec. 7
	Low voltages at sockets or terminal strip	Check using tables, p. 18. Locate defective part by continuity test and replace
	Shorted 0.002 mfd. condenser in tone control	Check by rotating ½ megohm variable resistor to extreme clockwise position which opens circuit. Replace defective condenser (located across terminals of A.F. input transformer).
	Bathtub condensers out of line	Align. See R-66 Service Notes, pp. 22 and 23
	Silent tuning switch stuck	Check by pulling forward on Station Selector Knob. Replace mechanism, if defective

SERVICE DATA CHART—Continued
Referring to Radio Reception

Indication	Cause	Remedy
Low Vol.	Oscillator trimming condensers out of adjustment	Adjust. See Part II, Sec. 7
	Open or shorted parts	Check by continuity tests, pp. 25-34, and repair or replace
Distorted Reproduction	Defective Radiotrons	Replace
	Improper voltages at Radiotron sockets	Check voltages (See tables, p. 19) Isolate trouble by continuity tests
	Oscillator trimming condensers out of adjustment	Adjust. See Part II, Sec. 7
	Oscillation in R.F. or I.F. stages	See Part II, Sec. 7
	I.F. transformers out of alignment	See Part II, Sec. 7
	Defective audio input transformer	See text, p. 22. Replace, if defective
	Defective output coupling device	See text, p. 23. Replace, if defective
	Shorted cone coil	Check DC resistance (approx. 11 ohms) Replace cone if defective
	Cone out of center	Adjust. See R-66 Service Notes, p. 24
	Open or leaky condensers in capacitor packs	Test (See text, p. 20). Replace if defective
	Defective connections or parts	Check by continuity tests
	Heterodyne due to interfering signal	Try local position of Local-Distant Switch
Hum	Defective Radiotrons	Replace
	Open or shorted center-tapped fixed resistors	Repair or replace
	Hum suppressor out of adjustment	Adjust. See R-64 Service Notes, p. 11
	Low-emission UX-281	Replace
	Open by-pass or filter condensers	Test and replace. See text, p. 20
	Shorted filter reactor (or reversed polarity)	Test and replace. See text, p. 22.

SERVICE DATA CHART—Continued
Referring to Radio Reception

Indication	Cause	Remedy
Hum	Open chassis grounds	Check from diagrams pp. 26, 28, 32
	Interference from external arcing ground	Try local position of Local-Distant Switch
	Grounded pilot lamp socket	Clear ground
	Loose laminations in power transformer	See R-66 Service Notes, page 16
Acoustic Howl	Failure to remove shipping blocks	Remove and check rubber mounting in receiver assembly
	Microphonic Radiotrons	Interchange tubes
Audio Howl	Poorly soldered or corroded joints	Clean and re-solder
	Open by-pass condenser or ground connection	Check connections
	R.F. or I.F. oscillation	See Part II, Sec. 7
	Heterodyne from interfering radio signal	Try local position of Local-Distant Switch

If the radio receiver and associated audio system operate normally, but throwing the Radio-Record Switch to the "Record" position results in unsatisfactory phonograph reproduction, the following charts will be found helpful in diagnosing the trouble.

Referring to Phonograph Reproduction

Indication	Cause	Remedy
No Reproduction	Poor contact or broken connections in Radio-Record Switch	Check connections and clean contact points
	Open connection of volume control	Repair
	Defective winding in phonograph input audio transformer	Check resistance of windings. See Figure 6, p. 9.

MAGNETIC PICK-UP SERVICE DATA CHART

Indication	Cause	Remedy
No Reproduction	Poor volume control contact between arm and resistance	Clean volume control resistance with a pipe cleaner and any of the various cigarette lighter fluids
	Open or shorted pick-up coil or connections	Repair any loose connections by resoldering or replace an open coil as described in Part III, Section 3, R-47 S. Notes
Weak or Distorted Reproduction	Loose needle	Tighten needle in socket with needle set screw
	Dirty contact in volume control	Clean volume control resistance and contact arm
	Armature out of adjustment	Center armature as described in Part III, Section 1, R-47 S. Notes
	Defective rubber damping block or pivot supports	Replace rubber damping block and pivot supports as described in Part III, Section 2, R-47 S. Notes
	Dirt in armature air gap	Clean all dirt from air gap by means of a blower or disassemble pick-up and clean. Remove rust from armature if necessary.
	Weak magnet	Remagnetize magnet by taking to magneto repair shop. Place keeper across pole faces until magnet is again in place in the pick-up. Making repairs without placing a keeper on the magnet is the easiest way of having the magnet lose its magnetism.
	Needle holder rattle	If the needle hole of the pick-up cover touches the set screw that holds the needle, a rattle will result. Relocate the cover by shifting the magnet clamp

PHONOGRAPH MOTOR SERVICE DATA CHART

Indication	Cause	Remedy
Failure to run	Operating switch or record switch "off" or defective	Turn switches "On" or repair any defective switches
	No A. C. power at socket outlet	Check with a O-150-V. A. C. voltmeter
	Loose or open connection in the connector cord or plug	Repair any defective connections
	Wrong or open connections of motor coils	Check wiring and make any repairs necessary
	Jammed motor	Rotate turntable by hand with power on. If jammed examine motor and replace or repair part causing jamming
	Shipping blocks not removed	Remove paper blocks between disc and coils use to hold motor during shipment
Motor fails to maintain correct speed	Low line voltage	Check line voltage with a O-150 Volt A. C. voltmeter while motor is running and phonograph is in operation. The voltage must be between 105-125 for proper operation. See Part IV, Sec. 3, R-47 S. Notes
	Improper lubrication	Examine moving parts, bearings and gears. If oil and grease is gummy clean and lubricate as described in Part III, Section 4, R-47 S. Notes
	Motor improperly mounted or jarred in shipping	Loosen the three motor mounting screws and tighten alternately while motor is running. Do not tighten any screw sufficiently to cause binding or slowing down of the motor.
	Worn motor spindle ball bearing	Replace a worn ball bearing
	Weak motor coils	After checking all the above causes and the motor still fails to maintain speed replace one or both of the motor coils as described in Part IV, Section 9, R-47 S. Notes. It is possible for them to test electrically O. K. but be weak in operation
Noisy operation	See R-47 S. Notes, Part IV, Section 6, for the cause and remedy of defects or improper adjustments that may cause noisy operation	
Hum	Loose coils or coil laminations	Tighten screws that hold coil cores together. If this does not correct the hum place a small wooden wedge between inside of coil and core.
	Cabinet hum	Tighten motor mounting screws or replace felt washers between motor and cabinet.

AUTOMATIC STOP SERVICE DATA CHART

Indication	Cause	Remedy
Failure to trip	Loose latch plate	Tighten latch plate screws with plate in correct position (See Fig. 15, R-47 S. Notes)
	Latch trip does not engage latch plate properly	Increase tension on latch trip by cutting off one or more of tension spring coils
	Defective latch plate. If the friction lever swings with the eccentric record groove but the operating lever fails to swing or swings slightly, the latch plate is probably caught in a lever on one of the teeth of the latch plate	Remove all burrs from the latch plate with a piece of emery cloth or a fine file. Also make sure no burrs are on the edge of the latch trip
	If failure to trip is not due to the above causes, bend the lug "A," Figure 15, R-47 S. Notes, on the brake lever away from the brake lever pivot so that there will be a smaller bite between the hand lever and the latch at point "B"	
Premature Tripping	Worn surface	Examine the contact surfaces between the hand lever and the latch (point "B," Figure 15, R-47 S. Notes). These two surfaces must be square, they should be squared with a fine file
	Insufficient tension	If the latch does not strike the latch stop pin "C" (Figure 15, R-47 S. Notes), when the hand lever is pulled to the "On" position, increase the tension of the latch spring or decrease the tension of the latch trip spring
	If the mechanism still trips prematurely after checking the springs and contact surfaces as suggested in the foregoing, bend the lug "A" toward the brake lever pivot so that there will be a larger bite of the hand lever at the point "B" (Figure 15, R-47 S. Notes).	
Brake fails to stop turntable	Worn friction leather, sticky brake	See Part V, Section 1, R-47 S. Notes
Switch Failure	Mal-adjustment of switch	See Part V, Section 2, R-47 S. Notes

PART III—ELECTRICAL TESTS

(1) VOLTAGE SUPPLY SYSTEM

Figure 10 illustrates schematically the resistance network which supplies the proper plate, grid-bias, and cathode-bias voltages to the Radiotrons. The resistances associated with the automatic volume control are also shown (See also Figure 8). (For further detail concerning the operation of the automatic volume control see Radiola 64 Service Notes, p. 24).

(2) VOLTAGE READINGS AT TERMINAL STRIP (SPU)

Contact with the maximum open-circuit—cable off—high voltage available across Terminals 3 and 11 at the terminal strip should be avoided. Also power should NOT be applied to the S.P.U. with reproducer field disconnected.

The column entitled "Cable Connected and Tubes Lighted" in the appended table gives the terminal voltages under actual operating conditions.

The column entitled "Cable Off" gives the open circuit voltages. If these check reasonably well, it is a good indication that the S.P.U. is O.K., except possibly for excessive hum or high resistance joints caused by corrosion or poor soldering.

If the "Cable Off" voltages are normal, but some of the readings are low with the cable connected, a short-circuit or ground in the cable or receiver assembly is indicated.

Should the "Cable On" voltages check with the table, but no voltage be available at some of the Radiotron socket points, an open circuit is indicated in the cable or receiver assembly.

Having determined whether the fault is in the receiver assembly or SPU the proper continuity test (See pp. 24 to 34) may be applied which will indicate the location of the defect.

SOCKET POWER UNIT TERMINAL STRIP VOLTAGES

Volume Control at Maximum

Terminal Nos.	Cable Connected and Tubes Lighted Volts	Cable Off Volts
12 to 13 (Heater Tubes 2-5-6)	2.55	2.60 A.C. (rms)
14 to 15 (Heater Tubes 1-3-4)	2.58	2.70 A.C.
16 to 17 (Heater Tube 7)	2.55	2.60 A.C.
9 to 3	358.	376. D.C.
9 to 4	235.	218. D.C.
9 to 5	174.	157. D.C.
9 to 6	167.	150. D.C.
9 to 7	153.	138. D.C.
9 to 8	147.	133. D.C.
9 to 11	134.	184. D.C.

Measurements should be made with line voltage within the range for which the 110-120-volt switch is set. It is assumed in Column 2 that O.K. tubes are placed in the sockets. Voltages given are approximate only and will vary somewhat under different operating conditions.

(3) VOLTAGE READINGS AT RADIOTRON SOCKETS

Socket voltage readings (which may be taken with a Weston Model 537 Set Analyzer or similar instrument) such as are given in the tables below are frequently helpful in locating trouble. It should be borne in mind, however, that it will be impossible in practice to duplicate these readings exactly due to manufacturing tolerances, variations in line voltages, the use of leads and meters of different resistances, and the fact that long leads may cause oscillation when attached to the R.F. or I.F. sockets.

The following measurements were made at a line voltage corresponding to the setting of the voltage adjustment 110-120-volt switch.

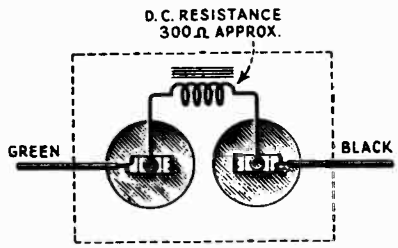


Figure 11—*Internal connections of filter reactor*

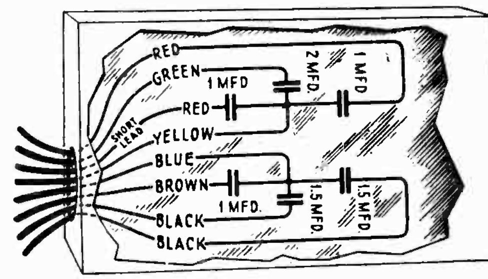


Figure 12—*Internal connections of receiver by-pass condensers*

VOLTAGE READINGS AT RADIOTRON SOCKETS
"Radio-Record" Switch in Radio Position—Volume Control at Minimum

Socket No.	Cathode to Heater Volts	Cathode to Grid Volts	Cathode to Plate Volts	Plate Current Milamps.	Filament or Heater Volts (rms.)
1 (R.F.)	19.	—35.	160.	0.0	2.40
2 (No. 1 Det.)	14.	—8.	68.	1.2	2.35
3 (No. 1 I.F.)	19.	—35.	160.	0.0	2.40
4 (No. 2 I.F.)	19.	—35.	160.	0.0	2.40
5 (Osc.)	14.	0.0	68.	6.2	2.35
6 (No. 2 Det.)	14.	—28.	215.	0.7	2.35
7 (V.C.)	0.	—1.5*	25.*	0.7	2.35
UX-250	—	—65.	435.	49.	7.2
Volume Control at Maximum					
1	16.	—8.	120.	4.5	2.40
2	14.	—8.	73.	1.5	2.35
3	16.	—8.	120.	4.5	2.40
4	16.	—8.	120.	4.5	2.40
5	14.	0.0	73.	5.8	2.35
6	14.	—29.	235.	0.6	2.35
7	0.	—2.5*	78.*	0.0	2.35
UX-250	—	—80.	440.	55.	7.2
Switch in "Record" Position					
6	14.	—20.	200.	1.8	2.35
7	0.	—1.5*	25.*	0.7	2.35

*Readings will vary considerably depending on resistance of voltmeter used.

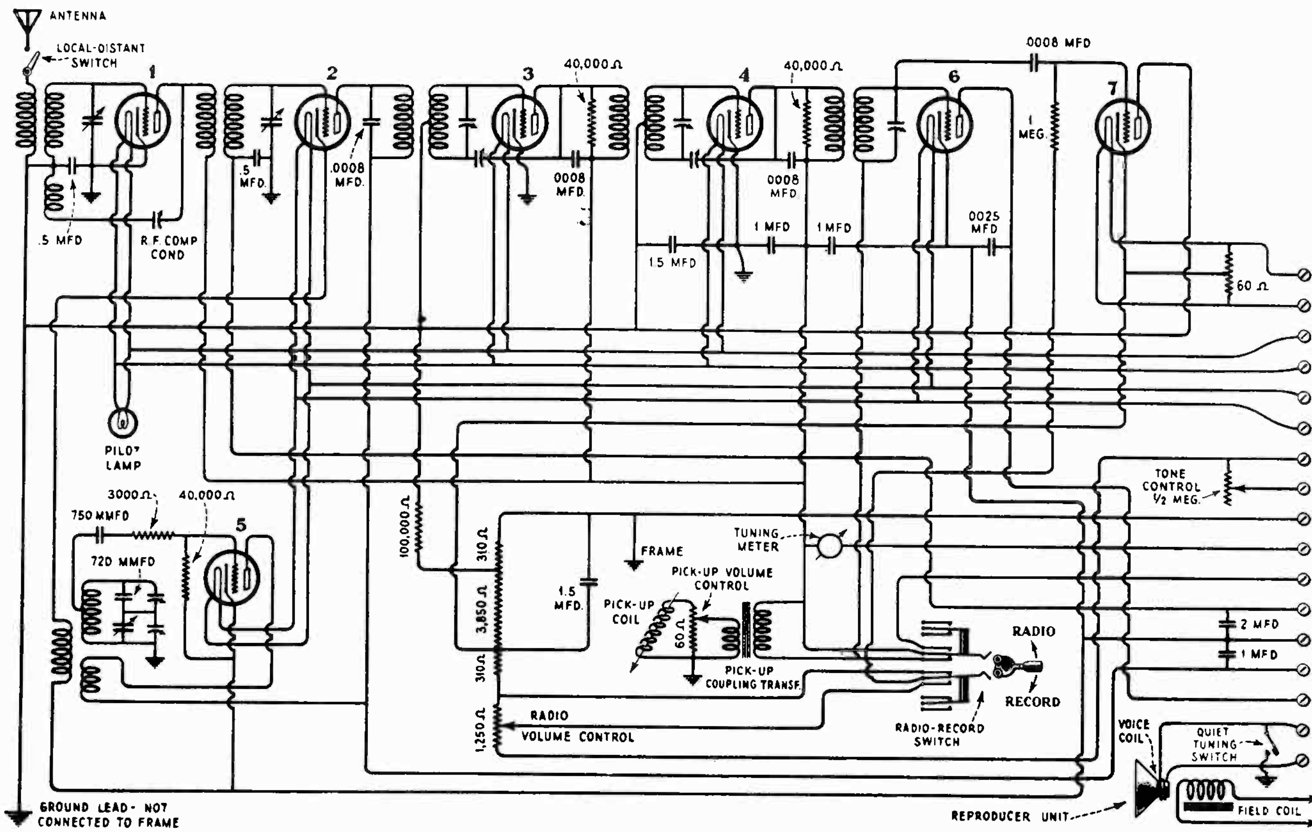


Figure 13—*Schematic circuit diagram of receiver assembly*

(4) GENERAL TESTING METHODS

Most radio receiver failures are due to one or more of the following electrical defects: short-circuits, partial short-circuits, open-circuits, and grounds (a special case of short circuit).

Coils and resistors are normally closed—or continuous—circuits and may be tested by means of a D.C. voltmeter in series with a battery having an E.M.F. approximately equal to the full-scale reading of the voltmeter. The resistance of the circuit can be calculated from the formula:

$$\left(\frac{\text{Reading obtained of battery alone}}{\text{Reading obtained with resistor or coil in series}} - 1 \right) \begin{array}{c}\text{Resistance}\\ \text{of meter}\\ \text{in ohms}\end{array} = \begin{array}{c}\text{Unknown}\\ \text{Resistance}\\ \text{in ohms}\end{array}$$

For high values of resistance a voltmeter having an internal resistance of 1,000 ohms per volt should be used.

Condensers, on the other hand, should pass no current when subjected to a pure D.C. voltage and are, consequently, under this condition, open-circuit devices. They may be tested by the D.C. voltmeter method described above. The needle of the meter may "kick" up-scale when the voltage is applied—due to the charging current—but it should return immediately to zero. If the meter continues to read, the condenser is leaky or short-circuited and should be discarded as defective.

Open circuits in condensers of more than 1,000 micro-micro-farads capacity (0.001 mfd.) may be tested for as follows: procure a Neon glow lamp—such as the Cooper-Hewitt 115-volt 3.5 milliamperes glow lamp—and connect it in series with a 115-volt supply of 60-cycle alternating current and in series with the condenser under test. The lamp will glow if the condenser is not open (the terminals of the condenser should be short-circuited momentarily to make certain that the lamp is OK). Condensers of less than 0.001 mfd. capacity cannot be tested by this method due to their high reactance at 60 cycles. In this case, a capacity bridge should be used. For

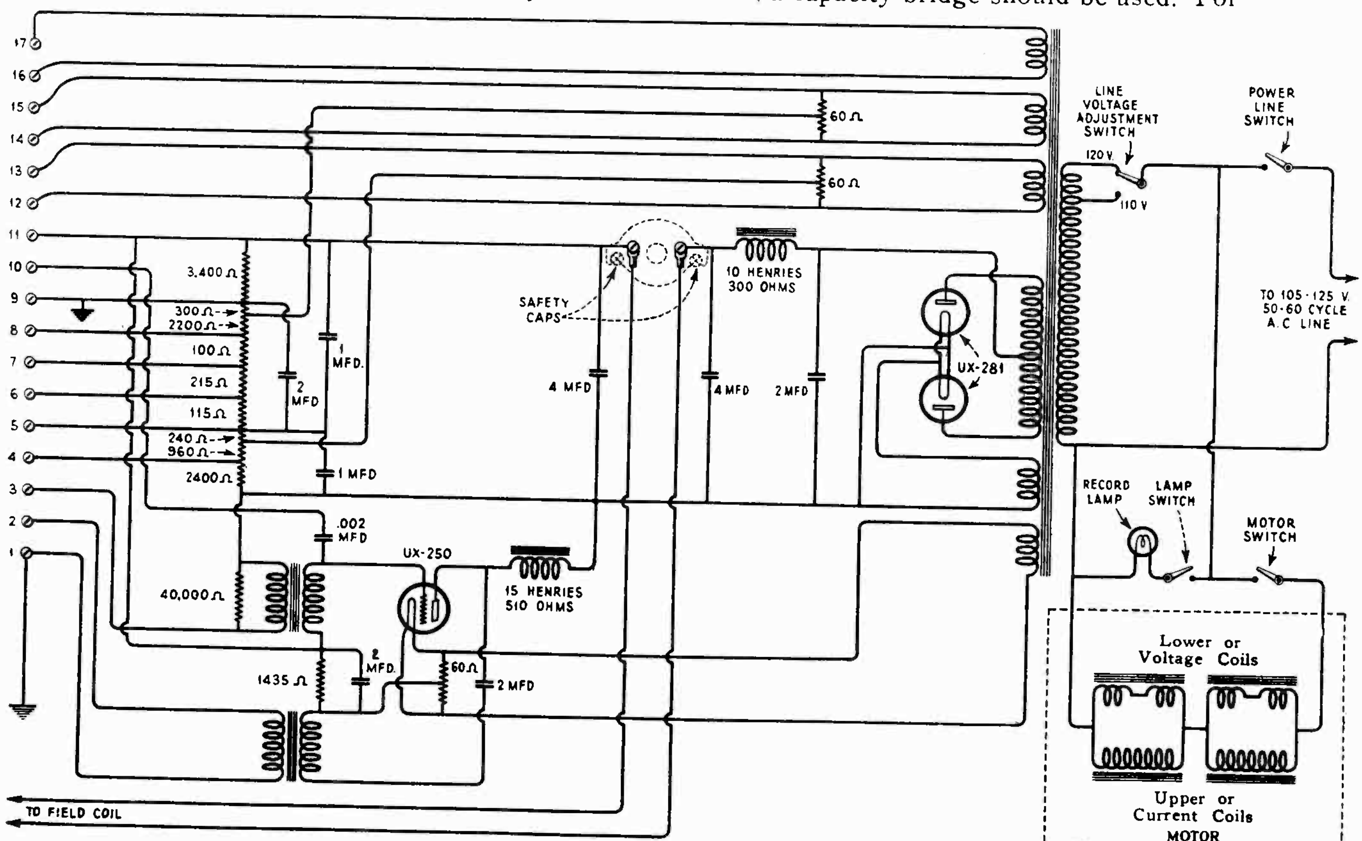


Figure 14—Schematic circuit diagram of socket power unit, phonograph motor and adjacent circuits

a rough test, a pair of 'phones can be connected in series with the condenser and an audio frequency voltage.

The possibility of a short-circuit in the condenser should be eliminated by the D.C. test before applying the open-circuit test.

(5) TONE QUALITY CONTROL CIRCUIT

An inspection of the schematic circuit diagram (Figure 13) will reveal that this circuit consists of a 0.002 mfd. condenser in series with a variable resistor. This combination is connected across the secondary of the audio input transformer (See Par. 7 this section.)

The resistance of the variable resistor increases from about 2,000 ohms to 500,000 ohms as the control knob is turned clockwise. In the extreme clockwise position, the resistance is infinite (nearly) and the tone control circuit is open.

From the above it will be evident that a short -circuited 0.002 mfd. condenser will greatly reduce the strength of the audio signal as the control knob is rotated counter-clockwise with no increase in the relative strength of the low-frequency tones. With normal output if no increase in bass tones is noted when the control knob is rotated counter-clockwise, an open in the tone control circuit is indicated. Also a short-circuited variable resistor will be manifested by a preponderance of low-frequency tones and no variation in tone quality as the knob is rotated. Check by disconnecting the resistor.

(6) CAPACITOR PACKS

The location of the S.P.U. capacitor pack is shown in Figure 15, and the internal connections together with the capacity values are illustrated in Figure 7. Short-circuited condensers will result in low terminal voltages and, in general, in excessive heating of the filter reactor (See Figure 15) and possibly of the plates of the UX-281 rectifier Radiotrons. An open-circuit in the pack or at its terminals will usually cause a hum in the signal output. The testing methods described in Section 4 can be used to isolate the defect.

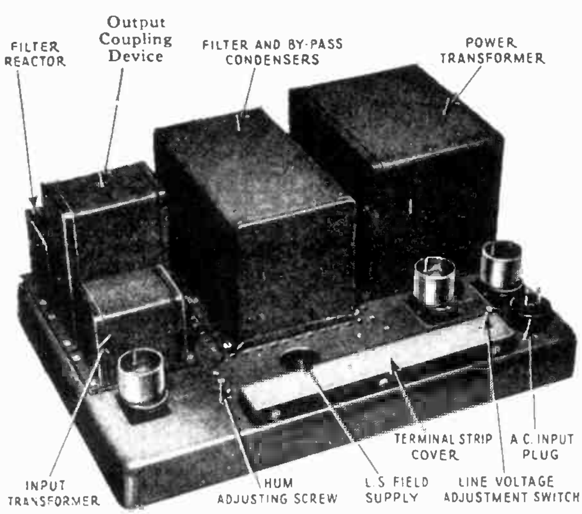


Figure 15—Top view of socket power unit

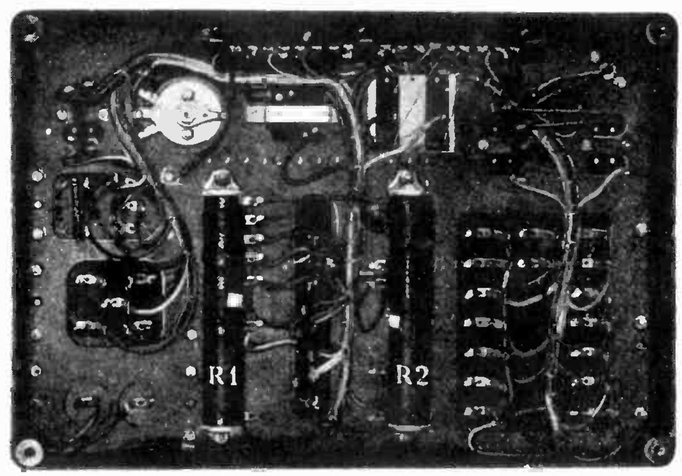


Figure 16—Sub-chassis view of socket power unit

The receiver assembly capacitor pack is shown in Figure 3 and the internal connections and capacitances are given in Figure 12. (N. B.—This diagram shows eight leads. Later productions of this pack will have seven leads; the short red lead will be connected to the brown lead internally and only the latter brought out). A short circuit in any of the capacitors will result in low voltages at some of the socket points. Open circuits in or at the terminals of the capacitor pack will probably result in varying signals or flutter.

(7) AUDIO INPUT TRANSFORMER

The location of this device is shown in Figure 15. The internal connections and the D.C. resistances of the windings are shown in Figure 19. It will be noted that there are five terminals on the base, of which, four are connected internally to the transformer windings. The fifth terminal serves as a support and connection for the 0.002 mfd. tone quality control condenser. Open or short circuits can be tested for by measuring the resistance of the windings by the method in Section 4.

(8) OUTPUT COUPLING DEVICE

The location of this device is indicated in Figure 15 and the internal connections of the plate reactor, coupling condenser, and output transformer are shown in Figure 20. The D.C. resistances of the windings are shown in Figure 20.

If the output coupling device is suspected of being defective, the resistance of the reactor—Terminals 1 to 2—and that of the output winding—Terminals 4 to 5—should be checked.

The 2 mfd. condenser can be tested by the D.C. test and the "glow lamp" test (See Section 4) across Terminals 2 to 3. If the glow lamp lights, it indicates that the A.C. circuit through the condenser and transformer primary is continuous. If the above tests have disclosed no defect, it is likely that the output transformer primary is totally or partially short-circuited. There is no simple method of making a direct test for this defect. The "elimination method" just described must be employed.

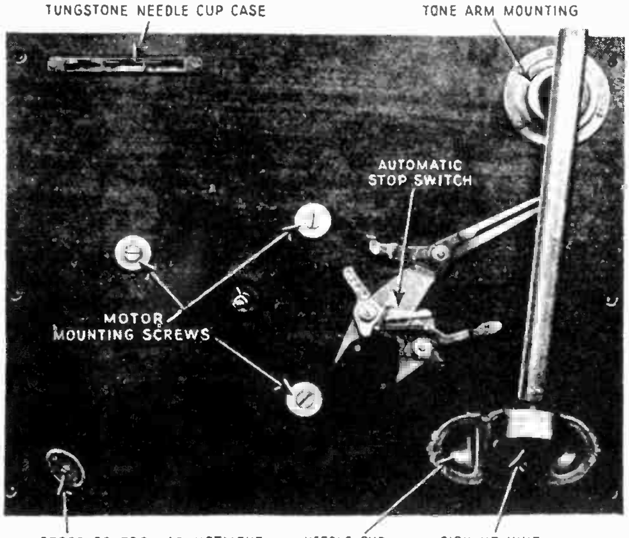


Figure 17—Top view of phonograph compartment with turntable removed

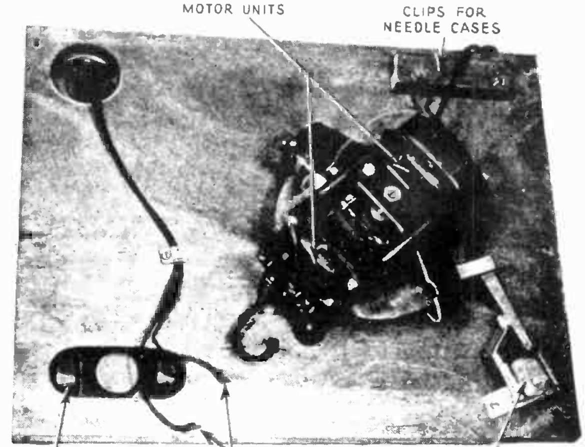


Figure 18—Sub-shelf view of phonograph compartment

(9) PHONOGRAPH MOTOR AND SWITCH (Illustrated in Figs. 17-18)

Electrical tests and mechancial adjustments covering these units are given fully in the Radiola 47 Service Notes, pp. 20-28. In addition, to the information contained therein, it should be noted that the reversal of the potential coil leads with respect to its associated current coil of either motor unit will result in zero torque and consequently the turntable shaft will not rotate. If the connections of the potential coils of both motor units are reversed with respect to their associated current coils, the motor will run with counter-clockwise rotation (backwards).

(10) PHONOGRAPH AUDIO SYSTEM

As will be noted in the Schematic Circuit Diagram, Figure 13, the phonograph audio system consists of a low-impedance, flexible pick-up, volume control, impedance matching input transformer (Location shown in Figure 3), and "Radio-Record" switch.

In the "Radio" position, the operation of the receiver and its audio system is normal and the secondary of the phonograph input transformer is short-circuited.

In the "Record" position, the bias of the "second detector" is decreased so that this tube acts as an audio amplifier receiving its audio excitation from the phonograph input transformer. Simultaneously the bias of the automatic volume control tube is decreased which—due to its increased plate current—increases the negative bias on the R.F. and I.F. amplifier Radiotrons to a point where these tubes no longer draw plate current, rendering the radio section of the Radiola 67 inoperative.

Due to the simplicity of the phonograph audio system, it is expected that little trouble will be experienced. Service data are given in the Service Data Chart, pp. 14-17. Details concerning the adjustments of the pick-up, phonograph motor, and automatic switch are given fully in the Radiola 47 Service Notes.

A defective phonograph input transformer (See Figure 6) can be checked by measuring the resistance of the windings. Also the pick-up coil can be checked in the same manner—the correct resistance is approximately 11 ohms. Should the coil be O.K., but the pick-up insensitive, it will be necessary to remove the permanent magnet, after affixing a soft-iron keeper thereto, and have it remagnetized.

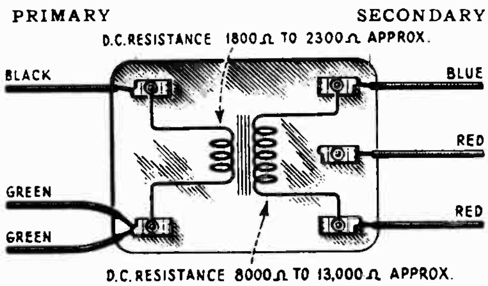


Figure 19—*Internal connections of input transformer*

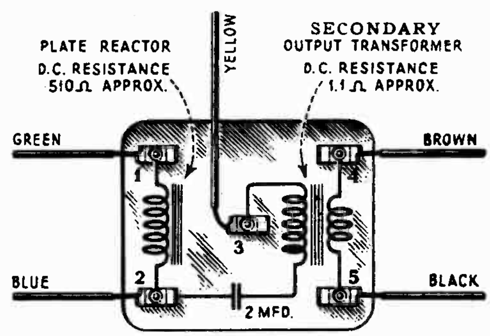


Figure 20—*Output coupling device*

(11) RECEIVER ASSEMBLY CONTINUITY TEST

Remove all Radiotrons, disconnect cable from terminal strip, and remove pilot lamp. See Figure 22 for cable lugs, terminals and Radiotron socket contacts. For convenience coloring of cable leads as well as numbers is shown. Code: Maroon (M), Black (Bla), Blue (Blu), Red (R), Brown (Br), Yellow (Y), Green (G). All resistance values noted in the following continuity test charts are D.C.

When testing from Lug 8 (R-M) the current taken by the measuring instrument should not exceed 15 milliamperes, as a higher current might injure the tuning meter. If necessary, the tuning meter can be short-circuited during test, but the resistance readings when thus measured with Lug 8 as one terminal should be approximately 800 ohms less than when the meter is not shorted.

RECEIVER CONTINUITY TEST CHART

Circuit	Test Terminals	Correct Effect	Incorrect Effect: Indication	Incorrect Effect: Caused by
Grid	G1 to Ground Lead	Closed (5.6 ohms)	Open	Open secondary of 1st R.F. transformer
	G1 to Frame	Closed (100.000 ohms)	Open Shorted	Open 100,000-ohm carbon resistor or open 310-ohm section of resistor Shorted .5 mfd.mid-tapped condenser or shorted 1.5 mfd. condenser in condenser pack or shorted 1st R.F. tuning condenser, or ground on any of the following; antenna inductance, secondary of 1st R.F. transformer, 1st or 2nd R.F. transformers
	G1 to P7	Closed	Open	Open lead or connection
	G1 to P1	Open	Shorted 100,000 ohms	Shorted R. F. compensating condenser Grounded primary of 2nd R.F. transformer or tuning meter
	G2 to Lug 6 (Bla)	Closed (5.6 ohms)	Open	Open secondary of 2nd R.F. transformer
	G2 to Frame	Open	Shorted	Shorted or grounded .5 mfd. mid-tapped condenser, or shorted or grounded 2nd R.F. tuning condenser, or grounded secondary of 2nd R.F. transformer, or grounded stator of 2nd R.F. tuning condenser
	G2 to C2	Open	Shorted	Shorted 2 mfd. condenser in condenser pack
	G3 to Ground Lead	Closed (50 ohms)	Open 100,000 ohms Shorted	Open secondary of 1st I.F. transformer Open connection to ground lead Shorted 1st I.F. secondary tuning condenser
	G3 to P3	Open	Shorted	Shorted 1st I.F. neutralizing condenser
	G4 to Ground Lead	Closed (50 ohms)	Open 100,000 ohms Shorted	Open secondary of 2nd I.F. transformer Open connectiton to ground lead Shorted 2nd I.F. tuning condenser
	G4 to P4	Open	Shorted	Shorted 2nd I.F. neutralizing condenser
	G5 to C5	Closed (40,000 ohms)	Open Shorted	Open oscillator grid leak Shorted 40,000-ohm oscillator grid leak
	G5 to Frame	Open	Closed (3,000 ohms)	Shorted 750-mmfd. oscillator coupling condenser or ground on oscillator coil and condenser system
	G6 to Lug 8 (R-M)(Switch in neutral or Radio position. See Sec. 11)	Closed 100 ohms	Open	Open secondary of 3rd I.F. transformer. Open switch contacts

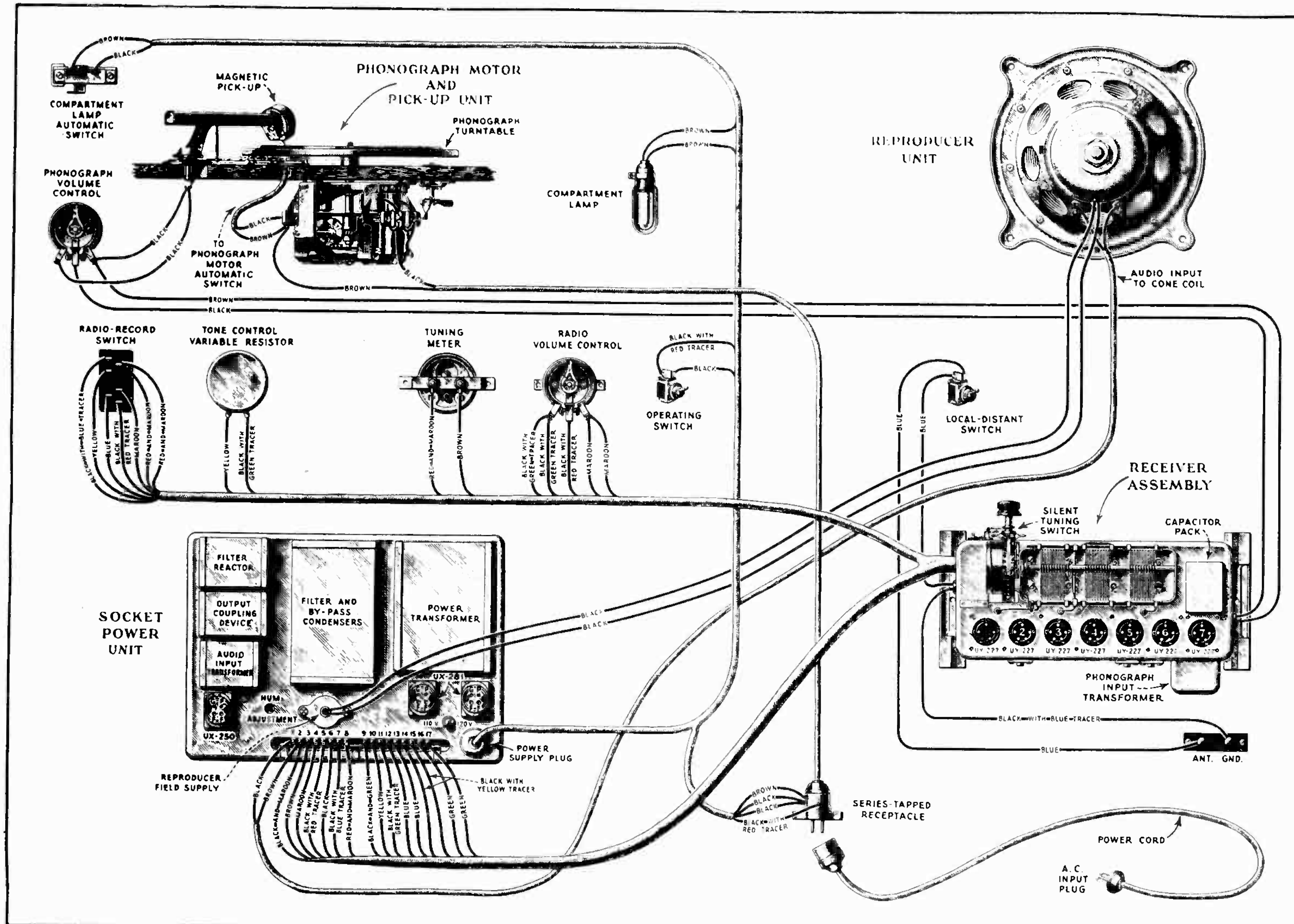


Figure 21—Complete layout of assemblies and cable connections

RECEIVER CONTINUITY TEST CHART—Continued

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	*Caused by*
Grid	G6 to Lug 8 (R-M) (Switch in Record position. See Sec. 11)	Closed (5,000 ohms)	100 ohms	Radio position contacts of "Radio-Record" switch do not open
	G6 to G7	Open	Shorted	Shorted .0008 mfd. condenser between G6 and G7
	G7 to Lug 11 (Bla-GTr) (Switch in neutral or Radio position)	Closed (1 meg)	Open	Open 1 meg. resistor Or open switch contact; Or open volume control potentiometer; Or open in mid-tap connection to volume control potentiometer
	G7 to Lug 11 (Bla - G. Tr.) (Switch in Record position)	Closed (1 meg)	Open	Open 1 meg. resistor or open switch contact Or open volume control potentiometer
Plate	P1 to Lug 8 (R - M) (See Sec. 11)	Closed (840 ohms) (45 ohms with tuning meter shorted out)	Open	Open primary of 2nd R.F. transformer or open tuning meter
	P2 to Lug 4 (M)	Closed (20 ohms)	Open Shorted	Open primary of 1st I.F. transformer Shorted 1st I.F. tuning condenser
	P2 to C2	Open	Shorted	Shorted 1 mfd. condenser in condenser pack
	P3 to Lug 8 (R - M) (See Sec. 11)	Closed (810 ohms) (19 ohms with tuning meter shorted out)	Open 40,000 ohms Shorted	Open primary winding of 2nd I.F. transformer and open 40,000-ohm resistor Open primary winding of 2nd I.F. transformer Shorted primary tuning condenser 2nd I.F. transformer
	P4 to Lug 8 (R - M) (See Sec. 11)	Closed (810 ohms) (19 ohms with tuning meter shorted out)	Open 40,000 ohms Shorted	Open primary winding of 3rd I.F. transformer and 40,000-ohm resistor Open primary winding of 3rd I.F. transformer Shorted primary tuning condenser of 3rd I.F. transformer
	P4 to Ground Lead	Open	Shorted	Shorted 2nd I.F. neutralizing condenser
	P4 to C4	Open	Shorted	Shorted 1 mfd. condenser in condenser pack
	P4 to C6	Open	Shorted	Shorted 1 mfd. condenser in condenser pack

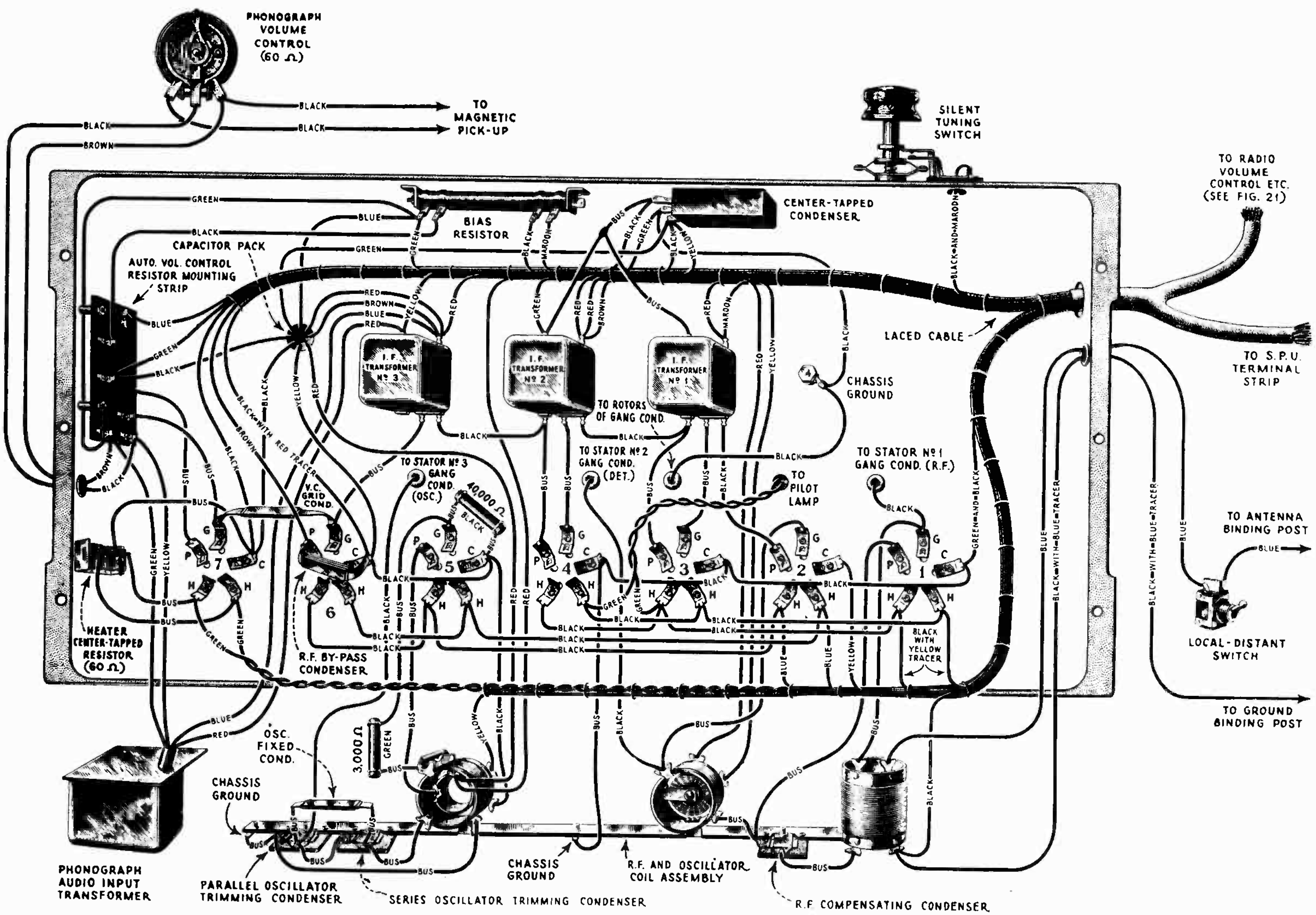


Figure 22—Wiring connections and parts of the receiver assembly

RECEIVER CONTINUITY TEST CHART—Continued

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	*Caused by*
Plate	P5 to Lug 4 (M)	Closed (1.8 ohms)	Open	Open primary winding in oscillator circuit
	P6 to Lug 3 (Br)	Closed	Open	Open in lead to terminal strip
	P6 to C6	Open	Shorted	Shorted .0025 mfd. condenser
Cathode	C1 to Frame	Closed	Open	Open connection or lead
	C2 to Lug 5 (Bla-R.Tr.)	Closed (1 ohm)	Open	Open coupling coil in oscillator circuit
	C3 to Frame	Closed	Open	Open connection or lead
	C4 to Frame	Closed	Open	Open connection or lead
	C5 to Lug 5 (Bla-R.Tr.)	Closed	Open	Open connection or lead
	C7 to Frame	Closed (4,160 ohms)	Open Shorted	Open 3,850-ohm section of resistor Shorted or grounded 1.5 mfd. condenser in condenser pack or grounded resistor unit
	C7 to Lug 11 (Bla-G.Tr.)	Closed (1,560 ohms)	Open	Open in 310-ohm section of resistor connected to volume control
Heater	Lug 15 (Bla-Y Tr.) to one heater contact of Sockets 1-3-4	Closed	Open	Open connections
	Lug 14 (Bla-Y Tr.) to other heater contact of Sockets 1-3-4	Closed	Open	Open connections
	Lug 13 (Blu) to one heater contact of Sockets 2-5-6	Closed	Open	Open connections
	Lug 12 (Blu) to other heater contact of Sockets 2-5-6	Closed	Open	Open connections
	One heater contact of Socket 7 to other heater contact of Socket 7	Closed (60 ohms)	Open	Open connections or open 60-ohm mid-tapped resistor
	Lug 17 (G) to Lug 16 (G)	Closed (60 ohms)	Open	Open connection or open 60-ohm mid-tapped resistor
	Heater contact of Socket 7 to C7	Closed (30 ohms)	Open	Open connection, cathode to mid-tapped resistor
Miscellaneous	Antenna binding post to ground binding post—Switch in "Distant" position	Closed (45 ohms)	Open	Open antenna inductance or "Local-Distant" Switch

RECEIVER CONTINUITY TEST CHART—Continued

Circuit	*Test Terminals*	*Correct Effect*	*Incorrect Effect*	
			Indication	*Caused by*
Miscel-laneous	Lug 10 (Y) to Lug 11 (Bla-G. Tr.)	In extreme clock-wise position of tone control, circuit should test open. At a position back a little from extreme clock-wise position circuit should test approximately .5 meg. In extreme counter clock-wise position it should test from 1000-3000 ohms.	Open	Open tone control resistor or leads
Frame	Lug 8 (R-M) to Frame (See Sec. 11)	Open	Shorted	Ground on any of the following: Primary of 2nd R. F. transformer; Primary of 2nd or 3rd I.F. transformer. Tuning meter and "Radio-Record" Switch
	Lug 3 (Br.) to Frame	Open	Shorted	.0025 mfd. condenser grounded
	Lug 4 (R) to Frame	Open	Shorted	Primary coil of oscillator or primary of 1st I.F. transformer grounded
	Lug 5 (Bla-R. Tr.) to Frame	Open	Shorted	Coupling coil of oscillator, or .0025 mfd. condenser grounded
	Lug 7 (Bla-Blue Tr.) to Frame. (Switch in Record position)	Open	Shorted	Ground on any of following: "Radio-Record" Switch, Secondary of pick-up transformer, Secondary of 3rd I.F. transformer, or .0008 mfd. condenser, connecting G6 to G7
	Lugs 12 (Blu) and 13 (Blu) to Frame	Open	Shorted	Ground on leads to, or on heater contacts of Sockets 2, 5 and 6
	Lugs 14 (Bla-Y Tr.) and 15 (Bla-Y Tr.) to Frame	Open	Shorted	Ground on leads to, or on heater contacts of Sockets 1-3-4

(12) S. P. U. ASSEMBLY CONTINUITY TESTS

Remove All Radiotrons and Disconnect Cable at Terminal Strip.

SOCKET POWER UNIT CONTINUITY TEST CHART

Terminals	*Correct Effect*	*Incorrect Effect*	
		Indication	*Caused by*
P of one UX-281 socket to P of other UX-281 socket	Closed (260 ohms)	Open	Open high voltage winding of power transformer
Across filament contacts of one UX-281	Closed	Open	Open UX-281 filament winding of power transformer or open connection
Across filament contacts of other UX-281	Closed	Open	Open UX-281 filament winding of power transformer or open connection
Terminal 1 to Terminal 2	Closed (1.1 ohm)	Open	Open low voltage winding of output transformer
Terminal 3 to Terminal 4	Closed (4000-4700 ohms)	42,000-48,000 ohms Open	Open primary of input transformer or open 2400-ohm section of resistor Both primary of input transformer and 40,000-ohm resistor open
Terminal 4 to Terminal 5	Closed (1200 ohms)	800 ohms Open	Shorted 1 mfd. condenser in condenser pack Open in either or both of 960-ohm and 240-ohm section of resistor
Terminal 5 to Terminal 6	Closed (115 ohms)	Open	Open 115-ohm section of resistor
Terminal 5 to Terminal 9	Closed (2930 ohms)	Shorted	Shorted 2 mfd. condenser in condenser pack
Terminal 5 to Terminal 11	Closed (6330 ohms)	Shorted	Shorted 2 mfd. condenser in condenser pack
Terminal 6 to Terminal 7	Closed (215 ohms)	Open	Open 215-ohm section of resistor
Terminal 7 to Terminal 8	Closed (100 ohms)	Open	Open 100-ohm section of resistor
Terminal 8 to Terminal 9	Closed (2500 ohms)	Open	Open in either or both 2200-ohm or 300-ohm section of resistor
Terminal 9 to Terminal 11	Closed (3400 ohms)	Open 1000-1300 ohms	Open 3400-ohm section of resistor Grounded filter reactor
Terminal 10 to Terminal 11	Open	Shorted	Shorted .002 mfd. condenser

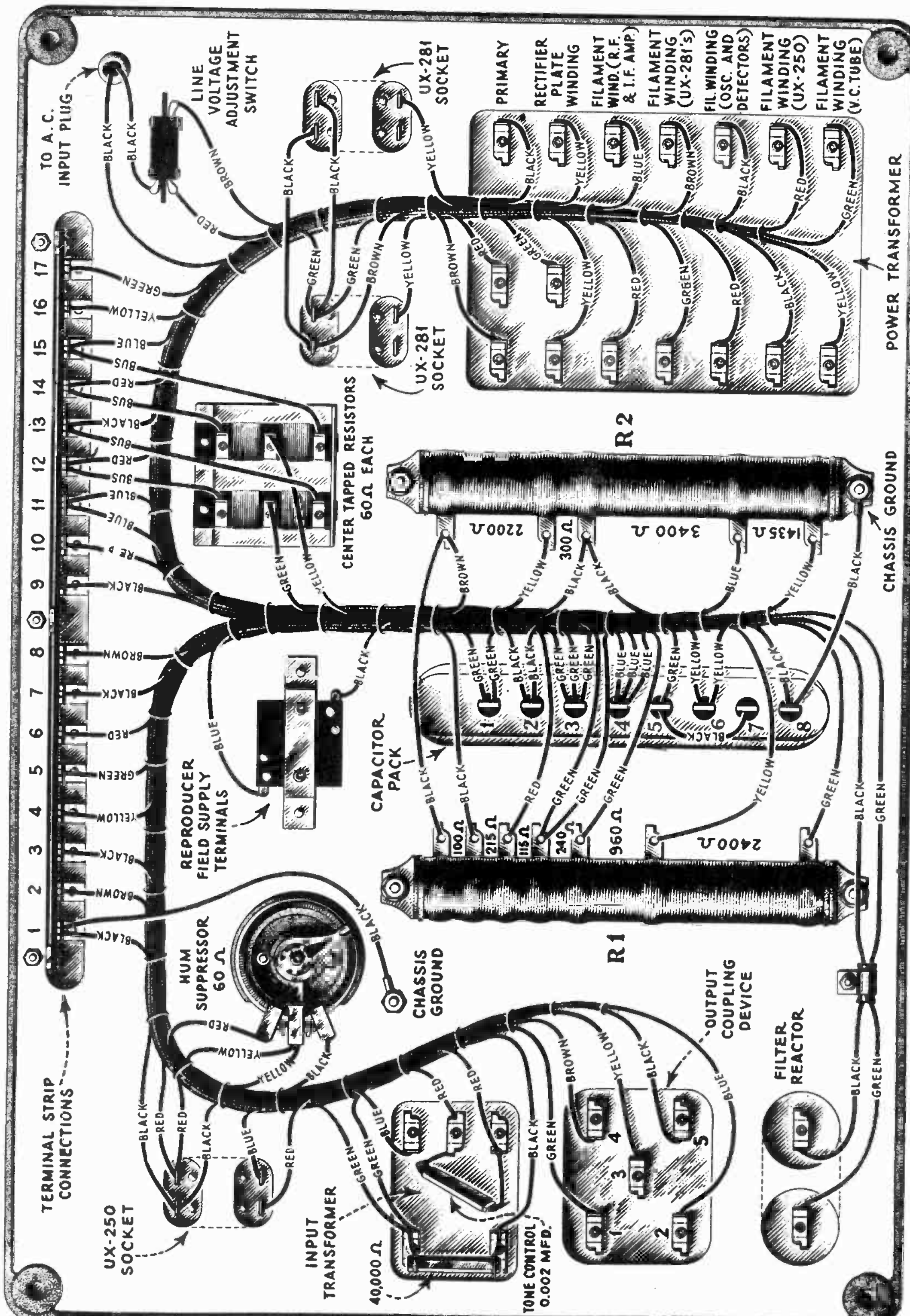


Figure 23—Continuity wiring diagram of socket power unit

SOCKET POWER UNIT CONTINUITY TEST CHART—Continued

Terminals	*Correct Effect*	*Incorrect Effect*	
		Indication	*Caused by*
Terminal 11 to Terminal 4	Closed (7530 ohms)	1800 ohms	Shorted filter condenser in condenser pack
Terminal 12 to Terminal 13	Closed	60 ohms Open	Open 2.5-volt winding in power transformer Open 2.5-volt winding in power transformer and mid-tapped resistor. Or open connection
Terminal 14 to Terminal 15	Closed	60 ohms Open	Open 2.5-volt winding in power transformer Open 2.5-volt winding in power transformer and mid-tapped resistor. Or open connection
Terminal 16 to Terminal 17	Closed	Open	Open 2.5-volt winding in power transformer. Or open connection
Terminal 11 to plate of either UX-281 socket	Closed (1450 ohms)	Open	Open filter choke or loudspeaker field
Terminal 4 to plate contact of UX-250 socket	Closed (2910 ohms)	Open	Open UX-250 plate reactor
Terminal 11 to plate contact of UX-250 socket	Closed (10,440 ohms)	1600 ohms 380	Shorted 2 mfd. condenser in output unit Shorted 2mfd. condenser in output unit, and shorted 2mfd. condenser across 1435-ohm section of resistor
Across filament contacts of UX-250 socket	Closed	60 ohms	Open in UX-250 filament winding of power transformer
Filament contact of UX-250 socket to Terminal 11	Closed (1465 ohms)	Open	Open 1435-ohm section of resistor
Grid contact of UX-250 socket to Terminal 11	Closed (8000-1200) ohms	Open	Open primary of input transformer
Across prongs of line plug with 110-120-volt switch in 110-volt position	Closed	Open	Open primary of power transformer
Across prongs of line plug with 110-120-volt switch in the 120-volt position	Closed	Open	Open primary of power transformer
Terminal 9 to prong of line plug	Open	Shorted	Grounded primary of power transformer

SOCKET POWER UNIT CONTINUITY TEST CHART—Continued

Terminals	*Correct Effect*	*Incorrect Effect*	
		Indication	*Caused by*
Terminal 9 to Terminal 12	Closed (3200 ohms)	Shorted	Grounded 2.5 volt filament winding of power transformer
Terminal 9 to Terminal 14	Closed (330 ohms)	Shorted	Grounded 2.5 volt filament winding of power transformer
Terminal 9 to Terminal 16	Open	Shorted	Grounded 2.5 volt winding of power transformer
Terminal 9 to filament contact of UX-250 socket	Closed (4865 ohms)	Shorted	Grounded UX-250 filament winding of power transformer
Terminal 9 to filament contact of UX-281 socket	Closed (6530 ohms)	Shorted	Grounded UX-281 filament winding of power transformer
Terminal 9 to plate contact of UX-281 socket	Closed (4700 ohms)	Shorted	Grounded high voltage winding of power transformer
Terminal 9 to plate contact of UX-250 socket	Closed (7000 ohms)	0-510 ohms	Grounded UX-250 plate reactor winding
Terminal 9 to Terminal 3	Closed (8300-8800 ohms)	0-2300 ohms	Grounded primary of input transformer
Grid contact of UX-250 socket to Terminal 11 with Terminal 11 connected to Terminal 9	Closed (Same resistance as between grid of UX-250 socket and Terminal 11 alone)	Lower resistance	Grounded secondary winding of input transformer

PART IV—MAKING REPLACEMENTS

The methods for replacing various defective component parts are described in Service Notes covering Radiolas 66, 64 and 47. Details will therefore be omitted here and only the procedure to be used in removing the major units and assemblies will be discussed.

(1) REMOVAL OF RECEIVER ASSEMBLY

(a) Remove set-screw from Station Selector Knob and pull off three remaining knobs.
(b) Remove "Local-Distant" Switch clamping ring.
(c) Remove rear covers from Reproducer compartment and Receiver- S. P. U. compartment.
(d) Make certain that power supply is off and remove S. P. U. terminal strip cover.

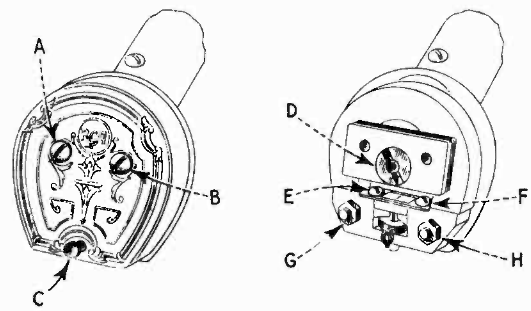


Figure 24—Details of the phonograph pick-up

(e) Remove cable connections from S. P. U. terminal strip.
(f) Remove two wood screws from antenna ground strip.
(g) Disconnect black and brown leads at phonograph volume control.
(h) Free tuning meter and radio volume control by removing two wood screws from each.
(i) Free Centralab tone control resistor by removing two hexagonal nuts from shaft (front of panel.)
(j) Free "Radio-Record" Switch by unscrewing switch knob, removing two wood screws holding escutcheon plate, and removing four machine screws which hold switch to metal mounting plate.
(k) Remove cleats holding receiver assembly wires and cables to cabinet.
(l) Remove four chassis machine screws from bottom of cabinet. Receiver assembly may then be lifted out to rear.

It should be replaced in the reverse order making certain that the two wooden spacing blocks and rubber supporting blocks are in place.

(2) REMOVAL OF S. P. U.

(a) Remove rear cover of Receiver-S. P. U. compartment.
(b) Lift off A.C. power input plug.
(c) Remove terminal strip cover and disconnect cable and cone leads.
(d) Pry open safety rosette cup, washer and remove screws holding field supply terminal.
(e) Disconnect leads to reproducer field.
(Note: S. P. U. Continuity Tests or S. P. U. voltage readings should be made with these leads connected. Beware of high voltage at this point.)
(f) Remove four machine screws from bottom of cabinet.
(g) S. P. U. may be lifted out to rear.

(3) REMOVAL OF PHONOGRAPH ASSEMBLY

(a) Remove phonograph compartment rear cover.
(b) Pull out motor power plug.
(c) Lift off turntable—holding pick-up and arm out of the way
(d) Disconnect pick-up leads (black) from phonograph volume control.
(e) Remove six wood screws from wooden phonograph compartment shelf.
(f) Entire unit may be lifted out to rear by elevating the rear edge to about 45 degrees.

(4) REMOVAL OF PHONOGRAPH PICK-UP

(a) Remove phonograph compartment rear cover.
(b) Disconnect pick-up leads (black) from phonograph volume control, and receiver cleats holding wires to cabinet.
(c) Remove three wood screws from pick-up arm mounting ring.
(d) Remove pick-up and arm assembly.
(e) Remove needle holder screw C, Figure 24, and two machine screws A, B, holding pick-up cover. Remove cover.
(f) Remove nut D, Figure 24, that holds the magnet bracket and fibre spacers. Mark the magnet poles and pole pieces so that the magnet may be replaced with correct polarity.
(g) Place a soft-iron "keeper" (such as a large nail) across the poles of the magnet and remove the magnet.
(h) Unsolder external leads from terminals.
(i) Remove machine screw holding pick up to pick-up arm. In assembling the unit, the above order is reversed.

(5) REMOVAL OF REPRODUCER UNIT

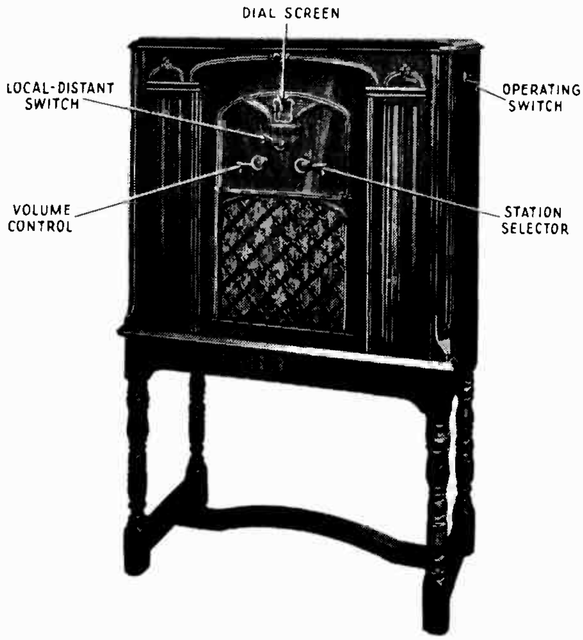
(a) Remove rear covers of Reproducer and Receiver-S. P. U. compartments.
(b) Make certain power is "off" and remove S. P. U. terminal strip cover.
(c) Remove voice coil leads (Brown and Black) from Terminals 1 and 2.
(d) Open safety rosette washers. Remove two machine screws holding cover. Take off cover and disconnect two (black) field supply leads.
(e) Remove cleat holding voice coil cable and field supply leads to cabinet.
(f) Remove four hexagonal nuts—holding reproducer in place by hand.
(g) Reproducer unit may then be removed.

(6) REMOVAL OF FRONT GRILLE PANEL

(a) Remove reproducer unit—(See Part IV, Section 5).
(b) Remove 12 wood screws from baffle board. Note position of these screws as four of them are somewhat shorter.
(c) Remove baffle board by swinging right edge to the rear and tilting lower edge to the rear.
(d) Remove eight wood screws from grille panel and free by tapping lightly on the front of grille panel.
(e) Grille may then be removed.

RCA
Radiolas 80 and 82

SERVICE NOTES



RCA Radiola 80
(Without Tone Control)

Third Edition—10M

RCA Victor Company, Inc.

RADIOLA DIVISION

Camden, New Jersey

REPRESENTATIVES IN PRINCIPAL CITIES

CONTENTS

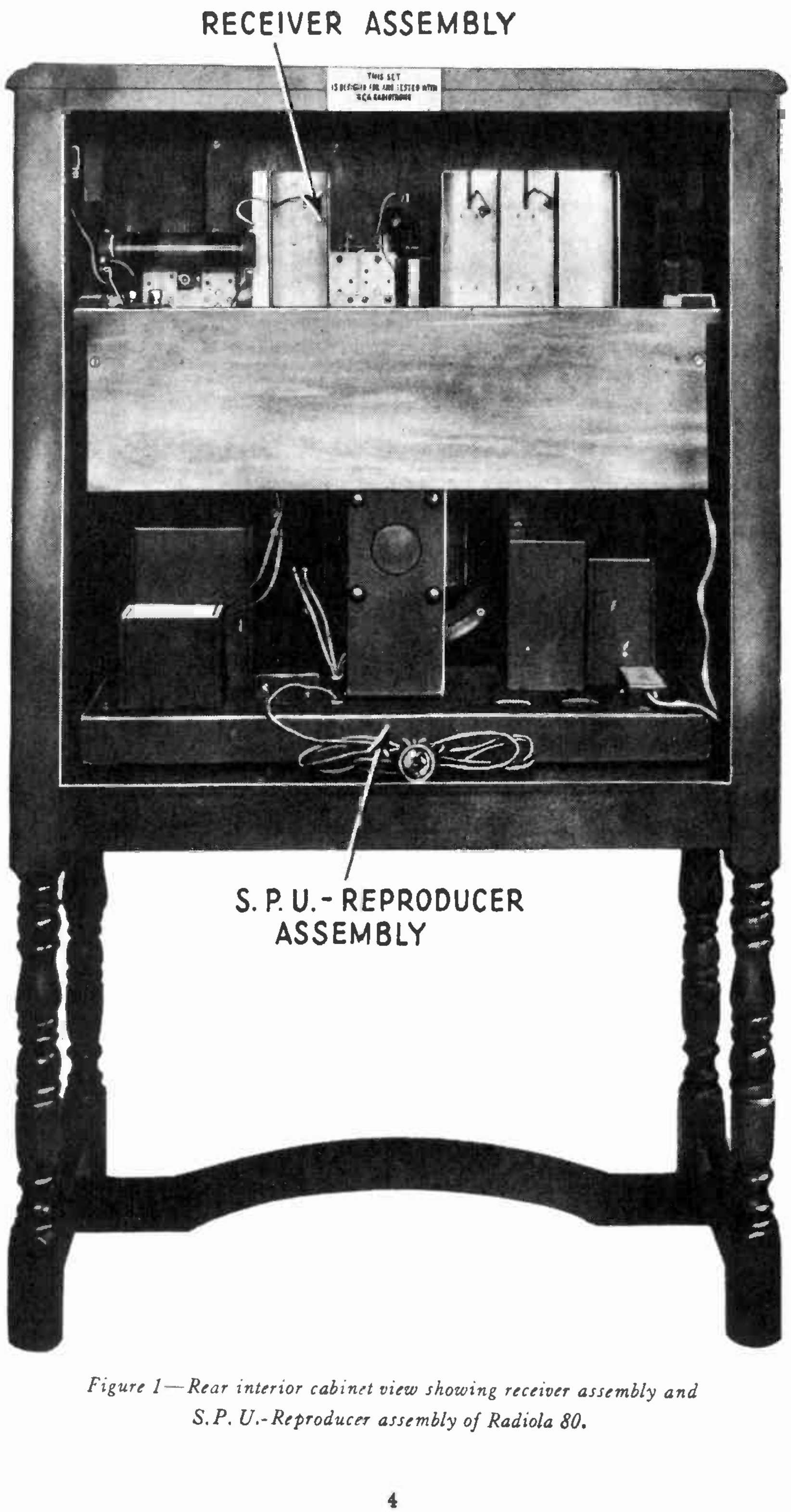


Figure 1—Rear interior cabinet view showing receiver assembly and S.P. U.-Reproducer assembly of Radiola 80.

RCA RADIOLAS 80 and 82
SERVICE NOTES

ELECTRICAL SPECIFICATIONS

Voltage Rating	105—125 Volts
Frequency Rating	50–60 Cycles, or 25–40 Cycles
Power Consumption	60 Cycles—120 Watts; 25 Cycles—120 Watts
Recommended Antenna Length	25–75 Feet
Type of Circuit	A.C. Screen Grid Super-Heterodyne
Type and Number of Radiotrons	4UY-224, 2 UY-227, 2UX-245, 1 UX-280—Total, 9
Number of Radio Frequency Stages	1
Type of First Detector	Tuned Input Grid Bias
Number of Intermediate Stages	2
Type of Second Detector	Power Grid Bias
Number of Audio Stages	1 (Push-Pull)
Type of Rectifier	Full Wave, UX-280
Type of Loudspeaker	Dynamic
Wattage Dissipation in L.S. Field	10 (110 V. 85 M. A.)
Undistorted Output	3.0 Watts

PHYSICAL SPECIFICATIONS (RCA RADIOLA 80)

Height	43 Inches
Depth	14 Inches
Width	27¼ Inches
Weight (Packed for Shipment)	150 Lbs.
Packing Case Dimensions	18″ x 32″ x 47″

INTRODUCTION

This instrument is a nine-tube A.C. operated screen grid super-heterodyne radio receiver. Included in the same cabinet is an improved dynamic type reproducer unit which, together with the receiver, gives a quality of reproduction closely approaching the original. A feature of this set is the calibrated kilocycle dial. This dial is accurate as to the divisions on the scale and a station will always be received at its correct kilocycle marking on the dial. This greatly facilitates the location of stations of known frequency even though they have not been previously received.

A local-distant switch is provided which, in addition to providing two different degrees of sensitivity, changes the selectivity of the receiver. At the local position the receiver is less sensitive and less selective, but has a better high frequency response. At the "distant" position of the switch the selectivity is increased with a slight loss in tone quality. This selectivity allows distant stations to be seceived easily and gives ten-kilocycle separation on most stations at any frequency in the broadcast.spectrum.

The set uses four Radiotrons UY-224, two Radiotrons UY-227, two Radiotrons UX-245 and one Radiotron UX-280. Excellent sensitivity, selectivity, and tone quality are secured through the use of these tubes together with a large power output. The output is about 3 watts. Figure 1 shows the rear interior cabinet view.

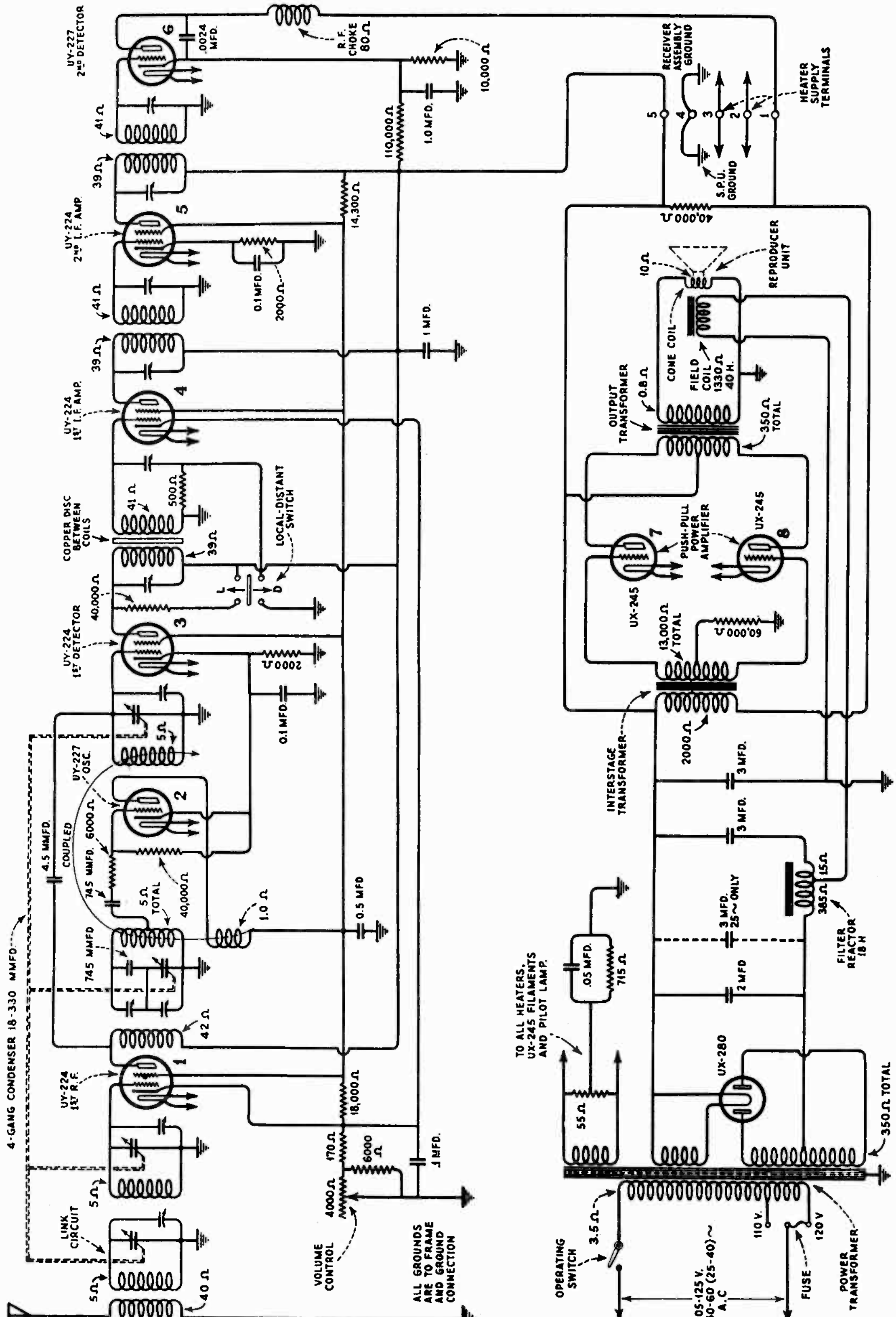


Figure 2—Schematic wiring diagram of Radiola 80 without tone control

DESCRIPTION OF CIRCUIT

Receiver Assembly

The Receiver Assembly schematic diagram is shown in Figure 2. Starting from the antenna circuit and following through each stage we find the following action taking place.

The antenna is coupled to a tuned link circuit by means of a high inductance concentrated coil connected from antenna to ground. The inductance is of a sufficient value that variations in the antenna system have but little effect on the tuning circuit.

The tuned circuit consists of a coil and condenser which tunes exactly with the tuned R.F. and first detector. The purpose of this circuit is to eliminate any cross modulation from stations to which the set is not tuned, or heterodyne whistles as far as possible, and to improve the selectivity of the receiver. There is no amplification gain in this circuit, it being merely a selection circuit.

A tuned Radio Frequency stage follows which uses a Radiotron UY-224. This stage gives about the same amplification as that obtained from two R.F. stages of an average good receiver. The output of this stage is coupled capacitively to the grid circuit of the first detector or mixing tube by means of a small condenser. The plate circuit of the R.F. stage has a high inductance coil which provides a high impedance, into which it is necessary to have the tube work in order to get good amplification.

At this point the oscillator should be considered, as its output is coupled also to the grid coil of the first detector. Its output, however, is inductively instead of capacitively coupled to this circuit. This is a tuned grid circuit oscillator using a Radiotron UY-227, and having a closely coupled plate coil that gives sufficient feed-back to provide stable operation. The grid circuit is so designed that by means of a correct combination of capacity and inductance a constant frequency difference between the oscillator and the tuned R.F. circuits throughout the range of the Radiola is obtained.

The next circuit to examine is the first detector. The circuit is tuned by means of one of the gang condensers to the frequency of the incoming signal. In the grid circuit there is present the incoming signal and the oscillator signal, the latter being at a 175 K.C. difference from the former. The first detector is biased so as to operate as a plate rectification detector and its purpose is to extract the difference or beat frequency, produced by combining the signal and oscillator frequencies. The beat frequency—175 K.C.—appears in the plate circuit of the first detector which is accurately tuned to 175 K.C. The tube used as a first detector is Radiotron UY-224.

The next two circuits are the first and second intermediate stages which give a very high degree of amplification. The grid and plate circuit of both stages as well as the plate circuit of the first detector and the grid circuit of the second detector, are tuned to 175 K.C.

Two resistances are arranged for connecting to the first I.F. transformer, the connection or disconnection of which constitutes the action of the "local-distant" switch. At the "local" position a 40,000-ohm resistor is connected across the primary of this transformer and a 500-ohm resistor in series with the secondary and one side of the tuning condenser. The effect of these resistors is to decrease the sensitivity, broaden the selectivity and thus improve the fidelity of the set. At the "distant" position the resistance is out of both circuits and the original sensitivity and selectivity is obtained. After the high amplification in the intermediate stages, the signal appears in the grid circuit of the second detector.

The second detector is a high-plate voltage, grid-biased type detector which gives sufficient output to drive two Radiotrons UX-245 connected in push-pull without an intermediate audio stage. The purpose of the second detector is to extract the audio frequency component of the R.F. signal which represents the voice or musical modulations produced in the studio of the broadcasting station. The audio component is extracted and used to drive the power tubes while the R.F. current is by-passed and not used any further.

Figure 3 is a top view of the receiver assembly and shows the parts located thereon. Figure 4 is a bottom view of the receiver assembly and shows such parts as are located there.

Socket Power Unit

The socket power unit (Figure 5) contains all the parts used in the rectifier and power amplifier circuit together with the reproducer unit. This makes for unit construction and easy assembly, together with efficient operation.

The power stage comprises two Radiotrons UX-245 connected in push-pull. These tubes give a large undistorted output which is delivered to the cone coil of the dynamic type loudspeaker by means of a center-tapped primary step-down transformer connected in the plate circuit of the Radiotrons UX-245. The primary impedance is of a value to match the plate impedance of the two tubes, and the secondary of a value that matches the cone coil of the reproducer unit. Thus the full output of the two Radiotrons UX-245 is efficiently applied to the loudspeaker.

In the grid circuit of the input transformer, a 60,000-ohm resistor is connected in series with the center tap of the interstage transformer. The purpose of this resistor is to eliminate audio oscillations.

The rectifier is a Radiotron UX-280 which provides a full wave rectifying device of ample capacity for providing all plate and grid voltages used in the receiver and power amplifier, as well as power for the field of the reproducer unit. A specially designed filter system removes all ripple from the D.C. output of the rectifier. This results in a receiver having no A.C. hum or extraneous noise other than that picked up in the antenna system.

The reproducer field is used as a reactor in the filtering system, thus receiving its energy and acting as a unit in the filtering system at the same time. Figure 6 is a view of the bottom of the S.P.U.

As the filtering system in this receiver is somewhat different from the usual arrangement a word of explanation may help the service man to properly understand its action.

Figure 2 shows the first stage of the filter having two condensers and a tapped reactor. The condensers function in the usual manner, acting as reservoirs to hold the current from one impulse to the next. The tapped reactor functions somewhat different from the usual manner, however. The D.C. current flows through one section of it, the other section being connected to a condenser. However, an A.C. voltage is present across the other section due to its transformer action, similar to an auto-transformer. This voltage is 180 degrees out of phase with the ripple voltage across the second condenser and therefore to a large extent cancels out all ripple flowing from the tap to succeeding circuits. This results in the output of this section of the filter being substantially free from ripple. The field of the reproducer unit is connected in series with this output and further removes the slight ripple voltage remaining. The condensers are of ample capacity, being one 2 mfd. and two 3 mfd. in capacity respectively.

A single filament winding on the power transformer provides all filament and heater voltages use, with the exception of the UX-280 which has a separate winding. It also supplies current to the dial lamp.

In addition to the 50–60-cycle models, 25–40-cycle models are also available. The difference between the 50–60-cycle and the 25–40-cycle receivers is the power transformer and an addition filter capacitor. This is shown in Figure 2.

PART I—INSTALLATION

(1) ANTENNA (Outdoor Type)

Due to the high sensitivity of this receiver the antenna length need be only 25 to 75 feet. In remote districts this length may be extended to secure improved pick-up of distant broadcasting stations.

The antenna 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.

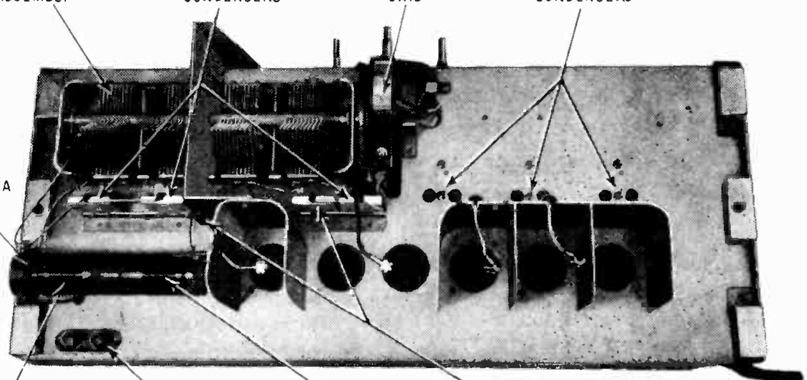


Figure 3—Top view of receiver assembly

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. Bring the lead-in wire from the outside through a porcelain tube or other approved insulator to the inside of the house for connection to the receiver.

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.

(2) 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 25 to 50 feet of insulated wire strung around the picture moulding or placed under a rug. In buildings with steel framework or where metal lathing is employed, satisfactory results are not always possible with this type of antenna. However, due to its sensitivity, this instrument will generally give entirely satisfactory reception with an indoor antenna.

(3) SPECIAL ANTENNA INSTALLATIONS FOR NOISY LOCATIONS

In line with other receivers, when this set is installed in some city locations, such as apartment houses, hotels and office buildings, it is possible that the level of noise compared with the signal strength of the desired station may be such that the station cannot be received without an objectionable noise background. This noise may be defined as inductive interference from electrical devices such as elevator motors, generators, violet ray machines, professional equipment, etc. It may have no apparent radio frequency peak, or it may have a broad peak. The effect of the noise may be divided into the following three general classes:

(a) Where the noise level is zero with no antenna or ground, but is equally great on either an indoor or outdoor antenna.

(b) Where the noise is equally great with the antenna and ground either connected or disconnected.

(c) Where the noise level is greater when the outside antenna is connected than when an inside antenna is used; the inside antenna, however, not giving sufficient pick-up for satisfactory reception.

In (a) where the noise level is zero with no antenna or ground connected, but equally great with either an indoor or outdoor antenna, it is at once apparent that the interference is not being brought into the receiver over the power supply lines. It has been found in such cases that an antenna five feet long inside the room picked up as much noise as when an entire outside antenna lead-in were used. This indicates that the noise is within the building and, in the case of the outside antenna, is being picked up on that portion of the lead-in that enters and goes through the building. In such cases the receiver should be located close to the point where the outside lead-in enters the building. If this is impractical the receiver can be placed in any location and a copper braid placed over the inside portion of the lead-in wire. This braid is not grounded. If the noise level is still appreciable a good receiver ground with a short lead may be obtained. A long lead is not desirable, as it may pick up noise. Placing a shield over the ground wire but not grounding the shield may help.

In (b) the noise is picked up with no antenna or ground connected to the receiver. This indicates the noise is entering the receiver through the power lines. In this case filters must be placed in the power supply at the source of the noise or at the receiver, depending on conditions. If the trouble is cleared up in this manner when the antenna and ground are disconnected, but again appears with the use of the antenna system, the remedies suggested in (a) must also be applied.

In (c) the noise is greater when the outside antenna is connected than when an inside antenna is used. The use of the inside antenna, however, does not give sufficient pick-up for satisfactory reception. In this case the pick-up is probably occurring on the lead-in wire between the receiver and the antenna. Copper braid should be placed over the entire lead-in from the receiver to the flat portion of the antenna. Also changing the direction of the antenna should be tried and the lead-in connected from the end of the antenna that gives the best results. The copper braid may or may not be grounded—best results being determined by experiment. The conditions existing in any locality must be analyzed and placed in its correct category. A little patience and experimenting will usually result in a satisfactory installation.

RCA type "A" line filters should be used where the interfering line apparatus draws up to 2.5 amperes at 110 volts A.C. or D.C. For larger apparatus drawing current from 2.5 amperes to 5.0 amperes, RCA type "B" line filter should be used.

(4) GROUND

A good ground is quite as important as a good antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be as short as possible and connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

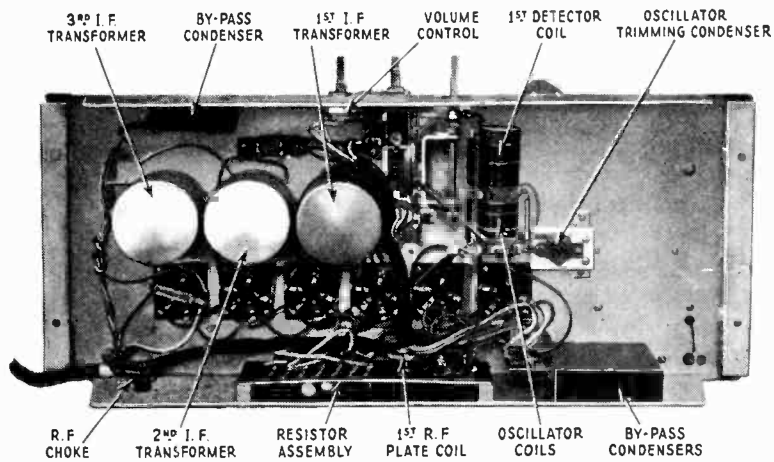


Figure 4—Sub-chassis view of receiver assembly

(5) RADIOTRONS

This set uses nine Radiotrons, four Radiotrons UY-224, two Radiotrons UY-227, two Radiotrons UX-245 and one Radiotron UX-280.

The Radiotrons should be placed in their correct sockets as shown in Figure 7. After placing the receiver in operation it is best to try interchanging the Radiotrons in the following manner so as to get the best results from a given set of tubes. Always turn the operating switch "off" before removing a tube.

1. Interchange the two UY-227 Radiotrons and leave the one in the oscillator socket that gives the loudest signal at a given position of the volume control. If another Radiotron UY-227 is available try interchanging it with the one in the detector socket and turn the volume up to its maximum output. Use the tube that gives the greatest undistorted output.

2. Radiotrons UY-224 should be tried in the first detector and first R.F. stage until those giving the loudest signal on a given station with the same setting of the volume control are found. The remaining tubes should be placed in the two intermediate stages. The two Radiotrons UX-245 are placed in the push-pull stage, and the UX-280 in the rectifier socket.

(6) LOCATION

This receiver should be tried in various locations in the room in which it is to be operated and the location giving the best acoustical results used. However, the eight-foot A.C. cord may prove a limiting factor if an A.C. outlet is not within its radius. An extension cord may be used in cases of this kind as the better results usually justify its small cost.

The antenna and ground leads should be separated as much as possible until they connect to the receiver, otherwise a reduction in signal strength will result due to the capacity between leads.

(7) ADJUSTMENT FOR LOW LINE VOLTAGES

A fuse is provided in the primary circuit of the power transformer which, in addition to acting as a protective device, allows proper adjustment to be made for lines having different voltages.

The fuse is so placed at the factory that the set will give normal results on A.C. lines of 115 to 125 volts. If the line is always less than 115, the set may be adapted to it for best results in the following manner:

(a) Remove the cover over the fuse by loosening its retaining screw and lifting clear. Underneath the cover will be seen three fuse clips with a small cartridge fuse inserted between two of them. (See Figure 7). One outside clip is marked 110 and the other 120. In its original position the fuse is placed between the center one and the one marked 120.

(b) Lift the fuse from its original position and insert it between the clip marked 110 and the center clip.

So connected the set will give best results on lines not exceeding 115 volts.

To replace a fuse, remove the cover and old fuse and place the new fuse in the same location. Then replace the cover.

(8) BLOWN FUSE

A blown fuse may be caused by the following:

(a) Connecting the set to a D.C. line.

(b) Plate to plate short of Radiotron UX-280.

(c) Shorted condenser in capacitor pack.

(d) Shorted filament or heater contacts or dial lamp socket.

(e) Defective power transformer.

Any of the above causes must be cleared up before a new fuse is installed otherwise the new fuse will blow as soon as the old one is replaced and the power turned "On."

(9) JERKY ACTION OF STATION SELECTOR

Should operation of the station selector be stiff or jerky a little oil dropped on each condenser bearing will effectively remedy this condition. When experiencing this trouble it is also well to check the cable tension spring to make sure that suitable tension is being applied to the condenser drive cable.

(10) USE OF "LOCAL DISTANT" SWITCH

The "local-distant" switch in this receiver performs a somewhat different function from the usual local-distant switch used in other receivers. At the local position the receiver is still very sensitive, but its selectivity is impaired slightly in order to get better tone quality. The set should normally be operated with this switch in the "local" position. In the "distant" position better sensitivity and selectivity is obtained, and throwing the switch to this position will give better volume on extremely weak signals and on all signals the frequency of which is but slightly different from powerful local stations. The difference in tone quality of the two positions of the switch while noticeably better at the local position is still very good at either position. At times when noise level is high, throwing the switch to the "distant" position, even when receiving a local station, may give better results.

(11) PRECAUTIONS FOR EXCESSIVELY LOUD SIGNALS

In some locations, very close to extremely powerful stations, it may be advisable to place a switch in series with the antenna and disconnect the antenna when receiving such stations. If the volume control does not give proper cut-off from such stations remove the 6000-ohm resistor shunted across it. This may be done without removing the receiver from the cabinet by using a small pair of side cutting pliers.

In some cases under such conditions, it may be necessary to interchange the R.F. and 1st I.F. Radiotrons.

(12) REMOVAL OF SHIPPING BLOCKS AND SCREWS

Two small wooden blocks are placed between the receiver chassis and the mounting brackets at each side to prevent its movement in the rubber supports during shipment. These blocks must be removed when an installation is made, as otherwise the set will howl when the volume control is advanced. These blocks are fastened by means of two machine screws which when removed allows them to be pulled from under the mounting bracket. If the blocks are held tightly, a little downward pressure on the chassis will allow them to be easily removed.

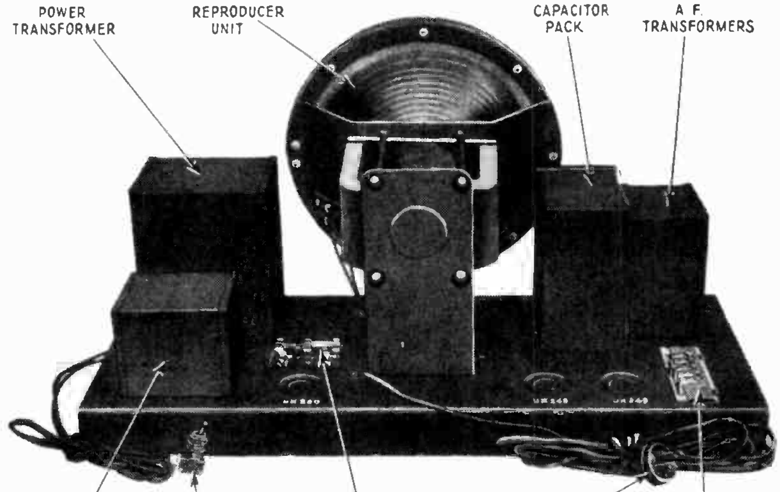


Figure 5—Top view of S.P.U.—Reproducer assembly

PART II—SERVICE DATA

(1) ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna, or the antenna touching some metallic surface such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

(2) RADIOTRON SOCKETS AND PRONGS

The tube sockets used in this set are of an improved type having a large contact surface and should require a minimum of service work. In order to get best results however, the tube prongs should be periodically cleaned, as dirty Radiotron prongs may cause noisy operation. Fine sandpaper may be used to clean them so as to insure a good contact surface. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

(3) NOISY VOLUME CONTROL

Noisy operation of the volume control is usually caused by dirt between the resistance element and the contact arm. Turning the volume control back and forth several times will usually clear the trouble. If it does not however, the use of a pipe cleaner and one of the various cigarette lighter fluids, using the pipe cleaner to apply the fluid to the resistance element will usually clear up the trouble. If neither of these remedies clears the trouble, the volume control must be replaced.

(4) BROKEN CONDENSER DRIVE CORD

The gang condenser is driven from the station selector knob by means of a cord arrangement that also functions as a vernier control. This cord is of rugged construction and a spring is used to maintain an even tension at all times. Should the cord become disengaged from the drum or a new cord be required follow the arrangement indicated in Figure 8 for the correct position of the cord on the drum, otherwise the cord length will be incorrect or the stops on the shaft will engage at the wrong time.

(5) EXCESSIVE HUM

Excessive hum may be caused by:

(a) Defective Radiotron UX-280. Replace with one in known good condition.

(b) Defective filter reactor. A filter reactor with shorted turns, or one in which the center tap has become open will cause hum in the loudspeaker.

(c) Open filter condenser. An open of any of the filter condensers will cause a hum to develop.

(d) Defective field coil in reproducer unit. As the field coil of the reproducer is a part of the rectifier filter, shorted turns or a grounded coil may cause hum. Any defective part must be repaired or replaced.

(e) Grounded or shorted by-pass condensers. Test all condensers and replace any condenser found defective.

(f) Defective center tapped resistance. A short of one section or an open in this resistance will cause a loud hum.

(g) Grounded filament lead. This may occur at the S.P.U. terminal strip due to the screw that holds the cover in place touching one filament lead.

(6) ACOUSTIC HOWL

Acoustic howl may be caused by:

(a) Failure to remove shipping blocks. See Part I, Section 9 of this book.

(b) Defective rubber cushions. If the cushions on which the receiver chassis is supported have become aged or hardened, they should be replaced.

(c) Any defect in the support of the chassis that prevents it from being entirely supported by rubber may cause acoustic howl.

(d) Microphonic detector tube. A microphonic tube, while rare, in the detector socket may cause a howl. The remedy is to replace the tube or use it in another socket.

(7) LOW VOLUME

Low Volume may be caused by:

(a) Defective Radiotrons. Try interchanging all Radiotrons with others of similar type known to be in good condition.

(b) Poor antenna system. Install antenna as suggested in Part I, Section 1.

(c) Receiver not properly aligned. First—Replace the oscillator tube. Second—Adjust oscillator trimming condensers, I.F. tuning condensers, and gang condenser vanes as described in Part II, Sections 11, 12 and 13.

(d) Defective A.F. transformer. The A.F. transformers, the internal connections of which are shown in Figure 16, are in a metal container. All coils should be tested for continuity and if other defects are considered likely, the coils should be measured for D.C. resistance. Shorted turns may be disclosed by substituting an entirely new unit for the one in use.

(e) Low Voltages from S.P.U. Measure all voltages and if low, replace tube (Radiotron UX-280), or any defective parts that are causing low voltages in S.P.U. Refer to Part III, Section 2.

(f) Open, shorts, or grounds in receiver assembly. Test with continuity tests and make any repair or replacement necessary.

(g) Shorted field coil in reproducer unit. Any defect that reduces the strength of the magnetic field of the reproducer unit will reduce the output of the receiver. Check the current (85 M.A.) in the field and the voltage drop (110 volts) across it. An open field coil will cause the receiver to be inoperative.

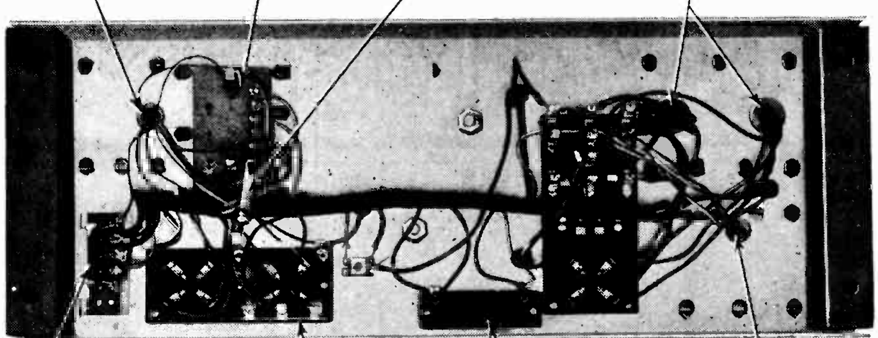


Figure 6—Sub-chassis view of the S.P. U.-Reproducer assembly

(8) DISTORTED REPRODUCTION

(Not due to failure in reproducer unit)

Distorted reproduction may be caused by any of the following:

(a) Radiotrons. A defective Radiotron will cause distortion and can be defective even though it lights. Defects other than heater or filament failures are checked only by substitution with a tube of known quality or by testing the tube.

(b) Defective A.F. transformers. An open in the secondary of the input transformer or shorted turns in any winding may cause distortion. Test by means of continuity or resistance measurement tests and make replacement if necessary.

(c) Oscillation in receiver assembly. Oscillation in the receiver assembly other than that of the oscillator will cause distortion to be experienced when tuning in a station. This distortion will be accompanied by a whistle when the station is tuned in. To remedy trouble of this character, refer to Part II, Section 10.

(d) Receiver improperly aligned. Improper alignment of the receiver in addition to affecting its sensitivity and selectivity, will cause distortion of any signal received. Realign the receiver as described in Part II, Section 11.

(e) Incorrect tuning. If the receiver is not accurately tuned to the station being received, distortion will result. Follow the instructions given on the instruction card accompanying each set when tuning.

(f) Heterodyne between stations too close in frequency. This is no defect in the receiver and, therefore, cannot be remedied except by shifting the frequencies of the transmitters.

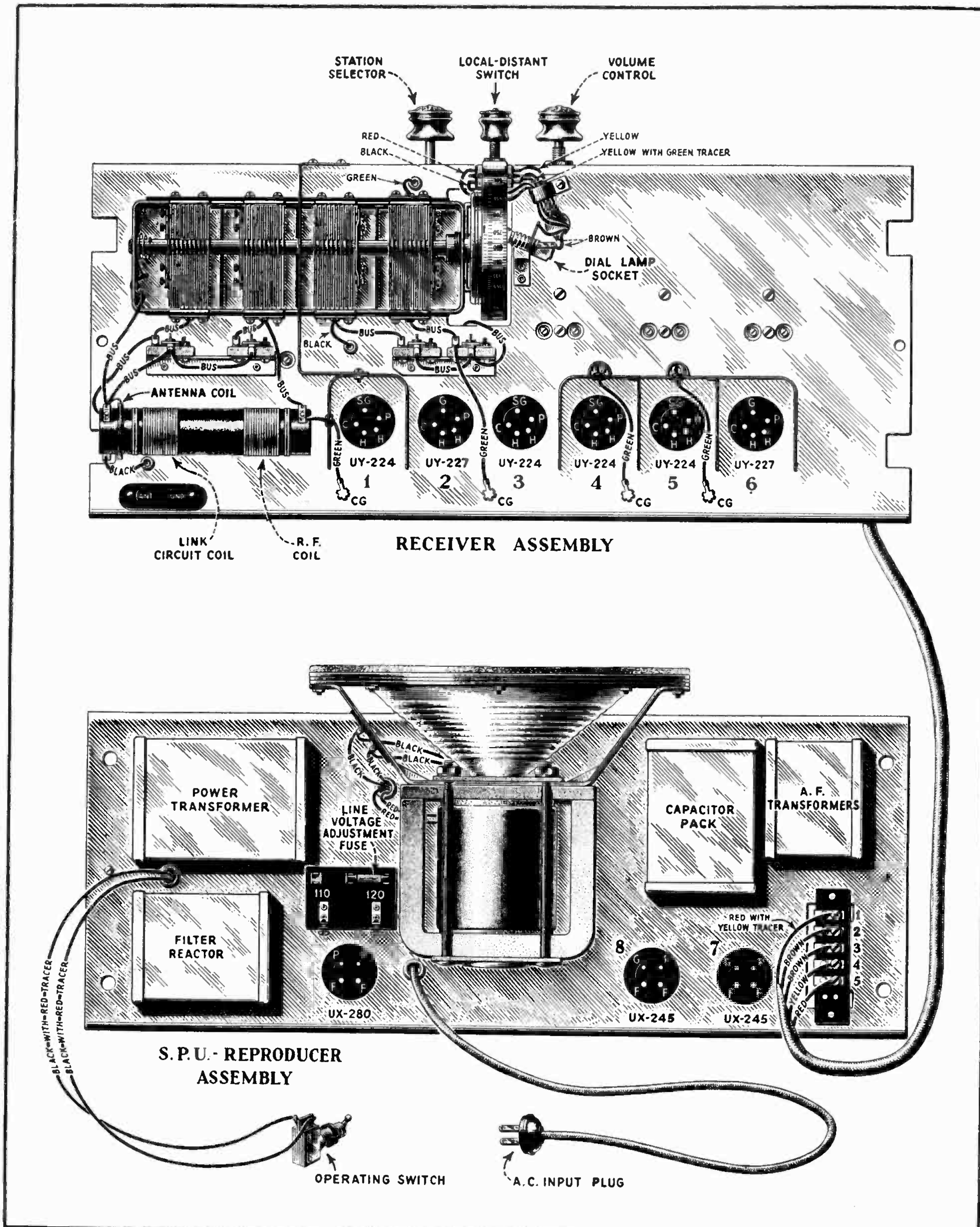


Figure 7—Complete layout of all assemblies and cable connections of Radiola 80 without tone contro

(g) Strong local station. Set "Local-Distant" switch in "Local" position. Shift R.F. tubes and first I.F. tubes. Shorten antenna. Place a switch in antenna lead.

(h) Open by-pass condensers or connections. Any failure that will cause a by-pass condenser not to function will result in distortion. Repair or replace any such defect.

(i) Defect in Receiver Assembly or S.P.U. Check by means of continuity tests and make any replacement necessary.

(9) AUDIO HOWL

Audio howl may be caused by:

(a) Stations too close in frequency. This is a fault of the broadcasting transmitting stations and no fault of the receiver. Such a howl will be picked up on any type of receiver.

(b) Open by-pass condensers. An open of any of the by-pass condensers may cause an audio howl.

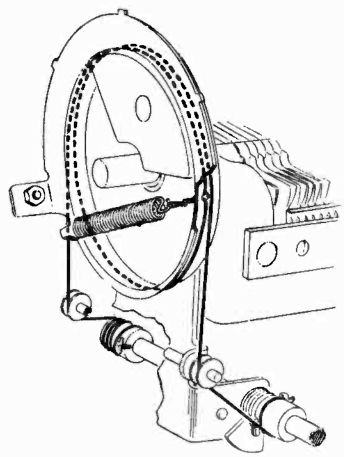


Figure 8—Condenser drive cord arrangement

(c) Receiver Oscillation. An oscillating receiver will give a whistle when a station is tuned in. Apply the remedies suggested in Part II, Section 10.

(d) Defective Radiotrons in push-pull or detector stage. A defective Radiotron in the push-pull or detector stage may cause the receiver to develop a howl. Replace any defective Radiotron.

(e) Vibrating elements in the receiver Radiotrons. A gradually developed howl may be due to the loudspeaker, causing the receiver Radiotron elements to vibrate. Apply the remedies given in Part II, Section 6.

(10) OSCILLATION

Oscillation in the R.F. or I.F. stages may be due to:

(a) Failure of shielding of Radiotrons UY-224, or their control grid leads not in place. Make sure all shielding and leads are as originally intended. Any failure should be repaired.

(b) Open by-pass condensers in receiver assembly. Test and make any repair or replacement necessary.

(c) Lead from by-pass condenser not properly connected. A separate lead is brought out of the by-pass condenser case for the ground connection to the condenser that is connected to R.F. and I.F. plate voltage supply leads. While the condenser is still electrically in the circuit, if this lead is not connected, oscillation in the intermediate stages will result.

(d) Defective Radiotron UY-224. A defective Radiotron UY-224 may cause oscillation and should be replaced by a Radiotron known to be in good operating condition.

(11) ADJUSTMENT OF R.F. LINE UP AND OSCILLATOR TRIMMING CONDENSERS

(*If dial does not read correctly, see Sec.* 14, *page* 23.)

Five adjustable condensers are provided for lining up the R.F. circuits and shifting the oscillator frequency so that it will be at a 175 K.C. difference from the incoming R.F. signal throughout the tuning range of the set. Poor quality, insensitivity and possible inoperation of the receiver may be caused by these condensers being out of adjustment.

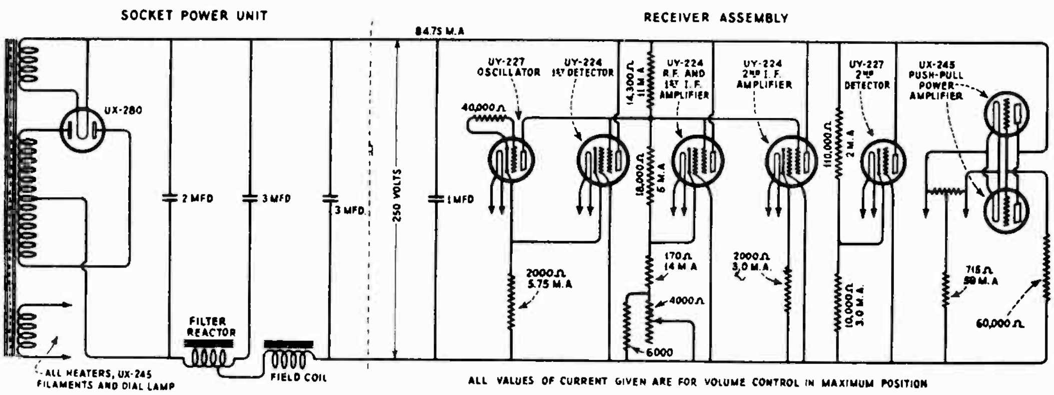


Figure 9—Voltage supply circuit (model without tone control)

If other adjustments have not been tampered with—the intermediate tuning and gang-condenser line-up condensers—the following procedure may be used for adjusting these condensers.

(a) Procure an R.F. oscillator giving a modulated signal at exactly 1400 K. C.and 600 K.C. The General Radio Co., type 320 or 360 after calibration by G. R. Co., will be suitable or one may be constructed by assembling and wiring the apparatus indicated in Figure 11. A non-metallic screw driver ¼″ in diameter is also necessary.

(b) An output indicator is necessary. This may be a current squared galvanometer connected to the secondary of the output transformer instead of the cone coil of the reproducer unit, a 0-5 miliammeter connected in series with the plate supply to the second detector (lead No. 1) or the output devices included in the General Radio Oscillators. In the type 320 the meter leads should be connected in the second detector plate circuit and in the type 360 across the cone coil connections of the loudspeaker. The cone coil may remain in place or be disconnected, satisfactory results being obtained in either case.

(c) Locate the 600 K.C. trimming condenser (Figure 10), and turn the adjusting screw until it is about ¾ of the way in. Set the "Local-Distant" switch at "Distant."

(d) Set oscillator in operation at exactly 1400 K.C. Place the set in operation and tune in the signal. Make sure the receiver is properly grounded and has an average antenna. Adjust the volume control until a reading is obtained in the output meter. While making adjustments regulate the volume control so that an excessive reading is not obtained. Then adjust the selector knob until the scale reads 1400 K.C. Now adjust the oscillator, 1st detector, R.F. and link circuit trimming condensers (See Figure 10) in the order given until maximum output is obtained.

(e) Set the oscillator at exactly 600 K.C. Tune in the signal on the set and adjust the 600 K.C. oscillator trimming condenser, Figure 10, for maximum output while rocking the gang condenser back and forth. The dial scale should read exactly 600 K.C. If it does not read 600 K.C. loosen the screws that hold the scale and slip it until it reads ½ the error from 600 K.C. on the opposite side of 600 K.C. For example, if the scale reads 620 K.C. at maximum output set the scale at 590 K.C. Another example would be if the scale read 580 K.C. to set it at 610 K.C.

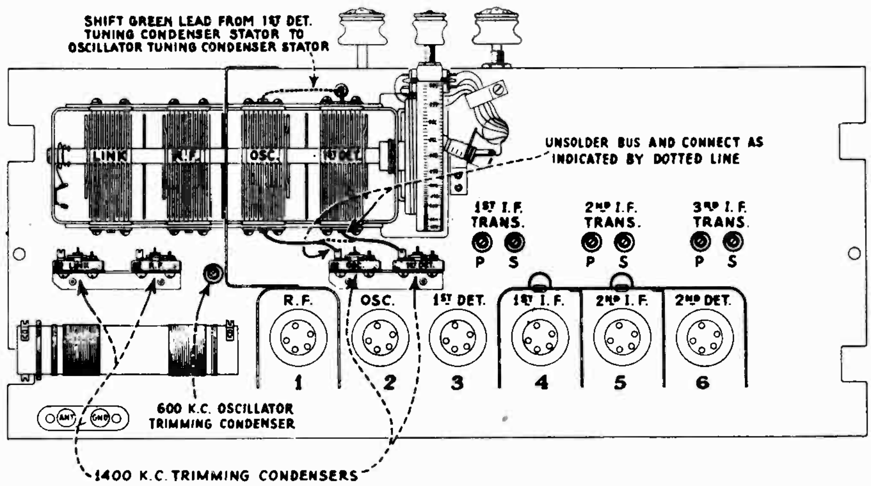


Figure 10—Top view of receiver assembly showing condenser adjustments

(f) Shift the oscillator frequency to 1400 K.C. and set the selector scale at exactly 1400 K.C. Now adjust the four trimming condensers in the order given under (d) until maximum output is obtained.

(g) Place the oscillator again in operation at 600 K.C. and tune in the signal with the receiver. If adjustments have been properly made, the signal will be received at maximum output when the scale reads exactly 600 K.C. If not, then the operations given under (e) and (f) must be again repeated.

With this adjustment so that the scale is exactly at 600 and 1400 all other dial readings will be correct within very close limits.

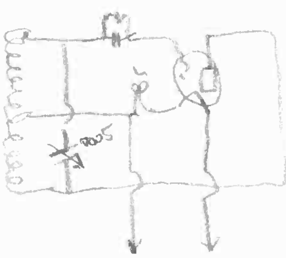
(12) ADJUSTMENT OF I.F. TUNING CONDENSERS

Two screen-grid intermediate frequency amplifier stages are used in this set. Three transformers are necessary for coupling these two stages. Both the primary and secondary of each transformer is accurately tuned to 175 K.C. and the correct functioning of the receiver is dependent on the proper alignment of the I.F. stages.

The first I.F. transformer—the one in the copper container—has its two windings very loosely coupled, this condition being further accentuated by having a copper shield placed between each winding, which makes possible very sharp tuning of this first I.F. stage unless the "Local-Distant" switch is in the local position and resistance is artificially added to the circuits. The other two transformers have their winding closely coupled—overcoupled—so that a flat top effect is obtained in the tuning curve. The reason for discussing the I.F. curve is that this type of coupling has a bearing on the method to be used for lining up the I.F. transformers. The second and third transformers being over-coupled, their tuning condensers are adjusted until a plus or minus equal frequency shift of the I.F. oscillator frequency will give the same output and a flat top effect is obtained on the tuning curve. This is not the adjustment of the condensers that will give a maximum output and is a different procedure from that used in previous super-heterodyne receivers. The first transformer being closely coupled the tuning condensers are adjusted for maximum output.

A detailed procedure for making these adjustments follows:

A modulated R.F. oscillator giving a signal at 175 K.C. and having a vernier condenser for shifting this frequency from 171 K.C. to 179 K.C. is necessary for aligning the I.F. stages of this set. The General Radio Co.'s type 360 oscillator gives this frequency variation, but calibration of these secondary points must be made on instruments purchased prior to June1,



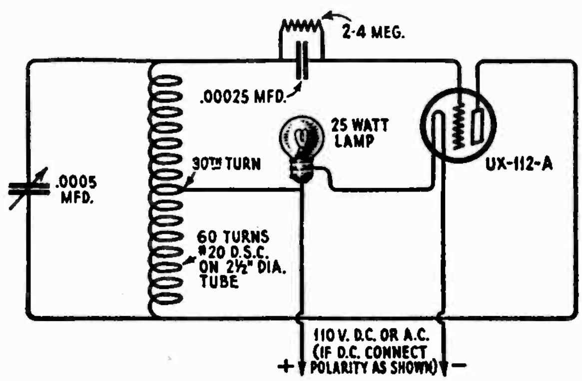


Figure 11—Modulated Oscillator

1930. On these earlier models and on the older General Radio Type 320 oscillators to which the 175 K.C. frequency has been added, the General Radio Co. will add such calibrations, together with a 600 K.C. and 1400 K.C. calibration, at a nominal cost.

A non-metallic screw driver ¼ inch in diameter is also necessary for making these adjustments. With the necessary equipment at hand, proceed as follows:

(a) Place the set in such a position that access to all mechanism is obtained. Place the receiver in normal operation with the volume control at minimum and then remove the oscillator tube. (Socket No. 2). Make sure a good ground connection has been made.

(b) Connect output meter in circuit. The meter leads of the Type 320 oscillator should be connected in series with lead No. 1 of the S.P.U. terminal strip. The output meter used on the Type 360 oscillator should be substituted for the cone coil of the reproducer unit and the switch on the oscillator set at "Dynamic."

(c) Place the oscillator in operation at 175 K.C. and connect the coupling lead to the control grid connection of the first detector Radiotron—(Socket No. 3). If excessive output is obtained disconnect the coupling lead from the oscillator and place it a short distance away, but in such a position that will cause an indication in the output meter without causing the needle to go beyond the scale.

(d) Now adjust the secondary and primary tuning condensers of the third, second and first I.F. transformers until maximum output is obtained.

(e) Shift the coupling lead to the control grid connection of the second I.F. Radiotron (SocketNo. 5). Adjust the volume control until a suitable reading is obtained in the output meter. Then adjust the secondary and the primary (See Figure 10) of the third I.F. transformer until a maximum reading is obtained in the output meter. After obtaining maximum output we know the two windings are closely adjusted to the same frequency. Now they must be readjusted until a flat top effect is obtained in the tuning curve. The flat portion should be at least 5 K.C. wide and generally will not exceed 7 K.C. in width. The method of doing this is to shift the oscillator frequency back and forth from 171 K.C. to 179 K.C. and noting, when the condensers are adjusted, that no appreciable change in output reading is obtained from 172.5 K.C. to 177.5 K.C. Also the drop in output should be the same at 171 K.C. and 179 K.C. This indicates that the flat top is centered at 175 K.C. The usual method to obtain this characteristic is, after adjusting to maximum output, to adjust the capacity of the secondary condenser until the flat top effect is obtained. It will probably not be centered at 175 K.C. It is, however, easy to shift its center point by increasing each condenser slightly to shift it to a lower frequency or decreasing both condensers slightly to increase its frequency. To make this adjustment the first time will be somewhat difficult, but after a little experience it is equally as easy as other super-heterodyne adjustments.

(f) After adjusting the third I.F. transformer, shift the coupling lead to the control grid connection of the 1st I.F. Radiotron and place it at a greater distance from the oscillator. Then advance the volume control to maximum. If necessary, reduce this coupling to an even greater extent so that too great an indication is not obtained in the output meter.

(g) Now adjust the secondary and primary condensers until maximum output is obtained. Then readjust in the same manner as with the third transformer until a flat top effect is obtained. This may not be quite as broad as the third transformer.

(h) If the "Local-Distant" switch is not already so adjusted, place it in the "Distant" position. Then shift the coupling lead to the control grid connection of the first detector (Socket No. 3). Now adjust the volume control until the meter reading is not excessive and then adjust the secondary and primary of the 1st I.F. transformer condensers until maximum output is obtained. This transformer tunes very sharply and no further adjustments are necessary.

This completes the I.F. tuning adjustments and when so made, the set will perform at maximum efficiency. However, it is best at this point to check the oscillator trimming and R.F. line-up condenser adjustments. The correct method of making this adjustment is given in Part II, Section 11.

(13) LINE-UP ADJUSTMENTS OF GANG CONDENSER

The four-gang condenser used is a new type having features not found in similar condensers. The outstanding of these features are the steel construction and the adjusting screws provided for lining up each condenser in exact electrical alignment with all the other condensers. Five such screws are provided on each unit which allows five adjustments to be made, each of which is independent of the other adjustments. These adjustments are made at the factory and unless tampered with, will not require any readjustments. If, however, adjustment is necessary a step by step procedure for making such adjustment follows:

(a) Remove the receiver assembly from the cabinet as described in Part IV, Section 1. Procure a small socket wrench as listed in the Parts Catalog, and also a modulated oscillator (See Figure 11) covering the broadcast range. A 0-2 milliammeter is necessary to place in the first detector plate circuit. This may be done with an adapter that breaks the plate circuit of this tube, or by unsoldering the wire that is connected to the plate socket contact and connecting the meter to this lead and the socket contact. Remove the oscillator tube and connect a 20,000-ohm resistor from the oscillator socket plate connection to the cathode connection. Make a good ground connection to the receiver.

(b) Place the receiver in operation and couple the oscillator to the antenna lead of the set. Turn the station selector knob until the first vanes of the gang condenser fully mesh with the stator plates and the next set is free. This is shown in Figure 12A. Now turn the screws on all the parallel trimming condensers until they are at their minimum capacity position.

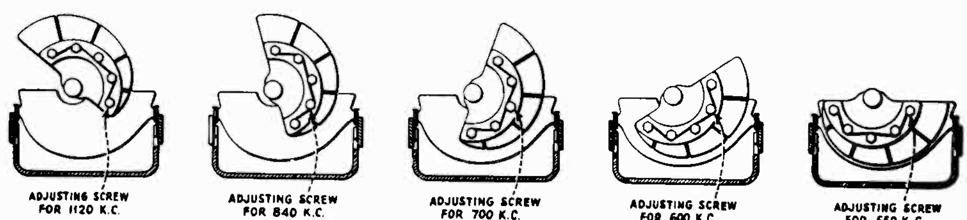


Figure 12—Gang condenser adjustment positions

(c) Adjust the oscillator until a deflection is obtained in the milliammeter. This will be at about 1120 K.C. If the condensers are accurately aligned, adjusting any of the screws that hold the first group of vanes in either direction, of the link circuit, R.F. circuit and first detector condenser will cause a decreased reading in the meter. If any, however, should cause an increased reading due to being pulled away from its adjacent plate—capacity reduced—then it should be adjusted for maximum output. If an increased amount of capacity is required at any vane to increase the output, i. e. the vanes brought closer to the adjacent plate, then the oscillator should be increased in frequency slightly and the other two vanes readjusted. This would be a reduction in their capacity. The reason for this shift of frequency is to make sure that the condensers are aligned with the minimum capacity possible, as otherwise the dial scale may read inaccurately.

Due to slight inaccuracies of the coils it may not be possible to exactly peak each vane, as a sufficient capacity variation is not present. However, adjusting for a maximum output reading while still maintaining clearance will give as good, or better, an adjustment as was originally present in the receiver.

(d) After aligning the link, R.F. and first detector circuit, the bus bar indicated in Figure 10 should be shifted to the position indicated by the dotted line and the black lead released from the oscillator tuning condenser stator. Allow this lead to remain free. Now shift the green lead from the stator of the first detector tuning condenser to the stator of the oscillator tuning condenser. This can best be done by using a clip and clamping on to a stator mounting screw of the oscillator tuning condenser. The vanes on the oscillator condenser may now be shifted for maximum output.

(e) Now shift the gang condenser so that the first and second section are fully meshed with the stator plates. Shift the oscillator frequency until a deflection is obtained in the output meter and adjust the second group of vanes in the same manner as the first were adjusted. Shift the bus bar and adjust the first detector condenser also.

(f) Follow this same procedure through until all the vanes have been adjusted. After their correct alignment the set must be realigned as described in Part II, Section 11. If the I.F. condensers require adjustment, they should be checked after the gang condenser adjustment has been made as just described and before the scale and oscillator condensers are adjusted.

(14) DIAL SCALE NOT READING CORRECTLY

Should the dial scale give a large error in the indicated scale reading it may be due to any of the following:

(a) Dial screen not in position. Sometimes the dial screen may slip slightly out of its position. Readjust at the low frequency end of the scale. It is readily accessible from the rear. Also check any possible bending of the dial lamp bracket.

(b) Set not properly aligned. Realign set as described in Part II, Section 11.

(c) Oscillator used for aligning not properly calibrated. Calibrate as described in Part III, Section 8.

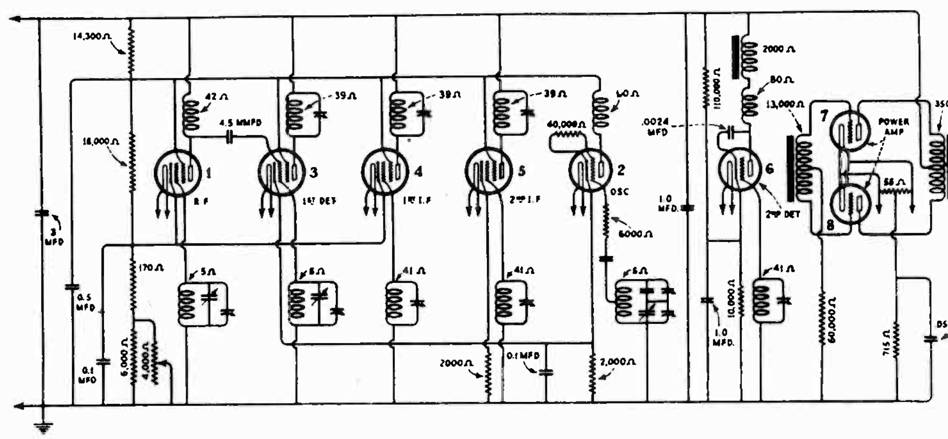


Figure 13—Continuity schematic diagram. (Local-Distant Switch in "Distant" position) (Model without tone control)

PART III—ELECTRICAL TESTS

(1) VOLTAGE SUPPLY SYSTEM

Figure 9 illustrates the schematic diagram showing the voltage supply system and the values of current flowing in the different circuits together with the values of the various resistors. It will be noted that the series method of voltage supply is used except in the volume control circuit. This keeps the current drain on the rectifier tube at a minimum value.

(2) VOLTAGE READINGS AT TERMINAL STRIP

The following voltages are taken at the S.P.U. terminal strip with a D.C. and A.C. voltmeter. The D.C. meter should have a resistance of at least 1000 ohms per volt. Line voltage 120, fuse at 120-volt position, volume control at maximum.

Terminals	Volts
2 to 3	2.5 A.C.
4 to 5	250 D.C.

(3) VOLTAGE READING SERVICE DATA CHART

The following service data chart provides a means of diagnosing trouble from socket voltage readings taken at Radiotron sockets with any of the usual set analyzers. These readings are average, and are not obtained with any particular test set. They are therefore slightly different from those given in Part III, Section 4.

VOLTAGE READING SERVICE DATA CHART

Volume Control at Maximum

Local-Distant Switch at Distant

VOLTAGE CHARACTERISTIC	TUBE 1 (R.F.)				TUBE 2 (osc)		TUBE 3 (1st DET.)				TUBE 4 (I.F.)				TUBE 5 (I.F.)				TUBE 6 (2nd DET.)			TUBE 7 (A.F.)			TUBE 8 (A.F.)			Cause of Incorrect Readings
	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	Plate Volts	Plate M.A.	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	C.G. Volts	S.G. Volts	Plate Volts	Plate M.A.	Grid Volts	Plate Volts	Plate M.A.	Grid Volts	Plate Volts	Plate M.A.	Grid Volts	Plate Volts	Plate M.A.	
Normal	2.2	90	240	4.0	70	6.0	8.0	80	235	.25	2.2	85	240	5.5	5.0	85	240	2.0	23	210	.5	20	200	30	20	200	30	
High grid bias on tubes 1 and 3	138	0	110	0	100	10	32	130	250	0	137	0	105	0	13	130	255	3.0	26	235	1.0							Open volume control and 6000-ohm resistor, or open 170-ohm resistor
No C.G. voltage on R.F. tube	0	85	245	5.0																								Open grid coil of R.F. transformer
Low plate voltage on R.F. tube	2.0	80	60	0																								Open plate winding of R.F. tube
High S.G. voltage	2.4	120	245	6.0	85	8.0	26	110	230	.25	22	110	240	6.5	65	105	240	3.0										Open 18,000-ohm resistor
No C.G. voltage on tube 3							0	70	225	3.5																		Open grid coil of 1st detector
No C.G. voltage on tube 4											0	85	240	6.0														Open secondary of 1st I.F. transformer
No C.G. voltage on tube 5															0	80	230	5.0										Open secondary of 2nd I.F. transformer
No grid voltage on tube 6																			0	100	8.0							Open secondary of 3rd I.F. transformer
High S.G. voltage and no Osc. volts or M.A.	3.2	115	240	5.0	0	0	6	115	235	2.5	3.5	110	240	6.0	7.0	110	235	3.0										Open Osc. plate coil
No plate volts or M.A. on tube 3							8.0	80	0	0																		Open primary of 1st I.F. transformer
No plate volts or M.A. on tube 4											2.0	80	0	0														Open primary of 2nd I.F. transformer
No plate volts or M.A. on tube 5															3.2	80	0	0										Open primary of 3rd I.F. transformer
No plate volts or M.A. on tube 6																			18	0	0							Open 2nd Det. R.F. choke
No Osc. or 1st Det. plate volts or M.A.	3.1	110	250	5.5	0	0	87	0	0	0	3.0	95	250	5.0	7.0	105	240	3.5										Open 2000-ohm Osc. and 1st Det. bias resistor
No voltages on tube 5															*7.5	0	0	0										Open 2000-ohm 2nd I.F. bias resistor
No plate volts and high grid volts on tube 6																			185	0	0							Open 10,000-ohm 2nd Det. bias resistor
High 2nd Det. plate M.A.																			22	225	2.0							Open 110,000-ohm resistor
No C.G. or S.G. volts on tubes 1, 2, 3, 4 and 5; high 2nd Det. volts	0	0	300	0	0	0	0	0	300	0	0	0	300	0	0	0	300	0	29	260	0							Open 14,300-ohm resistor
No C.G. volts on tubes 1 and 4	0	85	250	1.5							0	90	250	6.5														Shorted .1 Mfd. condenser across volume control and 170-ohm resistor
No C.G. or S.G. volts on tubes 1, 2, 3, 4 and 5	0	0	285	0	0	0	0	0	270	0	0	0	270	0	0	0	70	0										Shorted .5 Mfd. condenser from S.G. supply to ground
No C.G. volts on tube 3					78	6.5	0	90	250	5.5																		Shorted .1 Mfd. condenser from cathodes 2 and 3 to ground
No C.G. volts on tube 5															0	90	250	5.5										Shorted .1 Mfd. condenser from cathode 5 to ground
All voltages low; no grid volts on tube 5	2.0	70	210	2.5	60	4.5	6.5	70	205	.25	1.5	70	210	3.0	4.0	75	205	2.0	0	180	20							Shorted 1.0 Mfd. condenser from cathode 6 to ground
High grid and no plate volts on tube 6															4.0	80	225	2.0	195	0	0							Shorted .0024 Mfd. condenser from plate to cathode tube 6
Low voltages; no grid volts on tubes 7 and 8	1.0	40	120	1.5	40	2.5	3.5	40	120	.5	1.0	40	120	1.5	1.8	45	120	1.0	10	110	.5	0	125	50	0	125	50	Shorted .05 Mfd. condenser across 715-ohm bias resistor
High voltages on tubes 1, 2, 3, 4, 5 and 6	4.5	145	275	6.0	110	11.0	32	130	365	.5	4.5	135	370	8.5	8.0	105	370	4.5	38	340	1.0	140	180	1.0	140	180	1.0	Open 715-ohm or 60,000-ohm grid resistor in S. P. U.
High grid volts on tubes 7 and 8																						37	210	30	37	210	30	Shorted 60,000-ohm resistor
No plate M.A. on tube 6																			23	200	0	23	210	37	23	210	37	Open primary of inter-stage transformer
High plate current on tube 8	1.5	70	205	2.5	60	5.0	6.0	70	200	.25	2.0	70	205	3.5	4.0	75	200	2.0	20	180	.25	26	155	0	0	135	75	Open one-half secondary of inter-stage transformer
High plate current on tube 7	1.5	70	205	2.5	60	5.0	6.0	70	200	.25	2.0	70	205	3.5	4.0	75	200	2.0	20	180	.25	0	135	75	26	155	0	Open one-half secondary of inter-stage transformer
No voltages on tube 8	3.0	100	270	5.0	75	6.5	9.0	90	260	.25	3.0	95	260	6.5	6.0	95	260	3.0	26	230	.25	24	250	38	0	0	0	Open one-half primary of output transformer
No voltages on tube 7	3.0	100	270	5.0	75	6.5	9.0	90	260	.25	3.0	95	260	6.5	6.0	95	260	3.0	26	230	.25	0	0	0	24	250	38	Open one-half primary of output transformer

*Caused by connection of meter from control grid to cathode.

(4) VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron socket with the receiver in operating condition should prove of value when checking with test sets such as the Weston Model 547, Type 3, or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and line voltages. Therefore, the following values must be taken as approximately those that will be found under varying conditions. The numbers in column 1 indicate the tube socket numbers shown in Figure 7.

VOLTAGE READINGS AT RADIOTRON SOCKETS

Tube No.	Cathode to Heater Volts D. C.	Cathode or Filament to Control Grid Volts, D. C.	Cathode to Screen Grid Volts, D. C.	Cathode or Filament to Plate Volts, D. C.	Plate Current M. A.	Heater or Filament Volts	Screen Grid Current M. A.
Volume Control at Minimum							
1	—34	— 2.2	80	240	3.2	2.2	.5
2	—22	—	—	60	6.5	2.2	—
3	—25	— 9.5	72	230	0.25	2.2	.1
4	—34	— 2.2	78	240	4.0	2.2	.5
5	—31.5	— 4.2	78	240	1.6	2.2	.5
6	—12	—22	—	212	0.25	2.2	—
7	—	—19*	—	200	25.0	2.2	—
8	—	—19*	—	200	25.0	2.2	—
Volume Control at Maximum							
1	—25	—10	75	230	0	2.2	0
2	—22	—	—	65	7.5	2.2	—
3	—25	—10	82	240	0	2.2	.1
4	—25	—10	75	230	0	2.2	0
5	—32	— 6	90	250	2.2	2.2	1.0
6	—12	—23	—	220	0.25	2.2	—
7	—	—20*	—	210	28.0	2.2	—
8	—	—20*	—	210	28.0	2.2	—

*Not true reading due to resistor in circuit.

(5) CONTINUITY TEST

The following tests will show complete continuity for the receiver assembly and socket power unit of this instrument. Disconnect the antenna and ground leads; the cable connections at the terminal strip of the S.P.U., and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series; or a voltmeter with sufficient battery to give a good deflection when connected across the battery terminals should be used in making these tests.

The resistance of the various circuits are shown in the column titled "Correct Effect." Checking the resistance of the circuits adds an additional check on their correct functioning. This may be done by means of a direct reading "Ohmmeter," a resistance bridge, the voltmeter ammeter method or the method suggested in Part III, Section 6.

The receiver and S.P.U. Radiotron sockets, numbers, lugs and terminals used in making these tests are shown in Figure 7. The receiver wiring diagram is shown in Figure 15 and the S.P.U. wiring diagram in Figure 16.

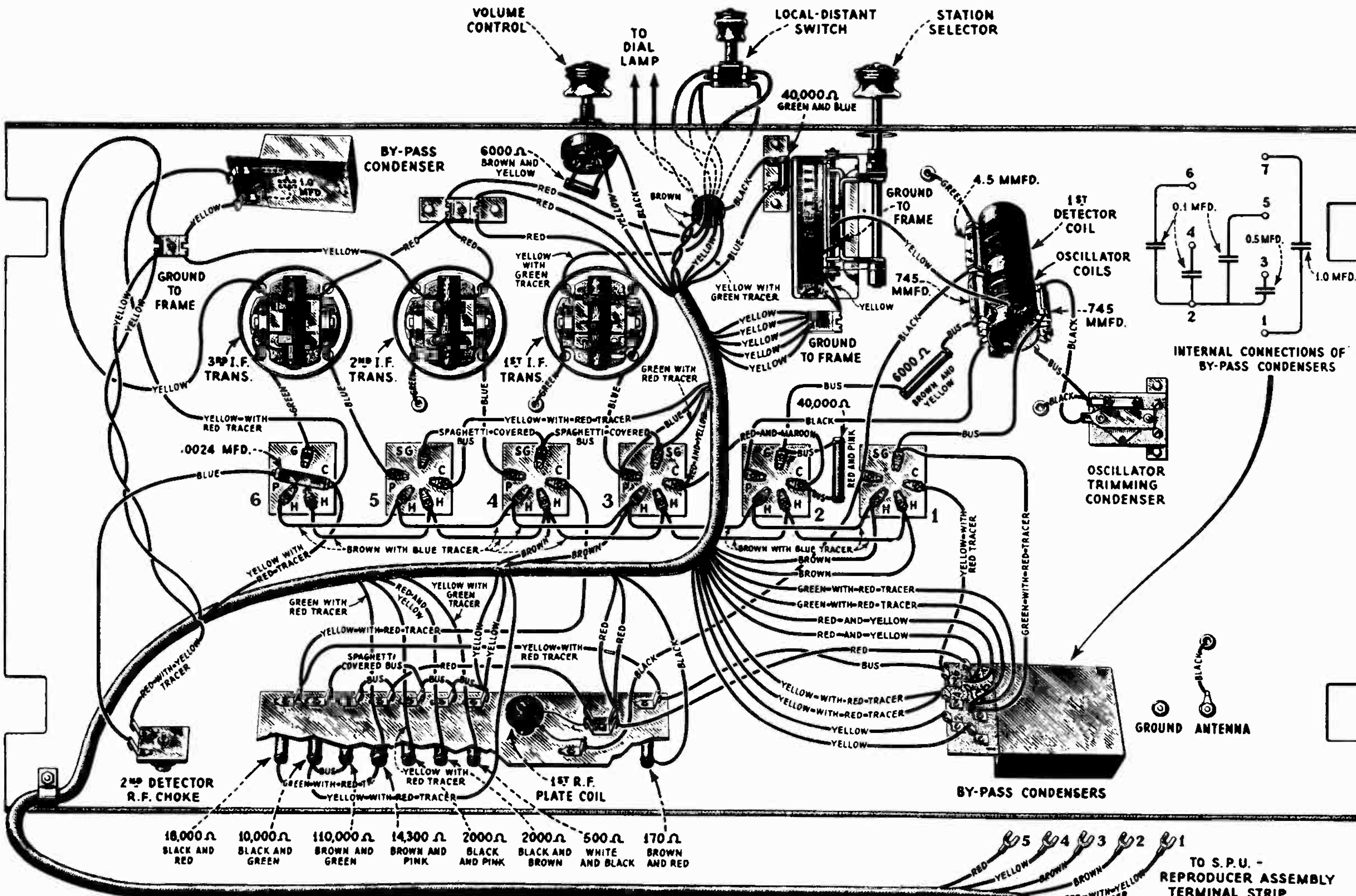


Figure 14—Wiring diagram of receiver assembly (Model without tone control)

RECEIVER ASSEMBLY CONTINUITY TESTS

Terminals	Correct Effect	Incorrect Effect: Indication	Incorrect Effect: Caused By
Ant. to Ground	Closed (40 ohms)	Open	Open antenna coupling coil
Stator tuning condenser No. 1 (See Figure 7) to Ground	Closed (5 ohms)	Open Short	Open link circuit coil Shorted link circuit tuning or trimming condenser
C1 and C4 to Ground	Closed (V.C. at Min.) 4170 ohms	Open Short	Open 170 ohm resistor or volume control Shorted .1 mfd. condenser
CG1 to Ground	Closed (5 ohms)	Open Short	Open R.F. grid coil Shorted R.F. tuning or trimming condenser
SG1, 3, 4, and 5 to Ground	Closed (V.C. at Min.) (22,170 ohms)	Open 18,000 ohms Short	Open 18,000 ohms, 170 ohm resistor or volume control Shorted .1 mfd. condenser Shorted .5 mfd. condenser
P1 to Lug No. 5	Closed (42 ohms)	Oren	Open R.F. plate coil
G2 to Ground	Closed (42,000 ohms)	Closed (6000 ohms) 40,000 ohms Open Short	Shorted 720 mmfd. oscillator grid condenser Shorted .1 mfd condenser Open 40,000 or 2000 ohm resistor Grounded 6000 or 40,000 ohm resistor
P2 to SG1	Closed (1 ohm)	Open	Open oscillator plate coil
C2 and C3 to Ground	Closed (2000 ohms)	Open Short	Open 2000 ohm resistor Shorted .1 mfd. condenser
P3 to Lug No. 5	Closed (39 ohms)	Open Short	Open primary of 1st I.F. transformer Shorted 1st I. F. primary tuning condenser
CG4 to Ground	Closed (41 ohms)	Open Short (Local-Distant at "distant")	Open secondary of 1st I.F. transformer Shorted 1st I.F. secondary tuning condenser
P4 to Lug No. 5	Closed (39 ohms)	Open Short	Open primary of 2nd I.F. transformer Shorted 2nd I.F. transformer tuning condenser
CG5 to Ground	Closed (41 ohms)	Open Short	Open secondary of 2nd I.F. transformer Shorted 2nd I.F. transformer tuning condenser
C5 to Ground	Closed (2000 ohms)	Open Short	Open 2000 ohm resistor Shorted .1 mfd. condenser
P5 to Lug No. 5	Closed (39 ohms)	Open Short	Open primary of 3rd I.F. transformer Shorted 3rd I.F. transformer primary tuning condenser
SG5 to Lug No. 5	Closed (14,300 ohms)	Open	Open 14,300 ohm resistor

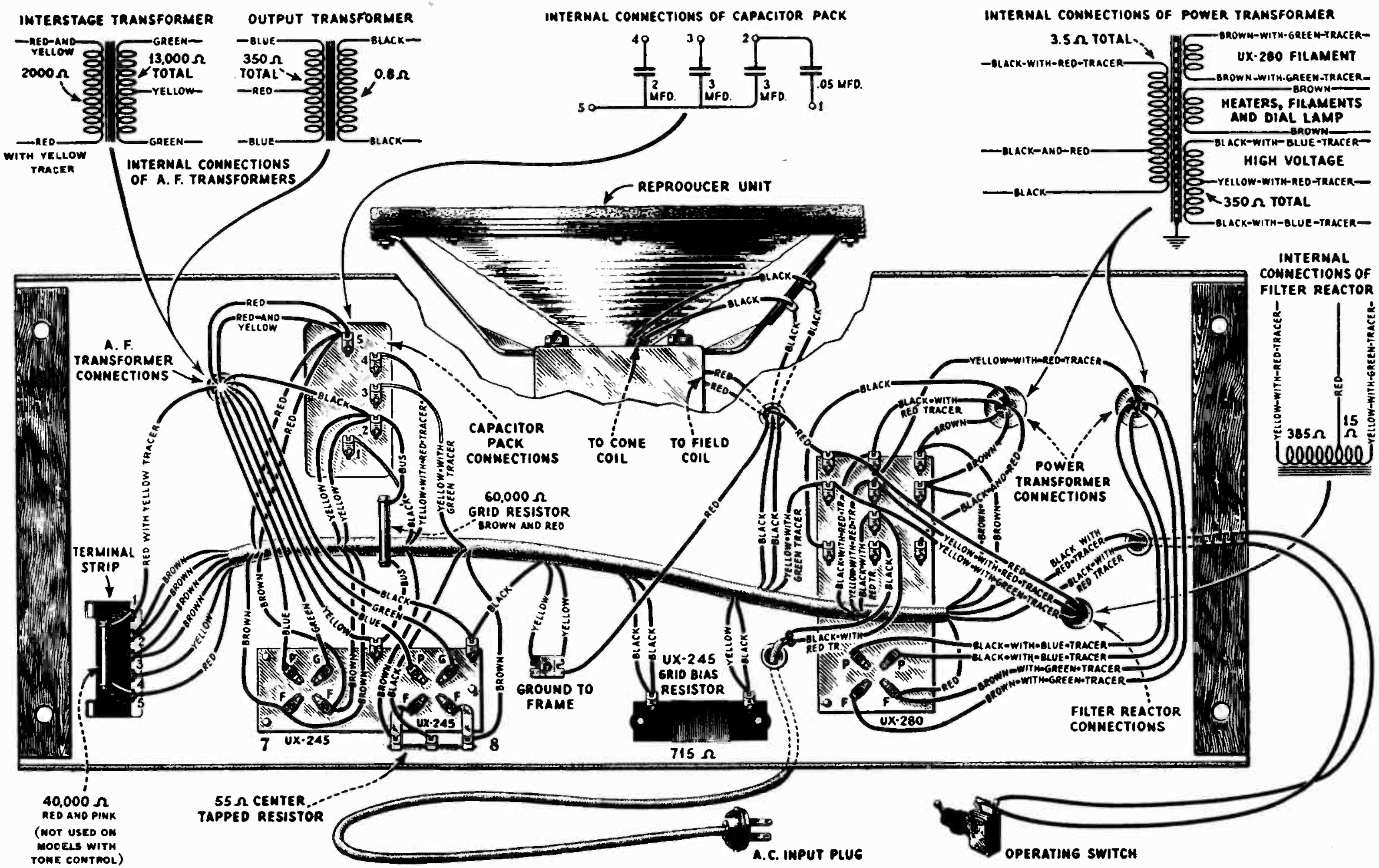


Figure 15—Wiring diagram of Radiola 80 S.P. U.-Reproducer assembly (This unit used in models with and without tone control)

RECEIVER ASSEMBLY CONTINUITY TESTS—Continued

Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused By
C6 to Ground	Closed (10,000 ohms)	Open	Open 10,000 ohm resistor
G6 to Ground	Closed (41 ohms)	Open	Open secondary of 3rd I.F. transformer
C6 to P6	Open	Closed	Shorted .0024 mfd. condenser
P6 to Lug No. 1	Closed (80 ohms)	Open	Open R.F. choke coil
Lug No. 2 to one heater contact of all sockets. Remove dial lamp)	Closed	Open	Open heater connection
Lug No. 3 to other heater contact of all sockets. (Remove dial lamp)	Closed	Open	Open heater connection

S.P.U. REPRODUCER CONTINUITY TESTS

Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused By
Across filament contacts of sockets 7 or 8	Closed	Open 55 ohms	Open filament winding and center tapped resistor Open filament winding
Either filament contact of sockets 7 or 8 to Ground	Closed (715 ohms)	Open Short	Open UX-245 grid bias resistor Shorted .05 mfd. condenser
G7 to G8	Closed (13,000 ohms)	Open	Open secondary of push-pull input transformer
G7 or G8 to Ground	Closed (66,500 ohms)	Open	Open secondary of push-pull input transformer or 60,000-ohm resistor
Terminal 1 to Terminal 5	Closed (1,900 ohms)	Open 40,000 ohms	Open primary of push-pull input transformer 40,000-ohm resistor Open primary of push-pull input transformer
P7 to P8	Closed (350 ohms)	Open	Open primary of output transformer
P7 or P8 to Terminal No. 5	Closed (175 ohms)	Open	Open primary of output transformer or center tap connection
Across cone coil (unsolder leads)	Closed (10 ohms)	Open	Open cone coil
Across output leads to terminal strip (cone coil disconnected)	Closed (.8 ohms)	Open	Open secondary of output transformer
Across UX-280 filament contacts	Closed	Open	Open UX-280 filament winding
P to P of UX-280 socket	Closed (350 ohms)	Open	Open high voltage winding of power transformer
Either P of UX-280 socket to Ground	Closed (1890 ohms)	Open	Open high voltage winding of power transformer, filter reactor or field of reproducer unit
Across A.C. input plug	Closed (3.5 ohms) (Operating switch "on")	Open	Open primary of power transformer or fuse

(6) TESTING FILTER AND BY-PASS CONDENSERS

The filter and by-pass condensers are in metal containers. The internal wiring diagram is shown in Figures 15 and 16.

The condensers can best be tested by charging them with approximately 200 volts D.C. and then noting their ability to hold the charge. After charging, short circuiting the condenser terminals with a screwdriver should produce a flash, the size of the flash depending on the capacity of the condenser and the voltage used for charging. A condenser that will not hold its charge, or a choke that clicks open is defective and requires replacement of the entire unit.

(7) CHECKING RESISTANCE VALUES

The values of the various resistance units in this receiver are shown in the schematic diagrams Figures 2 and 9. 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, or by the following method.

For resistances of low value, 5000 ohms or less, use a voltmeter having a resistance not greater than 100 ohms per volt. For high values of resistance use a meter of 1000 ohms or more per volt. The Weston Meters, Type 301 or 280, each have a resistance of 62 ohms per volt and are satisfactory for the low values. Use sufficient battery to give a good deflection on the meter, for example, a 45-volt "B" battery for a 0-50 volt meter. Take two readings, one of the battery alone, and one of the battery with the unknown resistance in series. Then apply the following formula.

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

(8) CALIBRATION OF R. F. AND I. F. OSCILLATORS

In servicing this receiver it is essential that the frequency of the I.F. and R.F. oscillator used for making adjustments be accurately known. Even with the best of material and construction oscillators will shift their frequency and a periodic check is both desirable and necessary.

I.F. OSCILLATORS

An easy way to check the frequency of the I.F. oscillator is to check its fourth harmonic against a station operating at that harmonic frequency. In the case of the 175 K.C. oscillator used for this receiver the broadcasting station operating at this fourth harmonic frequency would be WLW, operating at 700 K.C. The check is best made by tuning in the station accurately on a radio receiver and then setting the oscillator in operation coupled to the receiver antenna sufficiently so that it will be heard. Then adjust the I.F. oscillator until the beat note between the fourth harmonic and WLW will approach zero frequency (zero beat). At this point both the transmitting station and the harmonic of the oscillator are at the same frequency. The fundamental must therefore be at one-fourth of the frequency, or 175 K.C.

An interesting point in connection with this check is that the eighth harmonic of 175 K.C. is 1400 K.C. This check on the I.F. frequency will therefore serve as an additional check on the 1400 K.C. position by tuning in this harmonic on a receiver.

R.F. OSCILLATORS

The R.F. oscillator may be calibrated in the same manner as the I.F. oscillator with the exception that its fundamental frequency should beat against numerous broadcasting stations and a curve plotted so that all frequencies will be known. Such a curve is shown in Figure 16. As the dial of the receiver is adjusted at both 1400 K.C. and 600 K.C. it is very important that these two places on an oscillator used for that work be accurately known. A step by step procedure for making such a calibration follows:

1. Tune in a station with the receiver at the high frequency end of the scale.
2. Place the oscillator to be calibrated in operation and couple it to the antenna system of the receiver.

3. Adjust the dial of the oscillator until its signal is heard at maximum intensity in the receiver or zero beat is obtained with the broadcasting station. Note the reading of this position on the oscillator dial and plot this position on the chart shown in Figure 17. The vertical division represents frequency and the horizontal divisions, the oscillator scale readings.

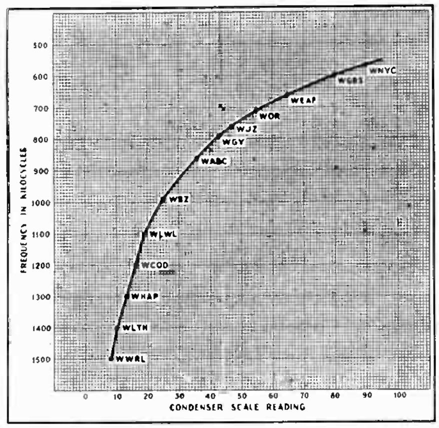


Figure 16—R.F. Oscillator calibration curve

4. Now repeat this procedure at a station slightly lower in frequency and plot this point on the chart.

5. As many stations as possible, tuned in at various positions throughout the dial scale, should be checked by this method, and after all points have been located on the chart, the points should be connected by means of a line. This line will represent the calibration of the oscillator. Figure 16 shows a typical calibration curve.

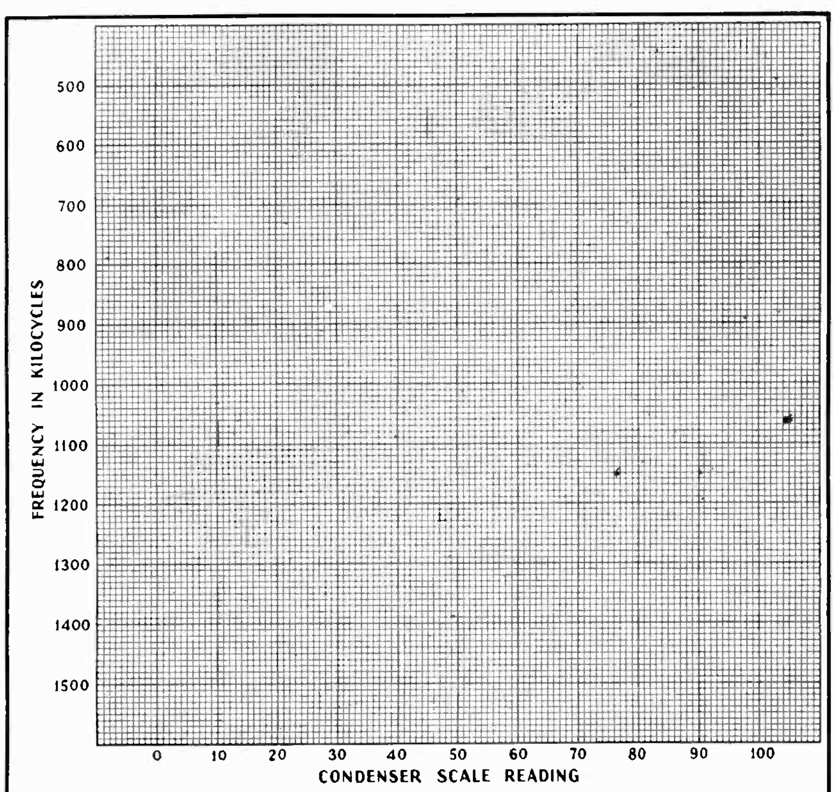


Figure 17—Chart for plotting R.F. Oscillator calibration curve

PART IV—MAKING REPLACEMENTS

(1) TO REMOVE RECEIVER ASSEMBLY

To remove the receiver assembly proceed as follows:

1. Remove two screws that hold the wooden back plate to the sides of the cabinet and remove this plate.
2. Loosen the screw that holds the terminal strip cover and release the cable attached to the terminals located under this cover.
3. Remove the four screws and nuts that hold the receiver assembly to the cabinet.
4. Remove all control knobs and release the local-distant switch.
   The receiver assembly may now be lifted clear of the cabinet and placed in a position convenient for work. To replace, proceed in the reverse manner of that used to remove it.

(2) TO REMOVE S.P.U.-REPRODUCER ASSEMBLY

The parts comprising the socket power unit and the reproducer assembly are all mounted and wired on one base. To remove this unit for repairs proceed as follows:

1. Release receiver assembly cable and wooden back plate as described in Part IV, Section 1.
2. Release operating switch by removing collar on outside of cabinet and removing staple on inside and then pulling the mechanism toward the inside of cabinet. Remove the four screws, nuts and washers that hold the S.P.U.-Reproducer assembly to the bottom of the cabinet. The S.P.U. may now be lifted clear and placed in a position convenient for work.

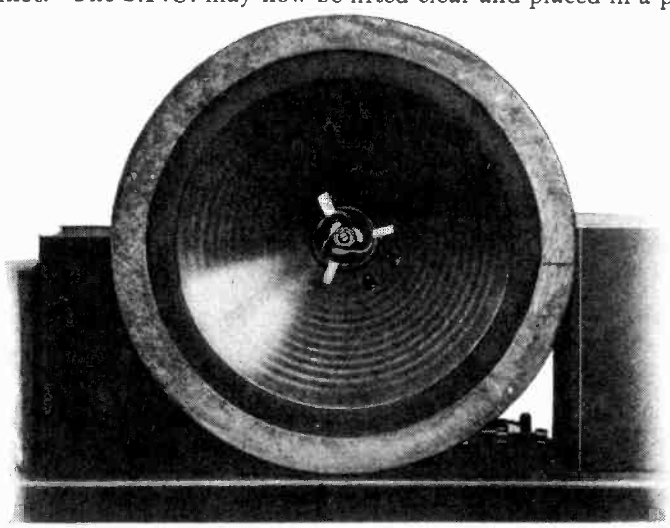


Figure 18—View showing loudspeaker adjusting strips

(3) REPLACING REPRODUCER CONE

Should replacement of the reproducer cone be necessary, proceed as follows:

1. Remove the S.P.U.-Reproducer assembly as described in Part IV, Section 2.
2. Remove the felt ring glued to the front of the reproducer unit.
3. Remove the nine nuts, screws and lock washers that hold the metal ring and cone edge in place. Remove the cone centering screw. The cone coil is connected by means of two soldered terminals located adjacent to the cone bracket. Unsolder these leads. The cone may now be removed.
4. Place the new cone in the position occupied by the old one, and replace cone ring, the nine screws, nuts and the lock washers. Do not tighten these screws.
5. Place three pieces of cardboard the thickness of a visiting card and approximately 1½X¼ in. in size in the space between the inside of the cone coil and the pole piece. This is shown in Figure 18.
6. Now replace the cone centering screws and screw in place tightly.
7. Tighten the nine screws that hold the cone edge and replace the felt ring.
8. Solder the cone coil leads in place.
9. Replace the S.P.U.-Reproducer assembly in the reverse manner of that used to remove it.

PART V—RCA RADIOLA 82 AND LATE MODELS OF RCA RADIOLA 80

INTRODUCTION

RCA Radiola 82 is a console model radio receiver employing the same circuit and chassis as the Radiola 80 with the exception that it includes a tone control. Late models of Radiola 80 also include the tone control and the diagrams will therefore apply to those models. The cabinet of Radiola 82 is of a high-boy type and includes doors.

PHYSICAL SPECIFICATIONS (RCA RADIOLA 82)

Height	48 Inches
Depth	16 Inches
Width	27½ Inches
Weight Alone	120 Lbs.
Weight Packed for Shipment	175 Lbs.

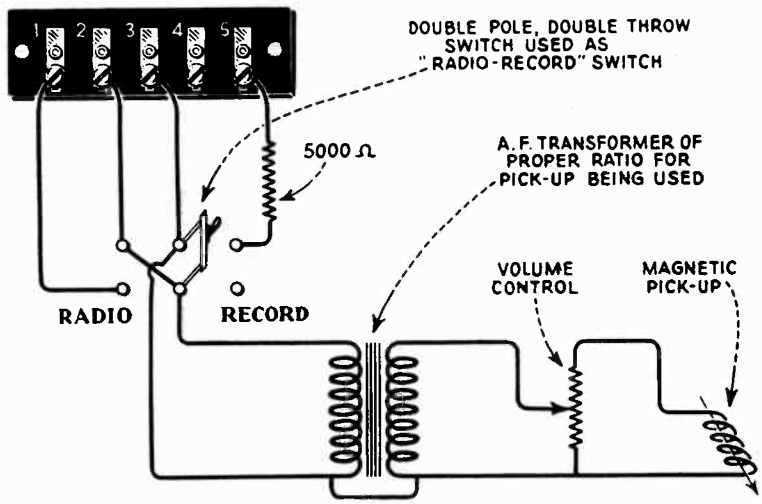


Figure 19—Connections for attaching a magnetic pick-up to RCA Radiola 80 with tone control and to RCA Radiola 82.

The tone control is, however, a new feature and therefore a description of its action is desirable. The tone control of Radiola 82 consists of a 40,000-ohm potentiometer in series with a .025 mfd. fixed condenser. This arrangement is shunted around a choke placed in the second detector plate circuit. With the resistor arm at the extreme "high" position, the reactor is shorted and the full amount of the resistance is placed in series with the condenser, thus giving the normal fidelity of the receiver. As the potentiometer arm is moved toward the extremes "low" position, the choke and condenser both become effective, and thus reduce the high frequency output of the receiver. The amount of this reduction is dependent on the position of the potentiometer arm, operated by the tone control knob.

(1) PHONOGRAPH PICK-UP CONNECTIONS

Figure 19 shows the correct connections for attaching a magnetic pick-up.

(2) ELECTRICAL TESTS

The electrical tests given on RCA Radiola 80 are all applicable to Radiola 82. There is one slight difference to remember, however, and that is the additional 1300-ohm choke and .000745 mfd. condenser in the plate circuit of the 2nd detector that is not present in the Radiola 80.

Figure 20 shows the assembly wiring diagram. Figure 21 shows the schematic circuit diagram. Figures 22 and 23 show the wiring diagrams of the receiver assembly and S.P.U., respectively.

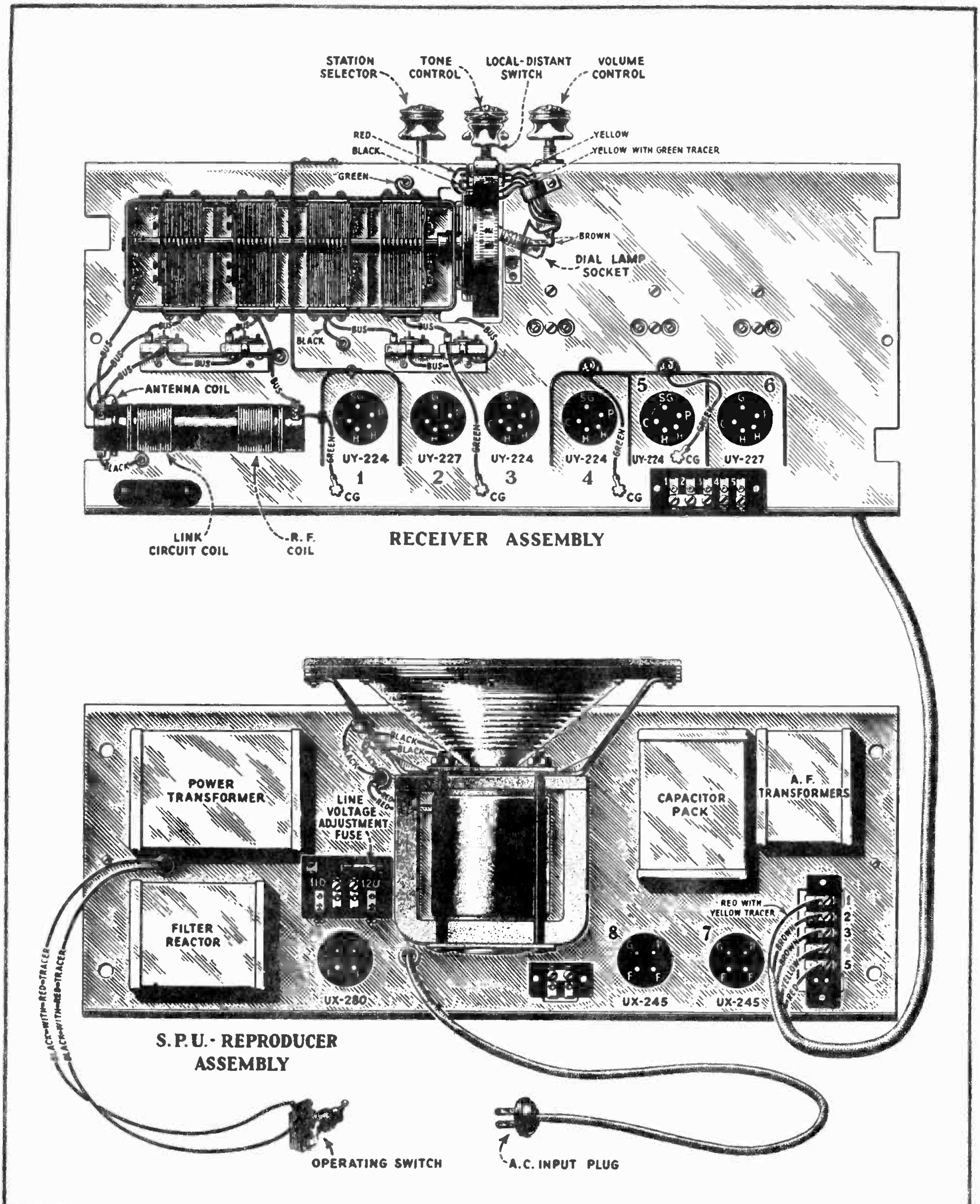


Figure 20—Assembly wiring of RCA Radiola 80 with tone control and RCA Radiola 82. (Note:—Radiola 80 with tone control uses the same S.P.U. as models without tone control. See Figure 7.)

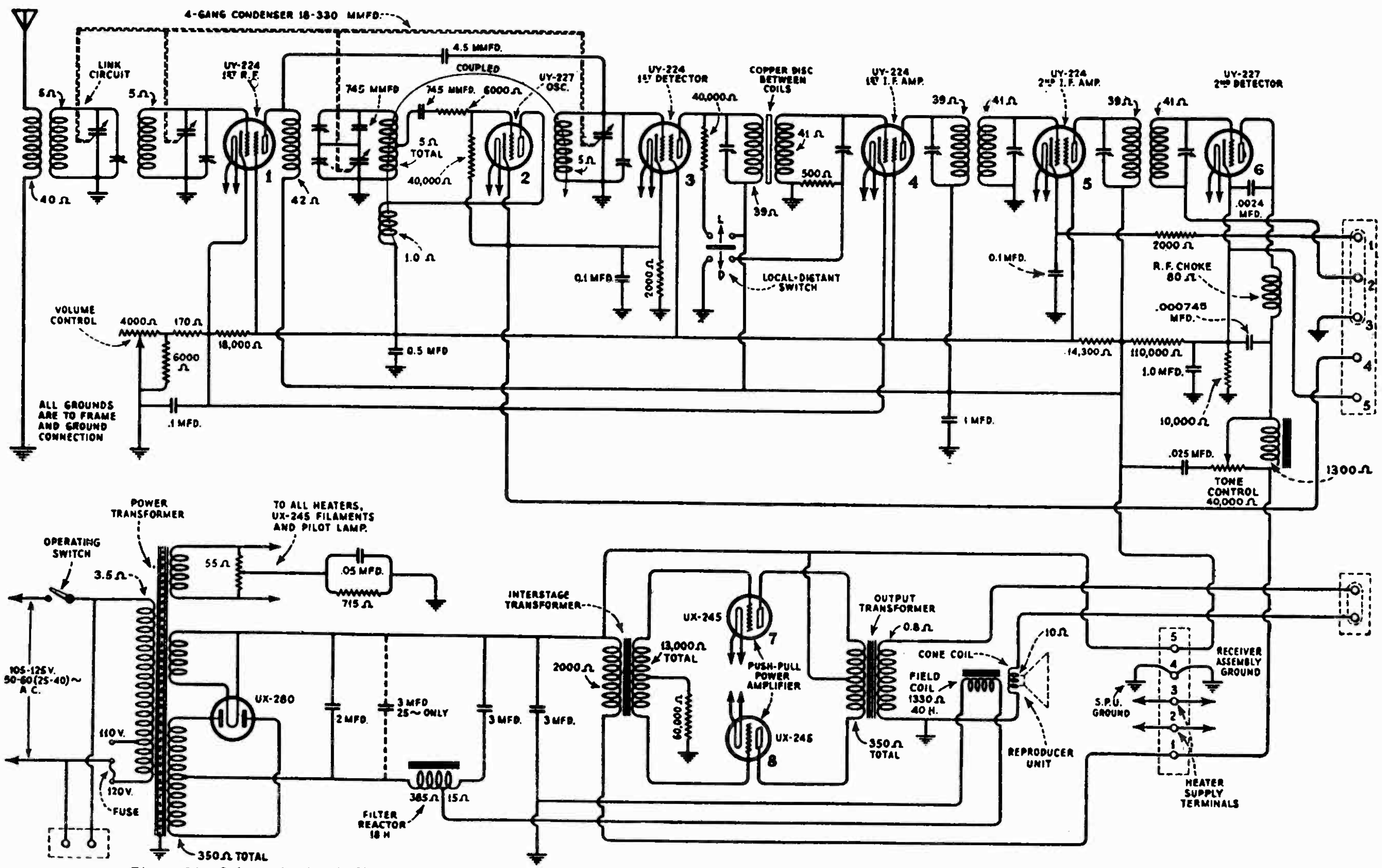


Figure 21—Schematic circuit diagram of Radiola 80 with tone control and Radiola 82. (Note:—The terminal strip in series with the cone coil and the extra A. C. terminals are not included with the Radiola 80.)

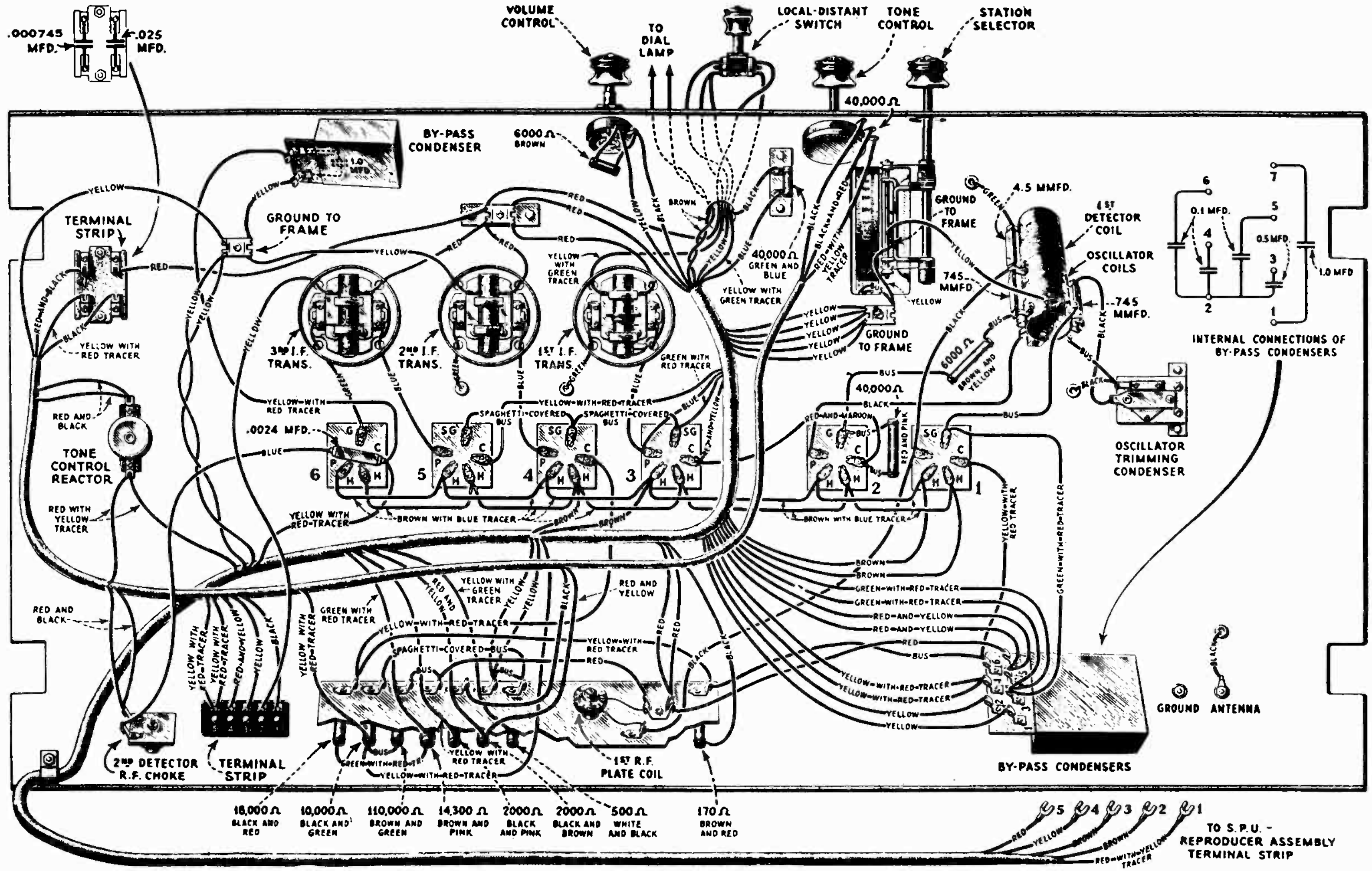


Figure 22—Receiver assembly wiring diagram of Radiola 80 with tone control and Radiola 82

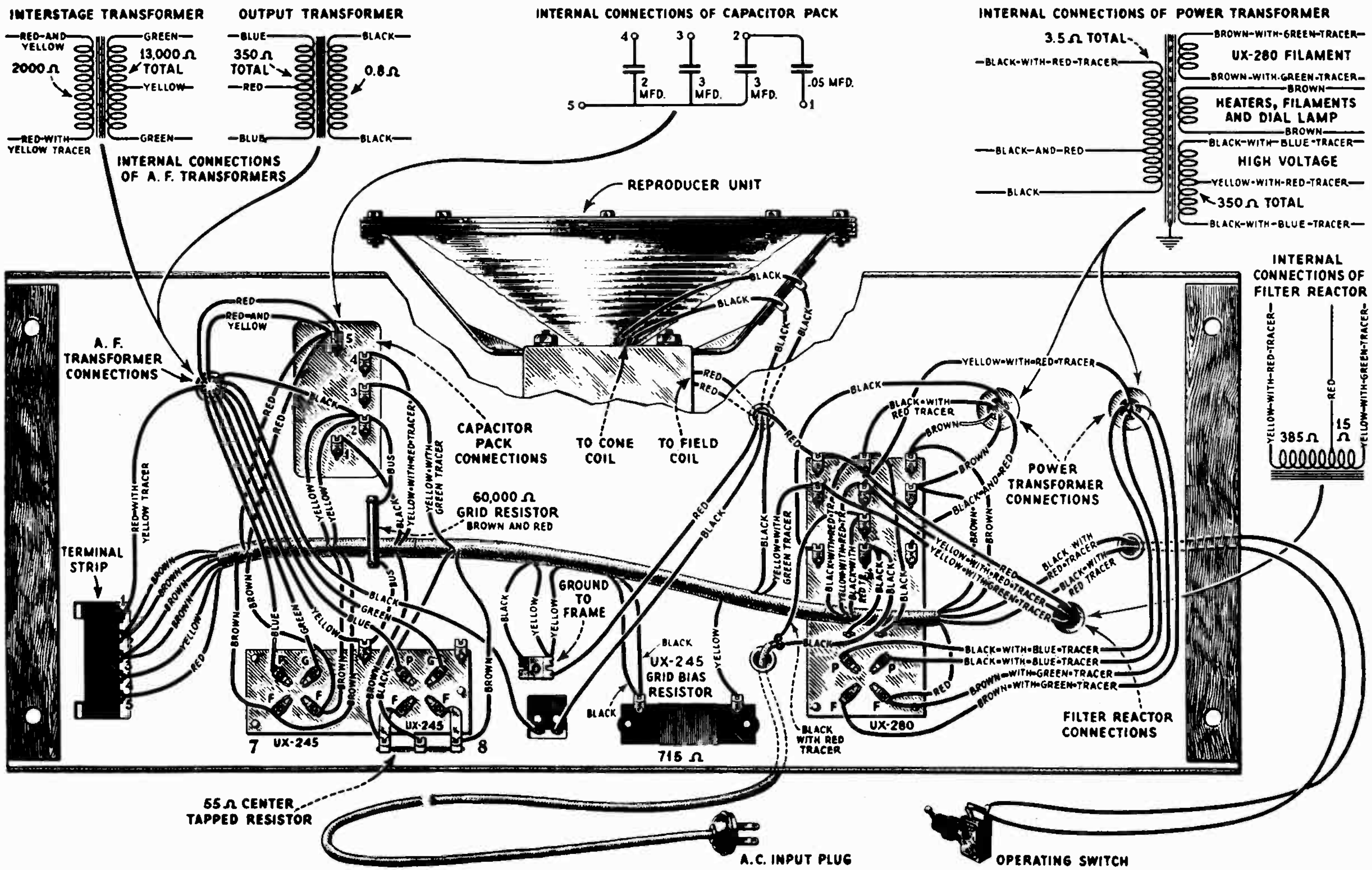


Figure 23—Wiring diagram of the Radiola 82 socket power unit

SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no reception, low volume, 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 the text should be made for further details.

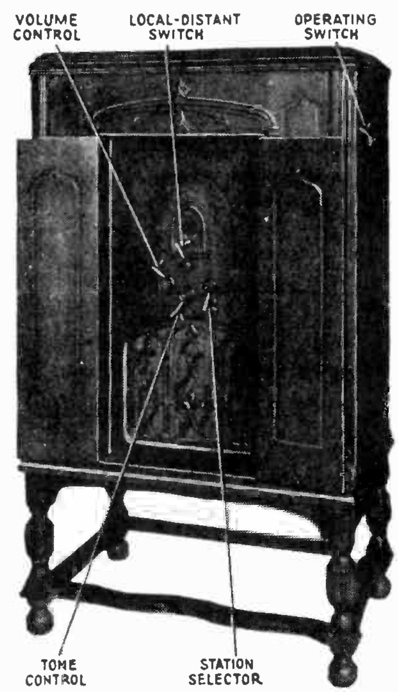
Indication	Cause	Remedy
No Reception	No current at outlet	Turn line current "On"
	Defective operating switch	Repair or replace operating switch
	Blown fuse	Repair cause of blown fuse and replace
	Defective parts in S.P.U.	Test and repair any defective parts
	Defective parts in receiver assembly	Test and repair any defective parts
	Open field coil of reproducer	Repair or replace open field coil
	Open cone coil of reproducer	Replace defective cone
Low Volume	Low voltage from S.P.U.	Repair any cause of low voltage
	Defective socket power unit	Repair or replace any defective part in S.P.U.
	Defective receiver assembly	Repair or replace any defect in receiver assembly
	Poor antenna system	Install antenna system as suggested on instruction card
	I.F. transformers not properly aligned	Align I.F. transformers correctly
	R.F. trimmers not properly aligned	Align R.F. trimming condensers correctly
	Shorted field coil of reproducer unit	Repair any defect in reproducer
Poor Quality	Receiver not properly tuned	Tune receiver correctly when receiving stations
	Local-Distant switch not operated properly	Be sure to use "Local" when receiving nearby strong stations
	Defective A.F. transformer	Replace defective transformer
	Defective tone control parts	Replace defective tone control parts
	Receiver improperly aligned	Align receiver correctly
	Defective or grounded 60,000-ohm resistor in S.P.U.	Replace defective resistor or repair ground
Howling	Shipping blocks not removed	Remove shipping blocks from receiver assembly
	Defective rubber cushions	Replace any aged or hardened rubber cushions
	Radiotrons	Check Radiotrons used in detector and push-pull sockets
Hum	Defective Radiotron UX-280	Replace defective Radiotron
	Defective part in S.P.U.	Replace defective part
	Grounded heater lead	Repair any ground in heater leads
	Defective field coil	Repair or replace field coil
Dial reads incorrectly	Dial screen not in position	Readjust dial screen at low frequency end of scale
	Dial lamp bracket bent	Bend dial lamp bracket back to normal
	Set not properly aligned	Align set correctly
	Oscillator used for aligning not calibrated correctly	Calibrate oscillator accurately

S O. 7539

S. O. 7539

RCA
Radiola 86

SERVICE NOTES



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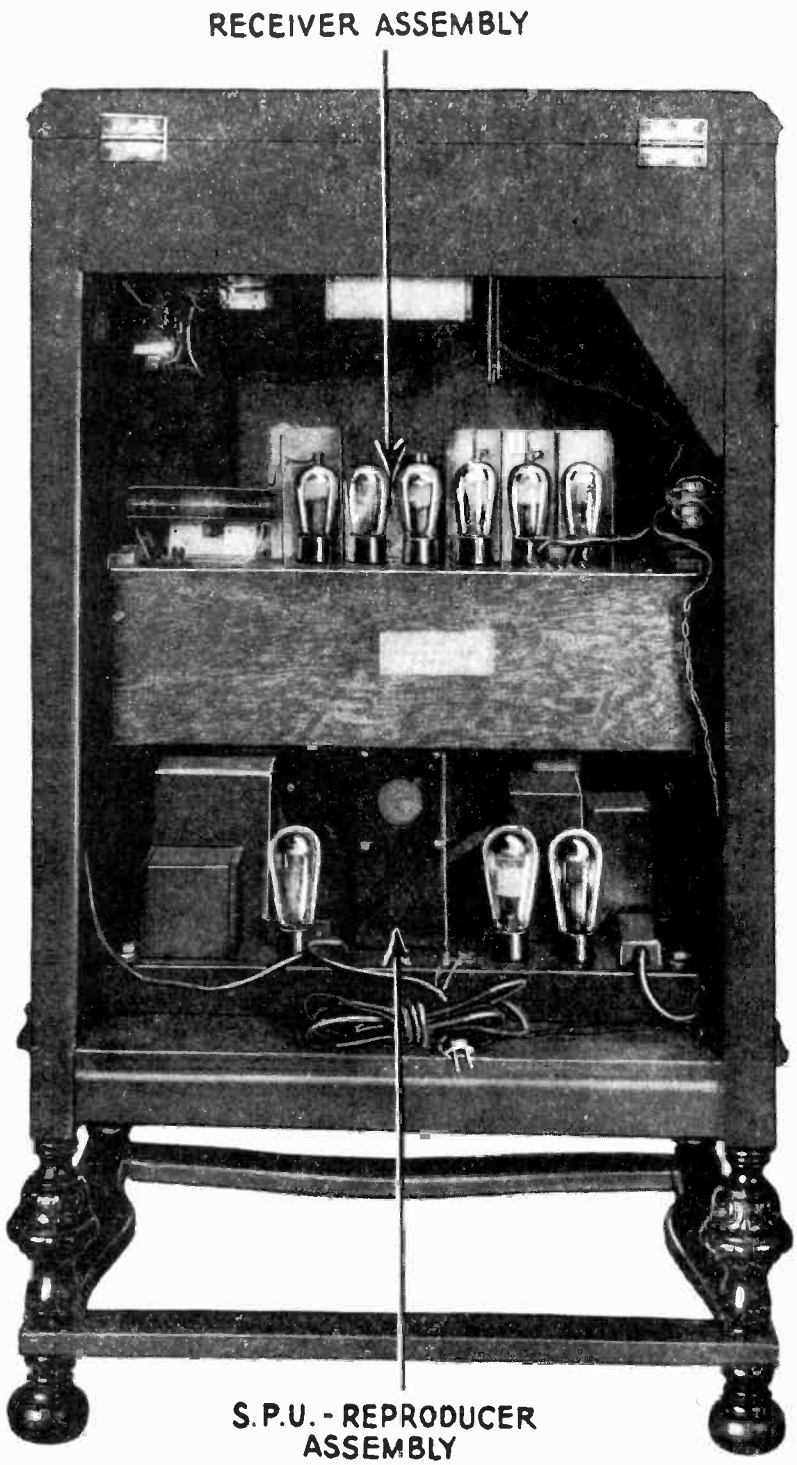
RCA Victor Company, Inc.

RADIOLA DIVISION

Camden, New Jersey

REPRESENTATIVES IN PRINCIPAL CITIES

CONTENTS



Rear interior cabinet view of the radio-phonograph combination instrument

RCA RADIOLA 86

SERVICE NOTES

Electrical Specifications

Voltage Rating	105-125 Volts
Frequency Rating	50-60 Cycles, or 25-30 Cycles
Power Consumption (Radio Alone)	60 Cycles—120 Watts; 25 Cycles—125 Watts
Power Consumption (Phonograph)	60 Cycles—155 Watts; 25 Cycles—200 Watts
Type of Circuit	A. C. Screen Grid Super-Heterodyne
Type and Number of Radiotrons	4 UY-224, 2 UY-227, 2 UX-245, 1UX-280—Total, 9
Number of Radio Frequency Stages	1
Type of First Detector	Tuned Input Grid Bias
Number of Intermediate Stages	2
Type of Second Detector	Power Grid Bias
Type of Tone Control—Variable resistance in series with condenser across output of 2nd detector	
Number of Audio Stages (Radio)	1 (Push-Pull)
Number of Audio Stages (Phonograph or Recording)	2
Type of Magnetic Pick-up	Low Impedance
Type of Tone Arm	Inertia
Diameter of Turntable	12 Inches
Type of Rectifier	Full Wave, UX-280
Type of Loudspeaker	Electro-Dynamic
Wattage Dissipation in L. S. Field	10 (110 V., 85 M. A.)
Undistorted Output	3.0 Watts

Physical Specifications

Height	48 Inches
Depth	27 Inches
Width	18 Inches
Weight Alone	150 Lbs.
Weight Packed for Shipment	210 Lbs.

ELECTRICAL DESCRIPTION OF CIRCUITS

This instrument is a combination radio receiver, similar to Radiola 82, an electric phonograph employing an improved type of magnetic pick-up and tone arm and a home recording mechanism by which either a radio program or sound production in the home may be recorded on the Victor home recording record blanks. The frontispiece shows a rear interior cabinet view.

Radiola 86 incorporates the tone control of Radiola 82 and when the rotary switch is in the "Radio" position, it is electrically the same as Radiola 82. The schematic circuit is shown in Figure 1. Its operation in the other positions follows:

Phonograph—When the rotary selector switch is in the "Phonograph" position, the radio portion of the receiver is made inoperative and the second detector is used as an audio stage together with the power amplifier. The magnetic pick-up is suspended by the new "inertia" type tone arm. This name originates from the method of weighting and then counter-balancing so as to have sufficient weight and mass present for best reproduction. This weight prevents the tone arm and pick-up from vibrating with the record variations and provides true reproduction, due to the needle following exactly the record variations. The phonograph parts are shown in Figure 4.

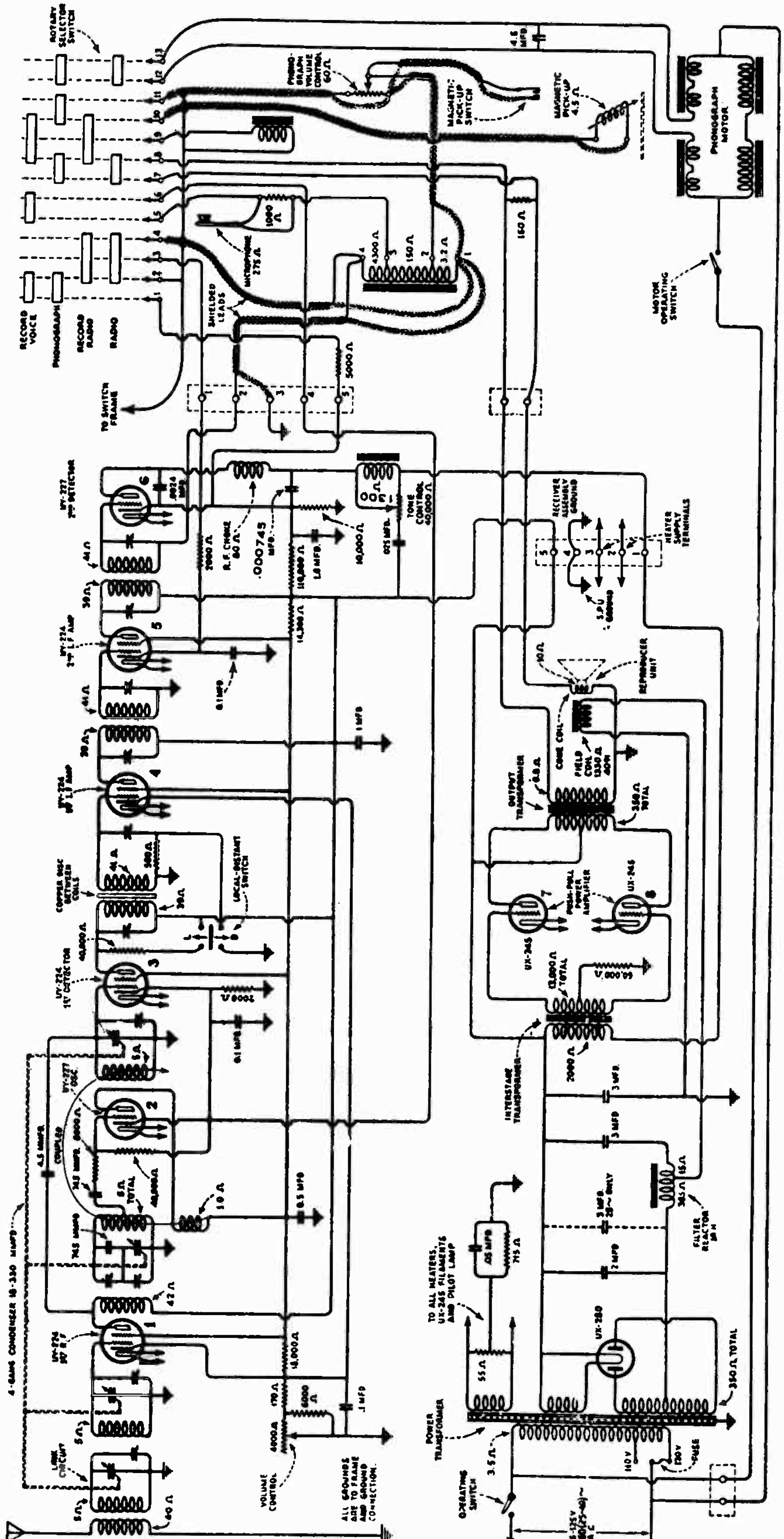


Figure 1—Schematic circuit diagram of the radio-phonograph combination instrument

The output of the pick-up is fed into an auto-transformer which in turn applies this voltage to the grid of the second detector. The grid bias of this tube has been changed in order to have it operate as an audio amplifier. The output of this tube is then applied to the two UX-245's, acting as a power amplifier, the output of which is in turn delivered to the reproducer unit. The volume of output is controlled by a 60-ohm potentiometer connected across the magnetic pick-up.

Radio Recording—Any radio program may be recorded on a Victor Home recording blank with this instrument. The additional material required is a record blank and a special home recording needle.

The electrical functions of recording a radio program are the same as that of receiving such a program with the exception that the pick-up is substituted for the cone coil of the reproducer unit. The cone coil is then connected across the output with a 150-ohm series resistor in the circuit and the reproducer is used as a monitor. When acting as a cutter greater pressure is required on the record than when reproduction is in progress. Therefore a small weight is provided for placing on the pick-up head while recording.

After making a record, it may be played either on the present instrument or any other phonograph in the usual manner with the exception that the special needle used for recording must also be used for reproducing. If the present instrument is used, it is important that the weight on the pick-up head be removed, otherwise the record will be damaged.

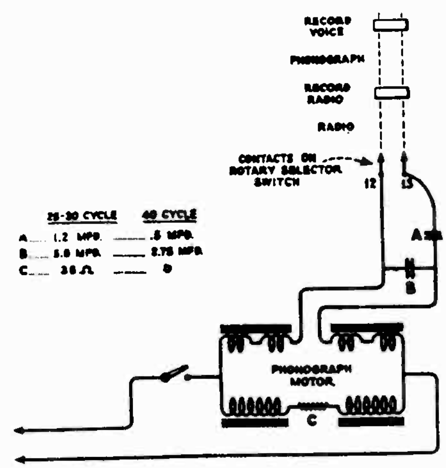


Figure 2—Circuit changes for 25-cycle and 40-cycle operation

Home Recording—A small hand microphone is provided for recording the voice or other programs originating in the home. This microphone is connnected in series with the bias resistor of the first detector and across a tap on the pick-up input transformer. About 10 milliamperes then flows through the microphone. The circuits then function as in "Phonograph Reproduction" except that the output of the UX-245 is fed into the pick-up instead of the reproducer unit. The weight must be used on the pick-up as in radio recording.

The operation of the audio circuits with selector in its various positions is shown in Figure 3.

Models are also available for 25-30-cycle operation and these may be adapted to 40-cycle operation by means of a special motor condenser. The differences between the 25-cycle and the 60-cycle models are: the power transformer; the additional filter capacitor; the rotary switch; and the motor condenser. These parts are shown in Figures 1 and 2.

SCHEMATIC AUDIO CIRCUIT DIAGRAMS

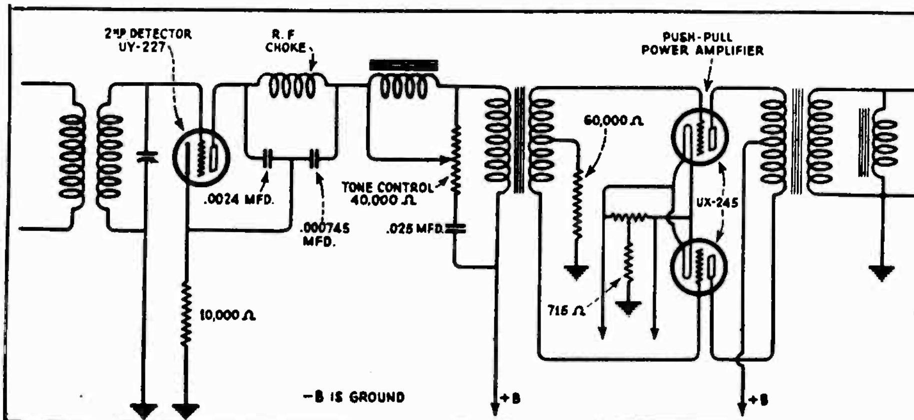


Figure 3A—Radio Recording

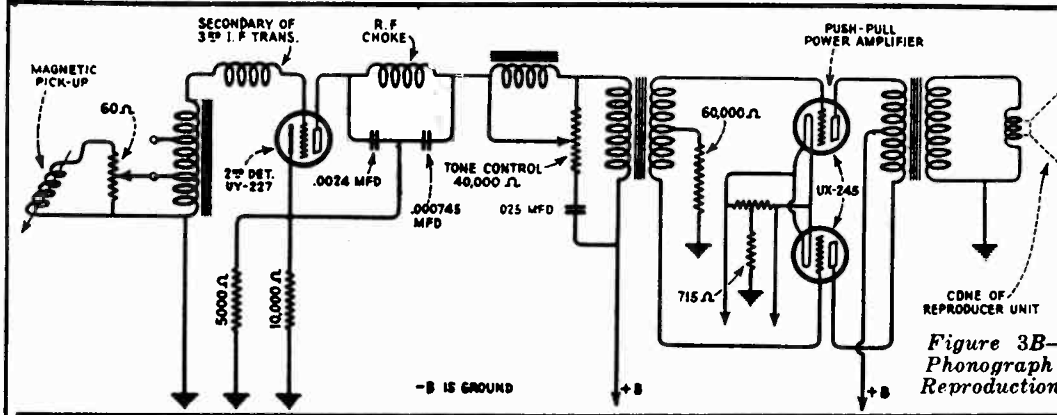


Figure 3B—Phonograph Reproduction

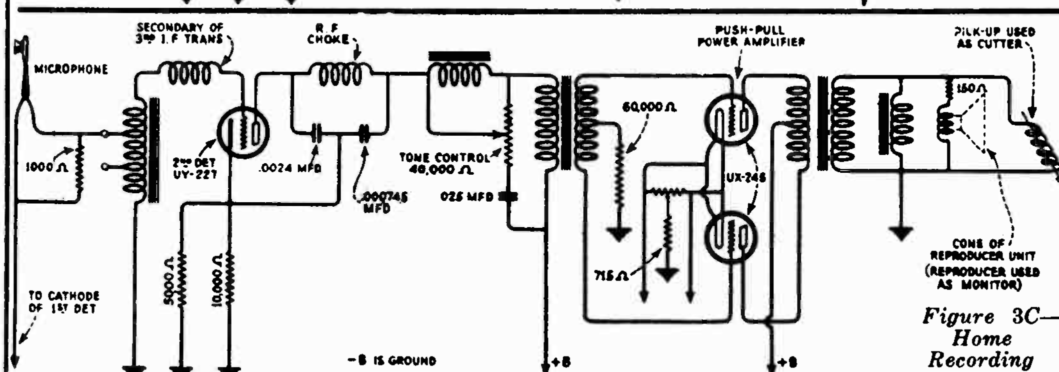


Figure 3C—Home Recording

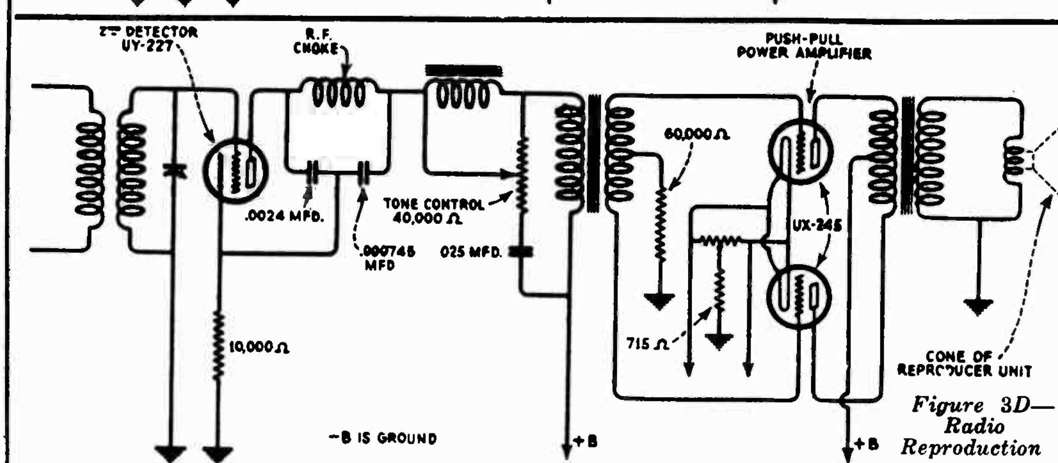


Figure 3D—Radio Reproduction

PART I—INSTALLATION

The reader is referred to the Radiola 80 Service Notes for the following data on installation.

Antenna (Outdoor type).
Antenna (Indoor type).
Special antenna installations for noisy locations.
Ground.
Radiotrons.
Location.
Adjustment for line voltages.
Jerky action of station selector.
Use of local-distant switch.
Precautions for excessively loud signals.
Removal of shipping blocks and screws.

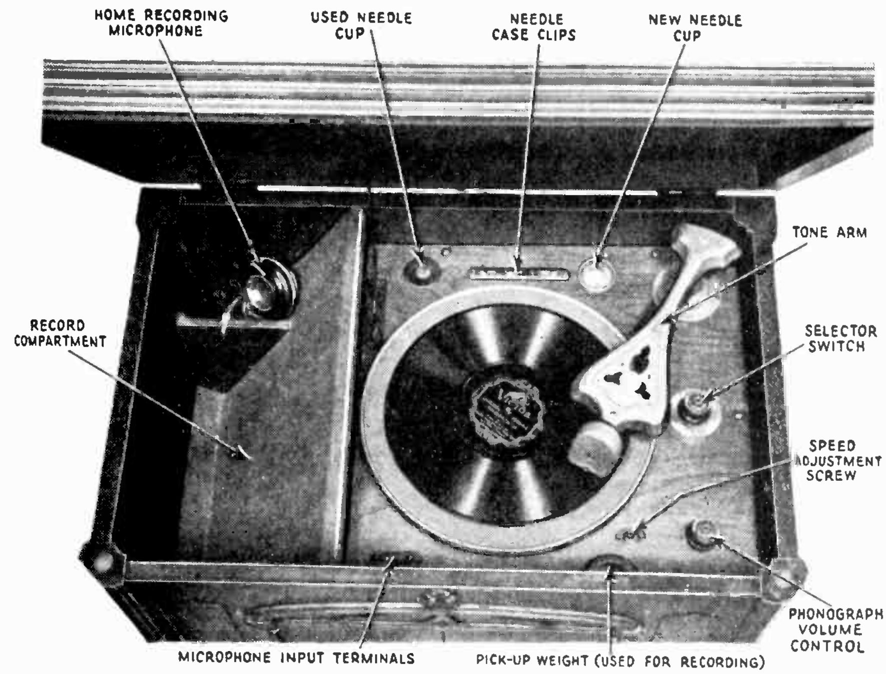


Figure 4—View of phonograph parts

(1) BLOWN FUSE

A blown fuse may be caused by the following:

(a) Connecting the set to a D.C. line.
(b) Plate to plate short of Radiotron UX-280.
(c) Shorted condenser in capacitor pack.
(d) Shorted filament or heater contacts or dial lamp socket.
(e) Defective power transformer.

Any of the above causes must be cleared up before a new fuse is installed otherwise the new fuse will blow as soon as the old one is replaced and the power turned "On."

(2) ADJUSTMENT OF LID MECHANISM

A spring mechanism is provided that balances the lid at any opening position. (See frontispiece.) Failure of proper operation is indicated by the lid either continuing to open or close after the hand is removed. If this condition is present adjust as follows:

(a) If the lid continues to open after being released, too much tension is present on the spring. Reduce the tension by turning the adjusting screw counter-clockwise gradually until normal operation is secured.

(b) If the lid closes upon release of the hand insufficient tension exists at the spring. Increase the tension gradually by turning the adjusting screw clockwise until normal operation is secured.

If the spring has lost its tension it must be replaced. If a replacement spring is not available try removing a turn from the old spring.

PART II—SERVICE DATA ON RADIO RECEIVER

The receiver assembly and S. P. U. of this receiver is very similar in both mechanical and electrical characteristics to that used in Radiola 80. For service information on these units other than that contained herein the reader is referred to the Service Notes on Radiola 80. This includes:

Antenna system failures.
Radiotron sockets and prongs.
Noisy volume control.
Broken condenser drive cord.
Excessive hum.
Acoustic howl.
Low volume.

Distorted reproduction.
Audio howl.
Oscillation.
Adjustment of R. F. line-up and oscilla or trimming condensers.
Adjustment of I.F. tuning condensers.
Line-up adjustments of gang condenser.
Dial scale reading incorrectly.

PART III—ELECTRICAL TESTS

The electrical tests given in RCA Radiola 80 Service Notes are all applicable to the present instrument when the rotary switch is in the "radio reproduction" position. There is one slight difference to remember, however, and that is the 1300-ohm choke and .000745 mfd. condenser in the plate circuit of the 2nd detector in the present instrument that is not in the Radiola 80.

In addition to the tests already mentioned, special tests may be necessary on the parts special to Radiola 86. These tests are included in the Service Data Sections (see page 11, etc.) on these parts.

The receiver assembly and S. P. U. of Radiola 86 are exactly the same as those used in the Radiola 82. The Radiola 82 Service Notes should be referred to whenever wiring diagrams are necessary for Radiola 86. Some models of Radiola 82 and all models of Radiola 86 have a slight change in wiring from that shown in the diagram of Radiola 82 receiver assembly, namely, the .025 mfd. condenser of the tone control connects to the positive plate supply instead of to ground. This change is made by replacing the bus bar from the .025 mfd. condenser to ground as shown in the diagram by a red lead from the condenser to the terminal strip to which five red leads are already attached. This is located on the under side of the chassis between the center I. F. transformer and the chassis front.

PART IV—MAKING REPLACEMENTS IN RECEIVER ASSEMBLY OR S. P. U.

Making replacements of parts in the receiver assembly and S. P. U. of Radiola 86 is very similar to that of Radiola 80. The reader is therefore referred to Radiola 80 Service Notes for information on the following:

To remove receiver assembly.
To remove S. P. U. Reproducer Assembly.
Replacing reproducer cone.

PART V—SERVICE DATA ON MAGNETIC PICK-UP

Service work on the magnetic pick-up may be divided into the following classes:

1. Adjustment of the armature.
2. Replacing rubber pivot supports and damping block.
3. Replacing coil.
4. Replacing armature.

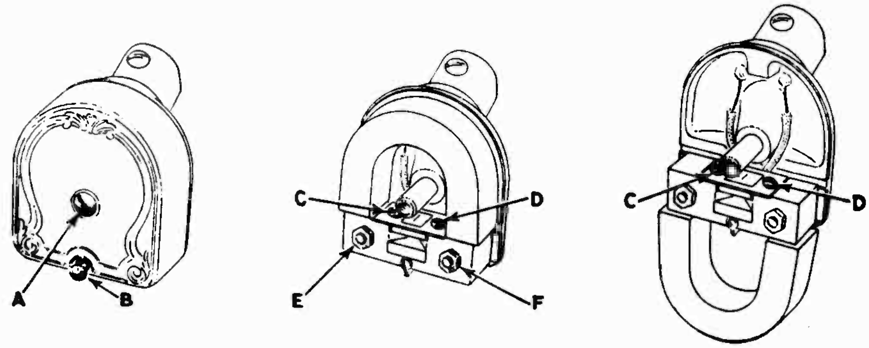


Figure 5—Disassembling the magnetic pick-up

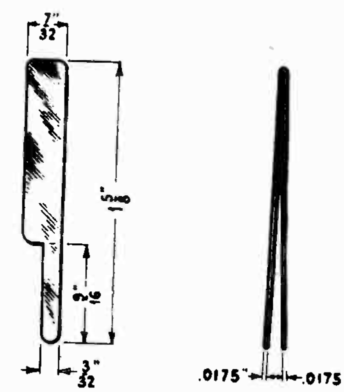


Figure 6—Magnetic pick-up armature spacing tool

(1) ADJUSTMENT OF ARMATURE

Adjustment of the armature consists essentially of having it in its electrical center between the two pole pieces. Need for this adjustment is usually evidenced by distortion during phonograph reproduction with blasting, especially on the low notes. The following procedure should be adopted when making this adjustment:

(a) Remove screws A and B (See Figure 5) from the pick-up, and remove the cover thereby released.

(b) Mark the magnet poles and the pole pieces so that when they are replaced they will be in their original position. The magnet may now be released. Place a keeper such as a large nail across the magnet poles and remove the magnet from the pole pieces. Another way is to slide the magnet over the pole pieces, until it is on the opposite side of the armature adjusting screws. (See Figure 5.)

If the magnet is released from the pole pieces or keeper even for an instant the efficiency of the pick-up as a record cutter is seriously impaired. Be careful not to let this happen and if it does, remagnetize the magnet before and after reassembling.

(c) With a small screw driver loosen screws C and D. The small piece of metal that holds the damping block may now be moved either way until the armature is approximately between the two pole pieces. Judging the center by the eye is sufficiently accurate for this adjustment.

(d) After the center has been located the two screws, C and D should be tightened. The magnet may now be replaced, the keeper removed and the pick-up re-assembled in the reverse manner of that used to remove it. While re-assembling be sure that all dirt is completely removed from any part of the magnet, armature or other parts of the pick-up.

(2) REPLACING RUBBER PIVOT SUPPORTS AND DAMPING BLOCK

After considerable time, or due to climatic conditions, the rubber pivot supports and the rubber damping block may become hardened and require replacement. Such hardening is usually evidenced by the armature being set to one side and not moving easily. As with other rubber articles, these parts give best life when used frequently.

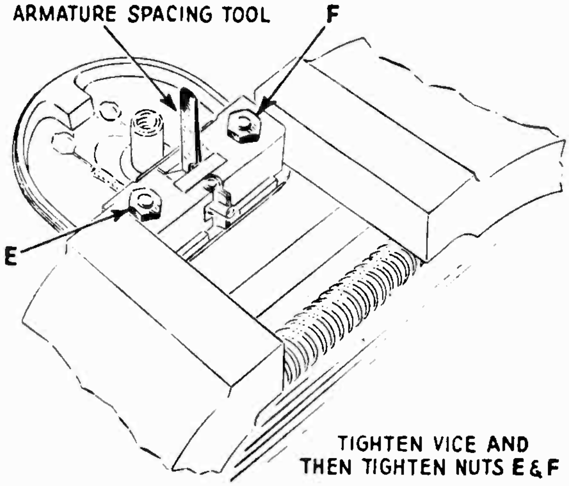


Figure 7—Magnetic pick-up in vise

The pick-up should not be supported, when not in use, by the needle resting on the record or turntable as such use will tend to set the armature to one side. The pick-up should hang free.

Usually the rubber pivot supports and damping block will require replacement at the same time, and are therefore supplied in sets of three. When a replacement is necessary such a set should be procured. If such a set is not available and a repair is urgently needed, the damping block may be cut from a piece of automobile inner tube. The rubber strips for the pivot support may be cut from the thin portion of a baby's rubber nipple.

Use the following procedure when making replacements:

(a) Procure magnetic pick-up armature spacing tool. This is listed in the spare parts catalog, or it may be easily constructed by referring to Figure 6.

(b) Remove the pick-up case and the magnet from the pole pieces as described in Part V, Section 1.

(c) Unsolder the leads to the coil at the terminal strip inside of the pick-up case. Remove nuts E and F, Figure 5, and release the pole pieces from the back support. Now remove screws C and D and disassemble the pole pieces, armature and coil. The old rubber should be completely removed from all parts, and the parts should be scraped clean with a knife.

(d) Place the new rubber pivot supports in their proper place. This may be either tubing or strips. Reassemble the pole pieces and coil, and new rubber damping block in place with armature spacing tool in place as shown in Figure 7. Now place in a small vise and clamp the pole pieces together, as shown in Figure 7, with the spacing tool in place. Tighten nuts E and F, remove pick-up from vise and remove spacing tool.

(e) Reassemble the magnet and cover as described in Part V, Section 1, making sure the small magnet clamp is in place at the top of the magnet.

(3) REPLACING PICK-UP COIL

The pick-up coil may be replaced in the same manner as the rubber supports and damping blocks, the difference being that the coil is replaced instead of the rubber pieces.

(4) REPLACING PICK-UP ARMATURE

The pick-up armature may be replaced in the same manner as the rubber supports or coil, the difference being that the armature is the part replaced. All adjustments are the same. In some cases replacement of the armature is made necessary due to rust. If a new armature is not available, the old one may be temporarily repaired by removing all rust with sandpaper. This is not a permanent repair due to the fact that the sandpapered surface will quickly rust, so therefore a new armature should be installed as soon as available.

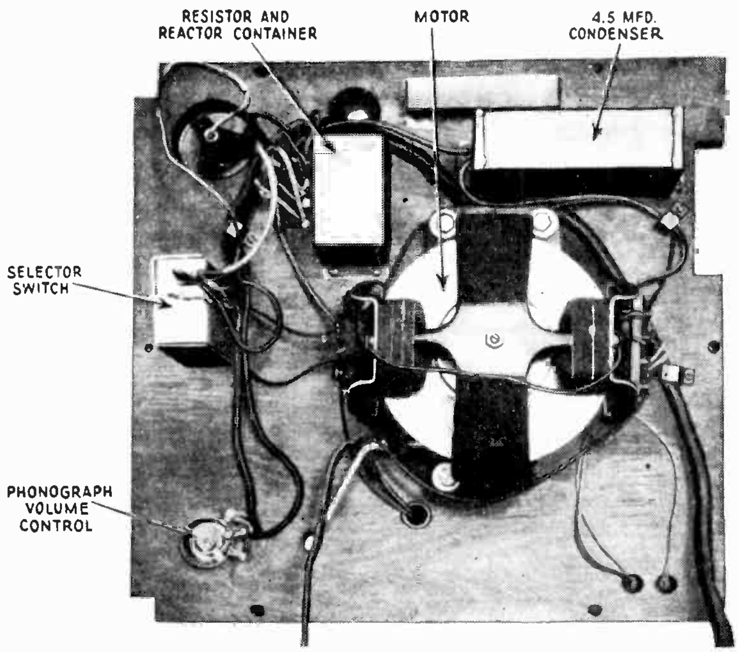


Figure 8—Bottom view of the phonograph motor mounting board, showing various parts.

(5) TESTING MAGNETIC PICK-UP AND TONE ARM

After a magnetic pick-up has been repaired it is good practice to test it on actual records. The following Victor records are very desirable for test purposes.

For testing the ability of the pick-up and tone arm to track the record groove use:—

FUNERAL MARCH OF A MARIONETTE—No. 6639

ZAMPA—No. 35985.

For a voice as well as low frequency test at the same time:—

A GAY CABALLERO—No. 21735

For dance music which has an evidence of high frequency as well as low frequency response use:—

BULL FIDDLE BLUES—No. 2155.

For checking low frequencies mainly use:—

ALOHA OE—No. 21121.

which at the very end has about 50 cycles recorded on it, also

ANDANTINO—No. 35843.

For testing rattle of pick-ups use:—

MY CAROLINA SUNSHINE GIRL—No. 40096.

MAGNETIC PICK-UP SERVICE DATA CHART

Indication	Cause	Remedy
No reproduction	Poor volume control contact between arm and resistance	Clean volume control resistance with a pipe cleaner and any of the various cigarette lighter fluids
	Open pick-up coil or connections	Repair any loose connections by resoldering or replace an open coil as described in Part V, Section 3
Weak or distorted reproduction	Loose needle	Tighten needle in socket with needle set screw
	Dirty contact in volume control	Clean volume control resistance and contact arm
	Armature out of adjustment	Center armature as described in Part V, Section 1
	Defective rubber damping block or pivot supports	Replace rubber damping block and pivot supports as described in Part V, Section 2
	Dirt in armature air gap	Clean all dirt from air gap by means of a blower or disassemble pick-up and clean. Remove rust from armature if necessary
	Weak magnet	Remagnetize magnet by taking to magneto repair shop. Place keeper across pole faces until magnet is again in place in the pick-up. Making repairs without placing a keeper on the magnet is the easiest way of having the magnet lose its magnetism.
	Needle holder rattle	If the needle hole of the pick-up cover touches the set screw that holds the needle, a rattle will result.

PART VI—PHONOGRAPH MOTOR SERVICE DATA

The phonograph motor used is of the induction disc type and is unusually rugged in construction. (See Figure 8). The following text covers the details of any service that may become necessary.

(1) LUBRICATION OF MOTOR

The various bearings and gears of the motor should be kept clean and should be lubricated at least once every six months. Phonograph motor oil and motor grease should be used and applied to the points indicated in Figure 9. Should phonograph motor oil and grease not be available, any high grade light engine oil may be substituted for the oil and vaseline for the grease. Before lubricating it is desirable that the parts first be cleaned with carbon tetra-chloride (Carbona), and all dirt and old grease removed. In addition to the regular lubrication all bright metallic parts, except the motor disc, should be covered with a light film of oil to prevent rusting.

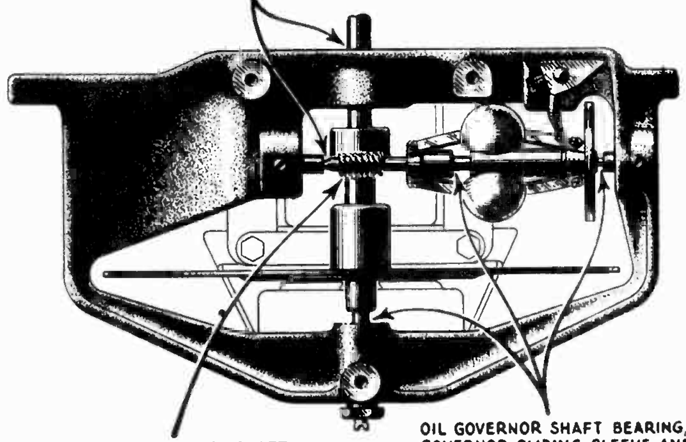


Figure 9—Lubrication points of the phonograph motor

(2) SPEED REGULATION

A stroboscope disc is included with each instrument which makes speed adjustments very easy. The instructions for its use are printed on each disc and will not be repeated here. If a stroboscope disc is not available the following method may be used for correct speed adjustments.

(a) Place a record on the turntable and insert a small piece of paper under the edge of the record to serve as an indicator.

(b) Play the record in the normal manner and count the number of revolutions made by the turntable for one minute. The speed should be 78 revolutions per minute.

(c) Turning the speed regulating screw (Figure 4) clockwise allows the motor to run faster, and counter-clockwise, slower. Adjust by trial until the speed is 78 revolutions per minute as determined from a full minute's count.

NOTE—The speed of the machine should be checked at least four or five times a year. Improper speed will cause distortion.

(3) GOVERNOR

The governor will maintain a constant speed of the motor within a range of sudden voltage changes of 20 volts, providing all the parts are correctly adjusted. Any adjustment made on the motor (including lubrication), will have a certain effect on the regulation of speed and the speed adjustment should be checked as described in Part VI, Section 2, before the unit is again placed in service.

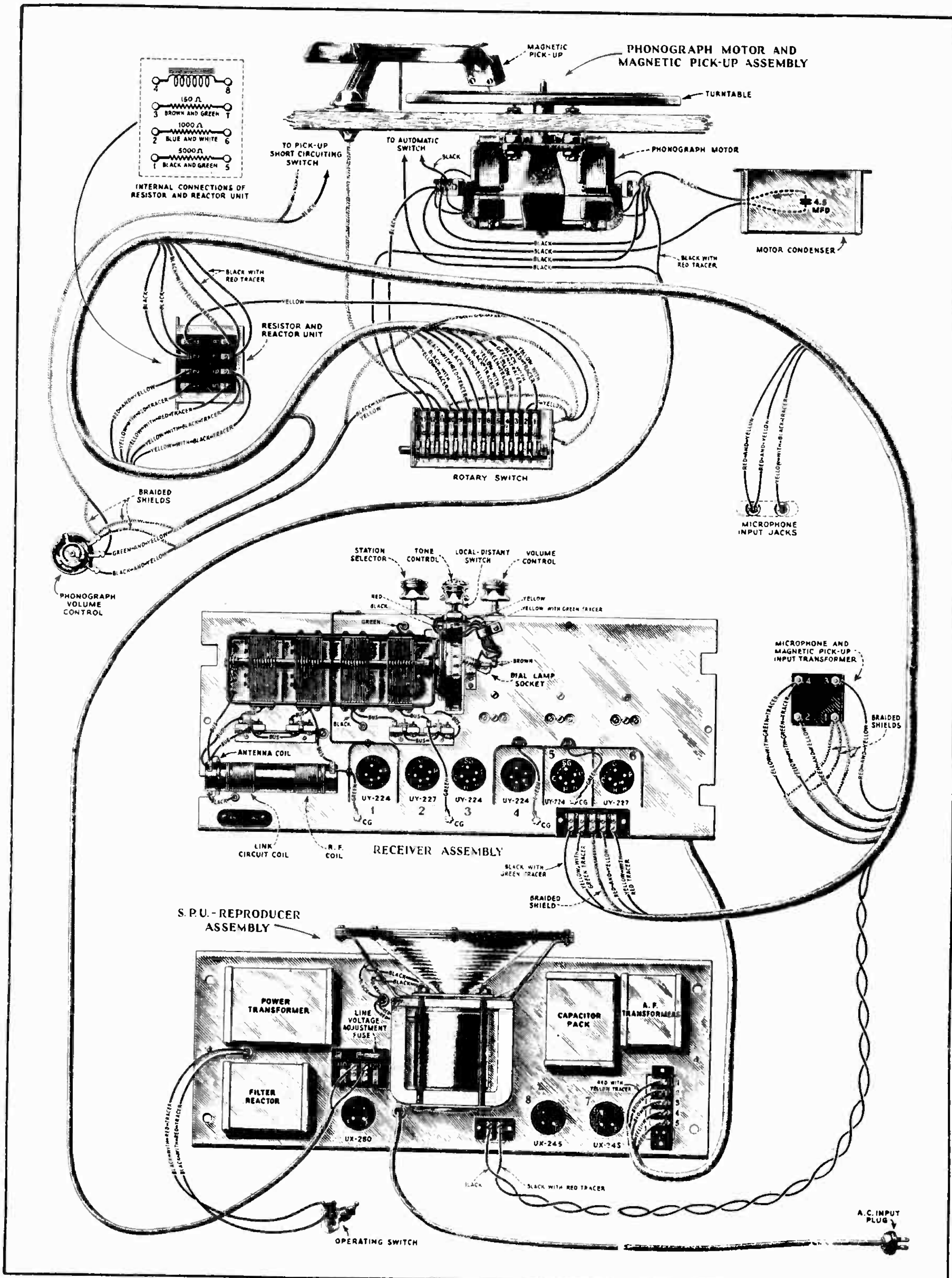


Figure 10—*Assembly wiring diagram of the radio-phonograph combination instrument*

(4) PHONOGRAPH MOTOR SERVICE DATA CHART

The following Service Data Chart indicates the cause and remedy for any difficulties which may be encountered in the operation of the phonograph motor. These are listed according to their indications:

Indication	Cause	Remedy
Failure to run	Operating switch or record switch "off" or defective	Turn switches "On" or repair any defective switches
	No A.C. power at socket outlet	Check with a O-150-V. A.C. voltmeter
	Loose or open connection in the connector cord or plug	Repair any defective connections
	Wrong or open connections of motor coils	Check wiring and make any repairs necessary
	Jammed motor	Rotate turntable by hand with power on. If jammed examine motor and replace or repair part causing jamming
	Shipping wedges not removed	Remove paper wedges if used between disc and coils to hold motor during shipment
Motor fails to maintain correct speed	Low line voltage	Check line voltage with a O-150 Volt A.C. voltmeter while motor is running and phonograph is in operation. The voltage must be between 105-125 for proper operation.
	Improper lubrication	Examine moving parts, bearings and gears. If oil and grease is gummy clean and lubricate as described in Part VI, Section 1.
	Motor improperly mounted or jarred in shipping	Loosen the three motor mounting screws and tighten alternately while motor is running. Do not tighten any screw sufficiently to cause binding or slowing down of the motor
	Worn motor spindle ball bearing	Replace a worn ball bearing
	Weak motor coils	After checking all the above causes and the motor still fails to maintain speed replace one or both of the motor coils as described in Part VI, Section 9. It is possible for them to test electrically O. K. but be weak in operation
Noisy operation	See Part VI. Section 5 for the cause and remedy of defects or improper adjustments that may cause noisy operation	
Hum	Loose coils or coil laminations	Tighten screws that hold coil cores together. If this does not correct the hum place a small wooden wedge between inside of coil and core
	Cabinet hum	Tighten motor mounting screws or replace the rubber between motor and cabinet

(5) NOISY OPERATION

There are several causes of motor noise other than hum, which is discussed in the Phonograph Service Data Chart.

(a) Governor Springs.—A noise or rattle may sometimes be caused by loose or broken governor springs. Tighten all the governor spring screws. If this does not stop the noise, loosen the screws on the gear end of the governor springs and allow the motor to run for a minute or two to allow the springs to assume their correct position. Stop the motor and retighten the screws. If any of the springs are broken or badly out of balance, they should be replaced.

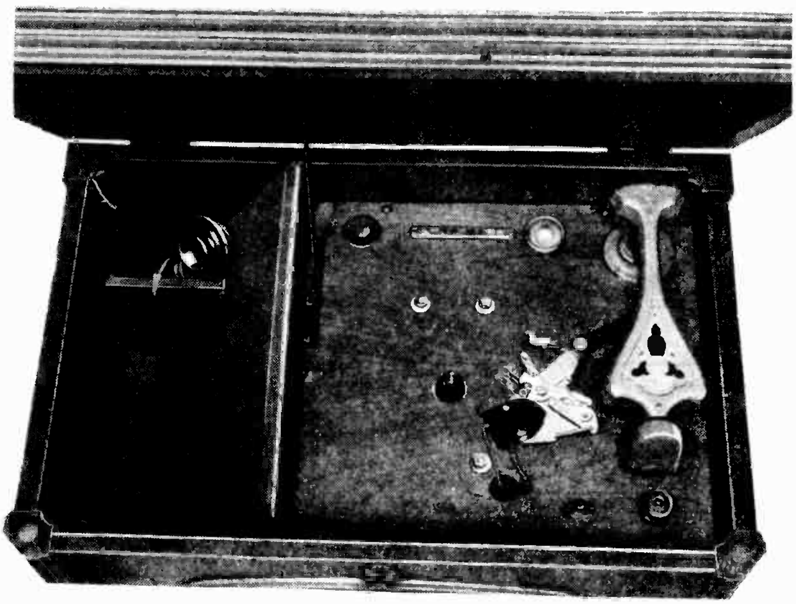


Figure 11—*View of motor board with turntable removed*

(b) Governor Bearings.—The thrust bearing at the gear end of the governor may cause noise while the motor is running. Hold one finger over the end of the bearing and loosen the set screw which holds the bearing in position. Adjust the bearing to the most quiet running position and retighten the set screw. If this procedure is not successful the position of the governor spiral relative to that of the governor drive gear should be shifted slightly until a condition of minimum spiral to gear noise is obtained.

To do this the set screw holding the thrust bearing at the gear end of the governor spindle is loosened and the bearing shifted slightly and re-clamped (loosening the bearing on the opposite end of the shaft first if necessary). Now, with the bearing at the disc end of the spindle loosened and one finger against it to prevent it from slipping out, start the motor. While the motor is running, press lightly against this bearing and clamp the set screw to hold it in place. The center of the worm should be approximately opposite the center of the worm gear. If this is not the case for the position of minimum noise a defective or poorly lubricated worm or worm gear is indicated. A bent governor spindle may also be the cause.

(c) Governor Spindle.—A bent governor spindle will cause binding in the gears and bearings as well as noise. The bent spindle should be replaced with a new one. Removal of the governor can be accomplished by loosening the two governor bearing screws, one at each end of the governor shaft, and lifting the governor from the frame.

(d) Governor Driving Gear.—Remove the motor spindle as described in Part VI, Section 10, and examine the gear for wear. If the wear on the teeth is uneven on opposite sides of the gear the turntable spindle is bent and both gear and spindle should be replaced.

(e) Turntable Spindle and Disc.—A bent turntable spindle, or a bent or improperly adjusted disc will cause noise. The bent spindle may cause the disc to rub against the iron core of one of the coils. A bent spindle can be detected by placing a pencil flat on the motor board with the point against the spindle; if the pencil point touches the spindle on one side only while the motor is running, the spindle is bent and should be replaced. If the disc is bent and rubs against the cores of the motor coils the lower spindle bearing should be adjusted as described in Part VI, Section 11, or the disc should be replaced, depending upon the extent of the damage.

(f) If the motor "bumps" (turntable jumps up and down), it may be due to a faulty or worn gear or worm; insufficient grease or poor grease on the worms; or not enough turns on one of the upper motor coils.

(6) HEATING

Normal operation of the motor will produce more heat than can comfortably be tolerated while touching any of the coil units. This is mentioned in order that the service man will not misconstrue this heating as an indication of a defect.

(7) CONTINUITY OF MOTOR CIRCUITS

Due to the absence of a motor terminal board it is best to disconnect the motor and test for continuity of circuit directly at the motor coils. This may be done by any of the methods used for regular continuity tests. Associated circuits should be checked by referring to the diagram, Figure 10.

(8) TO REMOVE MOTOR

If it is necessary to remove the phonograph motor, it may be done in the following manner:

(a) Place the pick-up and tone arm to the side, clear of the turntable. Remove needle from pick-up and remove turntable.

(b) Gain access to the rear and remove all wiring to the motor.

(c) Remove the three nuts, washers and rubber pieces from the motor supporting bolts, being sure to hold the motor so that it will not drop. It may now be moved to a place convenient for work.

When replacing the motor, care should be exercised to see that the motor speed adjustment arm lines up properly with the speed adjustment screw.

(9) REPLACING THE MOTOR COILS

Should the necessity arise for replacing the coils of the induction disc phonograph motor proceed as follows:

(a) Remove the motor as outlined in Part VI, Section 8.

(b) Open the lugs holding the black power leads to the motor frame and remove these leads to one side.

(c) Release the round head machine screws holding the coil unit, which is to be replaced, to the motor frame.

(d) Put the new coil unit in place and replace the coil unit mounting screws, tightening them carefully.

(e) Replace the black power leads under the lugs and reconnect the power leads to the proper points on the terminal board as shown in Figure 10. Lubricate motor if necessary.

(f) Replace motor and turntable and test for operation and speed.

(10) REPLACING THE MOTOR GOVERNOR PARTS

If it becomes necessary to remove the governor, to replace the governor spindle or springs use the following procedure:

(a) Remove the motor as outlined in Part VI, Section 8.
(b) Unscrew governor bearing screw.
(c) Push the governor spindle against this bearing so as to start it out of its socket, and remove this bearing.
(d) Remove the governor spindle with its associated parts.
(e) All governor parts are now readily accessible and it may be disassembled. The governor spring holding collar is fastened to the governor spindle by means of a small set screw, and the spindle is "spotted" to facilitate proper replacement.
(f) Replace the governor spindle and its assembled parts by placing the outer tip of the spindle in the outer thrust bearing socket first, and then inserting the inner tip into its bearing, after which the outer bearing is replaced, and its set screw tightened, being careful to leave a little play in the bearings.
(g) It is usually a good plan to lubricate the unit whenever service work is done.
(h) Replace motor and turntable, and test for operation and speed.

(11) REPLACING THE MOTOR SPINDLE, DISC OR GOVERNOR DRIVING GEAR

(a) Remove motor from cabinet as described in Part VI, Section 8.
(b) Open the lugs holding the power leads to the motor frame and move these leads to one side.
(c) Remove the three mounting screws from the coil unit on the opposite side of the motor from the governor, and remove this coil unit.
(d) Press down on the speed regulating arm so as to release the pressure on the governor friction disc, and turn the motor disc so that the set screws in the hub of the motor disc and the governor driving gear are readily accessible.
(e) Loosen both set screws far enough to back them out of the recesses provided for them in the motor spindle and draw out the spindle.
(f) The motor should now be reassembled in the reverse of the above procedure, making any necessary replacements.

NOTE—Care should be taken to see that the ball bearing under the lower end of the motor spindle is not lost.

(g) After assembling the motor the lock nuts around the spindle adjusting screw should be loosened and the spindle adjusting screw should be adjusted until the motor disc turns freely in the center of the air gap of the coil units.
(h) Tighten the spindle adjusting screw lock nut.
(i) Replace the motor and turntable.
(j) Lubricate the motor (Refer to Part VI, Section 1).
(k) Reconnect, following the wiring diagram, Figure 10, and test operation and speed (Refer to Part VI, Section 2).

(12) REPLACING THE MOTOR SPINDLE BALL BEARING

A worn motor spindle ball bearing will cause slow or varying speed and should be replaced as follows:

(a) Place the pick-up and tone arm clear of turntable, remove any needle which may be in the pick-up and remove the turntable.
(b) Loosen the spindle adjusting screw lock nut and remove the motor spindle adjusting screw. The ball bearing may now be removed.

(c) Place the unit in its normal operating position. The motor disc will now rest on the pole faces of the lower or current coil.

(d) Lay a card across the motor mounting panel, against the motor spindle, and mark the spindle lightly at the point of contact.

(e) Lift the spindle until the motor disc touches the pole faces of the upper or voltage coils and again mark the spindle.

(f) Put the new ball bearing in place and replace the motor spindle adjusting screw, adjusting it so that the card placed across the motor board will make contact against the spindle just half-way between the two marks previously made. This should place the motor disc in the center of the air gaps. If the disc is slightly warped an additional adjustment one way or the other may be necessary to prevent it from rubbing against the pole pieces in operation.

(g) Lubricate as described in Part VI, Section 1; replace turntable and test for operation and speed.

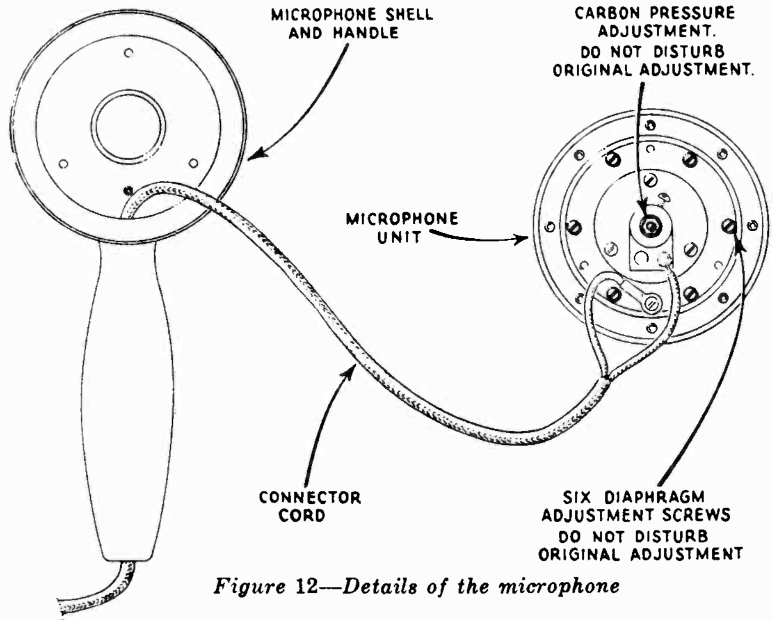


Figure 12—Details of the microphone

PART VII—SERVICE DATA ON MICROPHONE

The small hand microphone used for home recording is of rugged construction and will give good service.

If any difficulties be encountered, however, repairs other than replacement of the cord, the handle and shell, or the mechanism should not be attempted. The adjustment of the diaphragm and carbon pressure is made at the factory and is practically impossible to duplicate in the field. Figure 12 shows the essential elements of the microphone which may be replaced.

PART VIII—SERVICE DATA ON AUTOMATIC SWITCH MECHANISM

A special mechanism is provided which at the end of a Victor eccentric groove record, opens the power to the motor and short circuits the magnetic pick-up. The absence of a brake eliminates any mechanical noise that might be present while the turntable is being stopped and the shorting of the pick-up prevents any needle scratch from being reproduced. The effect is that at the end of a record a slight click is heard and then silence until the next record is played.

(1) PICK-UP SWITCH FAILURE

Should the motor stop at the end of a record, but the pick-up switch fail to work, resulting in a record scratch while the turntable is stopping, it may be due to any of the following causes:

(a) Poor connections at pick-up switch. Check and repair connections if necessary.

(b) Contact arm bent or its tension lost so that contacts do not close. Repair or replace if necessary.

(c) Adjustment of contact in relation to arm not properly made. Loosen the screws that hold the switch to the base plate and shift entire switch until the latch arm properly engages the switch contact.

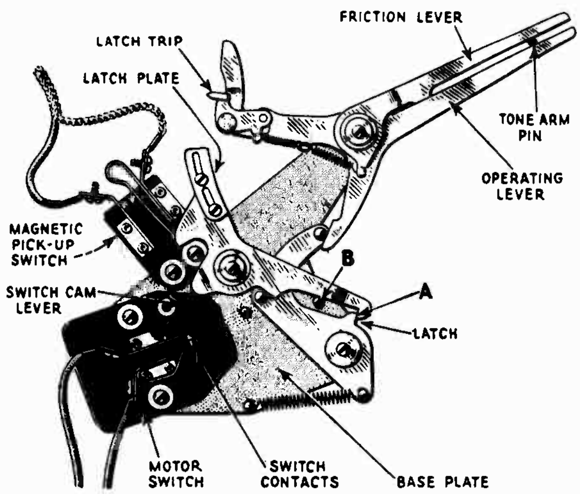


Figure 13—*Automatic switch mechanism*

(2) MOTOR SWITCH FAILURE

If the motor fails to start when the tone arm is pulled to the right, the switch should be examined to see that it is operating properly. See Figure 13.

The left-hand screw holding the switch to the base plate passes through an oversized round hole in the switch body and the right-hand screw passes through an elongated hole in the switch body. This permits of a considerable adjustment of the switch on the base plate.

(a) Remove the single small screw holding the switch cover in place.

(b) Set the tone arm to the "On" position and examine the switch contacts to see that they close.

(c) If the switch does not close and the switch cam lever may be moved away from the switch contact, leaving a gap between the contacts, the movable contact spring should be bent so as to increase its tension and cause the contacts to close.

(d) If the switch cam lever does not have a sufficiently free movement to permit the contacts to close, both switch mounting screws should be loosened, and the switch should be adjusted on the base plate (with the tone arm in the "On" position), so that there is a space of 1/32 in. between the switch cam lever and the latch cam, and about 1/16 in. between the switch cam lever and the spring anchor pin. When this adjustment has been made tighten the switch mounting screws.

(e) Clean the switch contacts with 00 sandpaper to remove any corrosion that may be present.

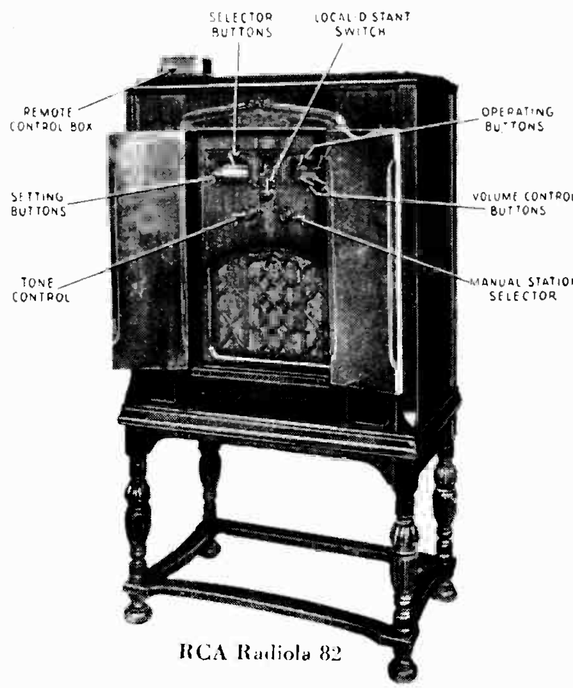
(f) Replace the switch cover plate.

(g) Replace the turntable with the tone arm in the "On" position so as to clear the brake lever arm of the inside rim of the turntable, and rotate the table by hand to permit the slot in the turntable hub to slip over the pin in the motor spindle.

AUTOMATIC SWITCH MECHANISM SERVICE DATA CHART

Indication	Cause	Remedy
Failure to trip	Loose latch plate	Tighten latch plate screws with plate in correct position. (See Fig. 13)
	Latch trip does not engage latch plate properly	Increase tension on latch trip
	Defective latch plate. If the friction lever swings with the eccentric record groove, but the operating lever fails to swing or swings slightly, the latch trip is probably caught in a burr on one of the teeth of the latch plate	Remove all burrs from the latch plate with a piece of emery cloth or a fine file. Also make sure no burrs are on the edge of the latch trip
Premature tripping	Worn surface	Examine the contact surfaces between the brake lever and the latch (point "A," Figure 13). These two surfaces must be square. If they have become worn round, they should be squared with a fine file
	Insufficient tension	If the latch does not strike the latch stop pin "B" (Figure 13), when the brake lever is pulled to the "On" position, increase the tension of the latch spring
Switch failure	Mal-adjustment of switch	See Part VIII, Sections 1 and 2

RCA
Radiolas 82 and 86
(With Remote Control)
SERVICE NOTES



RCA Radiola 82

Second Edition—2 M

RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

CONTENTS

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

ILLUSTRATIONS

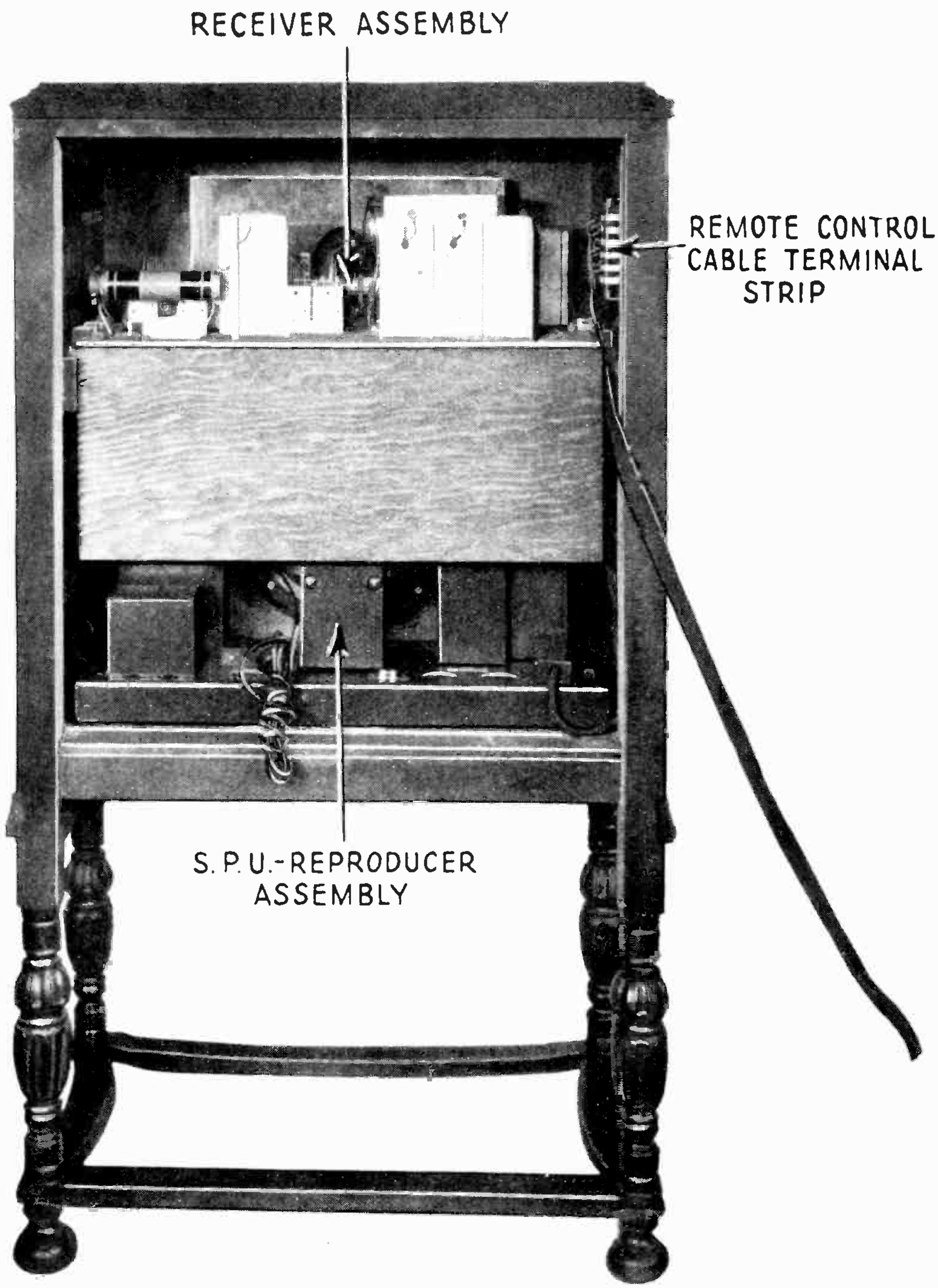


Figure 1—Rear interior cabinet view of door model

RCA RADIOLAS 82 and 86

(With Remote Control)

SERVICE NOTES

INTRODUCTION

RCA Radiolas 82 and 86 are supplied in models fitted with remote control attachments when desired. These receivers are identical with the standard models except for small wiring changes necessary to accommodate the remote control feature. Figure 1 shows a rear interior view of the Radiola 82. Figure 2 shows a top view of the receiver assembly.

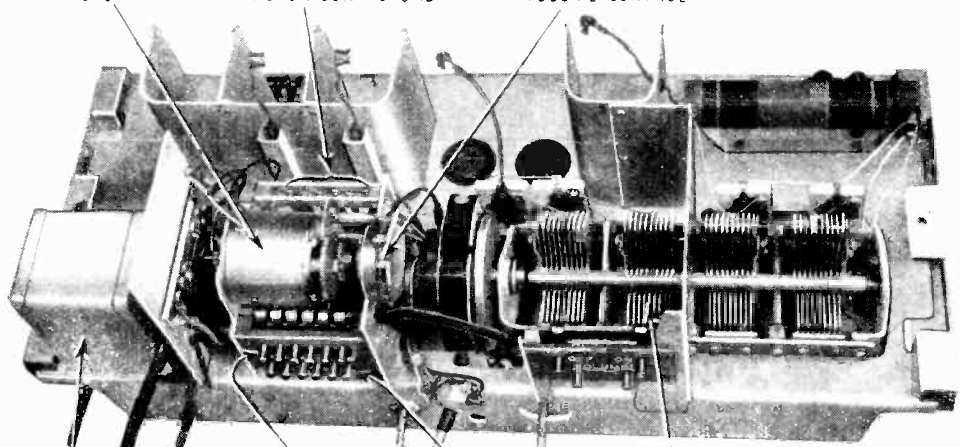


Figure 2—Top view of receiver assembly

The receiver assembly and S. P. U. of each of these models are exactly the same. The material in this booklet, therefore, refers equally well to either model. In the case of the phonograph combination instrument, the phonograph parts are connected exactly in the same manner as in the standard instrument. For service information other than on the remote control unit, the reader should refer to the Service Notes on the standard models of the receivers.

The remote control feature is unique in that it not only allows control of the receiver from a distant point but also pre-selects the desired station accurately. Manual tuning, other than necessary for the original setting of the selector buttons, is therefore eliminated. Selection of any one of six stations, adjustment of the volume control, or turning the receiver "on" or "off" may be accomplished at one or more remote points from the receiver. Operation of the tone control or local-distant switch must be done at the receiver.

One control box and twenty-five feet of flat cable are supplied. If desired, any number of additional units may be installed or the cable lengthened to seventy-five feet.

ELECTRICAL DESCRIPTION OF UNIT

The remote control feature consists of a standard chassis with a special gang condenser; a capacitor motor coupled to the gang condenser through a series of gears; a series of drums and contactors by which the motor is started in the right direction for a given station and stopped at the right point; a special volume control geared to the motor; a relay to turn the set "on" or "off" and a remote control box by which these operations are controlled.

The motor is provided with a tapped reactor and condenser for changing the phase angle of the applied current so that operation in either direction may be secured. The motor operates at 23 volts for the station selector and 18 volts for the volume control.

Referring to Figure 3 we see the normal position of the motor armature. It will be noted that a spring holds the armature so that the gear at one end is meshed with the volume control gears. At 18 volts, the voltage used for volume control operation, the gears remain in

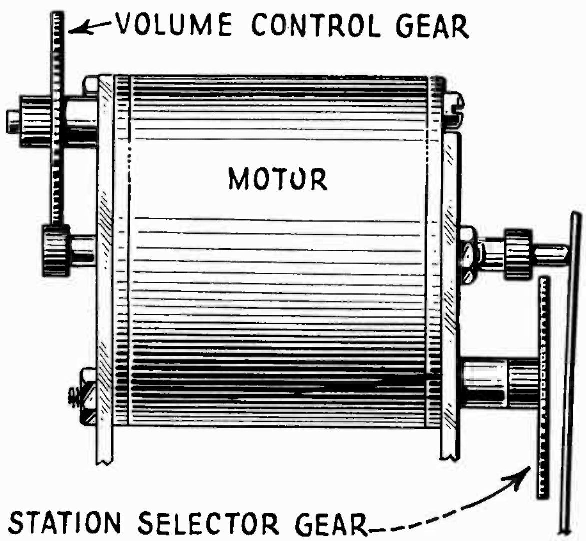


Figure 3—Motor with armature in volume control position

this position and operation of the volume control is secured. When the speed of the motor is increased by operating it at 23 volts, this voltage being used when the selector buttons are pressed, the end thrust of the armature causes it to move laterally, thereby disengaging the gear at the volume control end and engaging the gear at the station selector end. See Figure 4. The spring at the end of the armature causes it to always return to the volume control position when the current is "off" at the motor. As this action takes place with the motor operating in either direction, controlling the voltage at which the motor is operated determines its function. A sixty ohm resistor is placed in each motor circuit controlling the volume to reduce the voltage from 23 to 18 volts.

The proper direction of operation and stopping of the motor for selection of a desired station is controlled by a series of drums and contactors. Figure 5 shows a schematic circuit of the motor and its adjacent circuits. The drums hold the contactors in the proper position so that when a particular selector button is depressed, the motor will turn in the right direction. When the contactor is at the point on the drum where it is half way between each contact, the motor stops. This is 180° from the hole that is used to set the drum for a particular station.

The setting of the drums is made by the pins on the front panel. These are known as the "setting buttons." The selector button is pressed and the drum is moved by the motor until the corresponding contactor is midway between the contacts. The pin will now fall in the hole in the drum if pushed in by the finger. See Figure 7. Holding the pin firmly in the hole, the desired station is then accurately tuned in by means of the manual station selector knob. After tuning the pin is then released. As the point on the opposite side of the

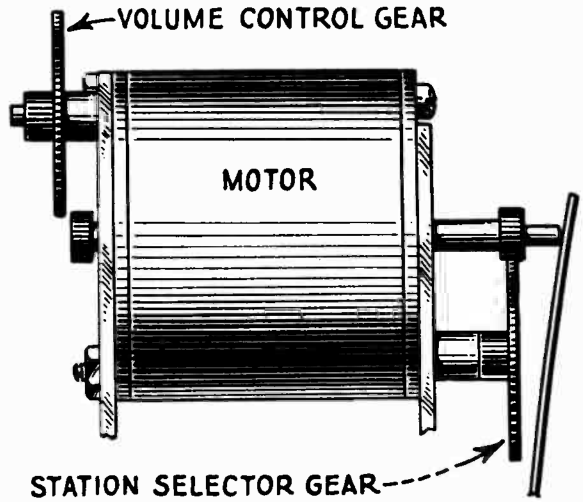


Figure 4—Motor with armature in station selector position

drum is where the diameter of the drum changes, the contactor is half way between the contacts. Pressing the selector buttons will therefore cause no movement of the motor. If another button is pressed and the drum moved, pressing the original button will always bring the drum back to the position for which it was set.

Referring to Figure 6, the schematic diagram, it will be noted that a common lead is used for the pilot lamp and the selector buttons in the remote control box. By doing this, when a selector button on the box is pressed, the current through the common lead is increased,

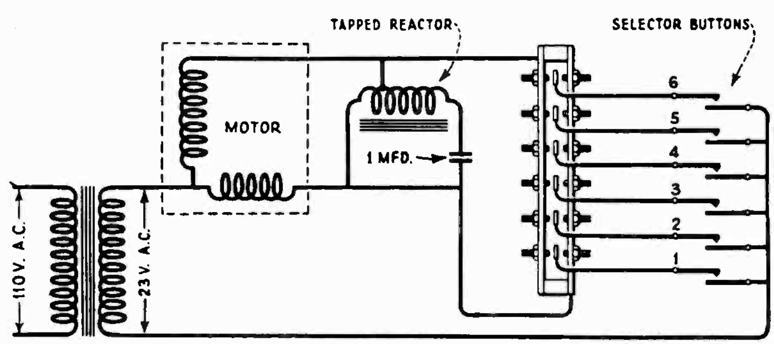


Figure 5—Schematic diagram of motor circuits

likewise the voltage drop in the lead is increased. The result is that while the motor is running the pilot lamp becomes very dim. As soon as the motor stops, the lamp flashes bright, thus indicating that the motor has stopped and the station is tuned in. If the station is not then heard, it is necessary to press the + volume control button a little at a time until the desired output level is obtained.

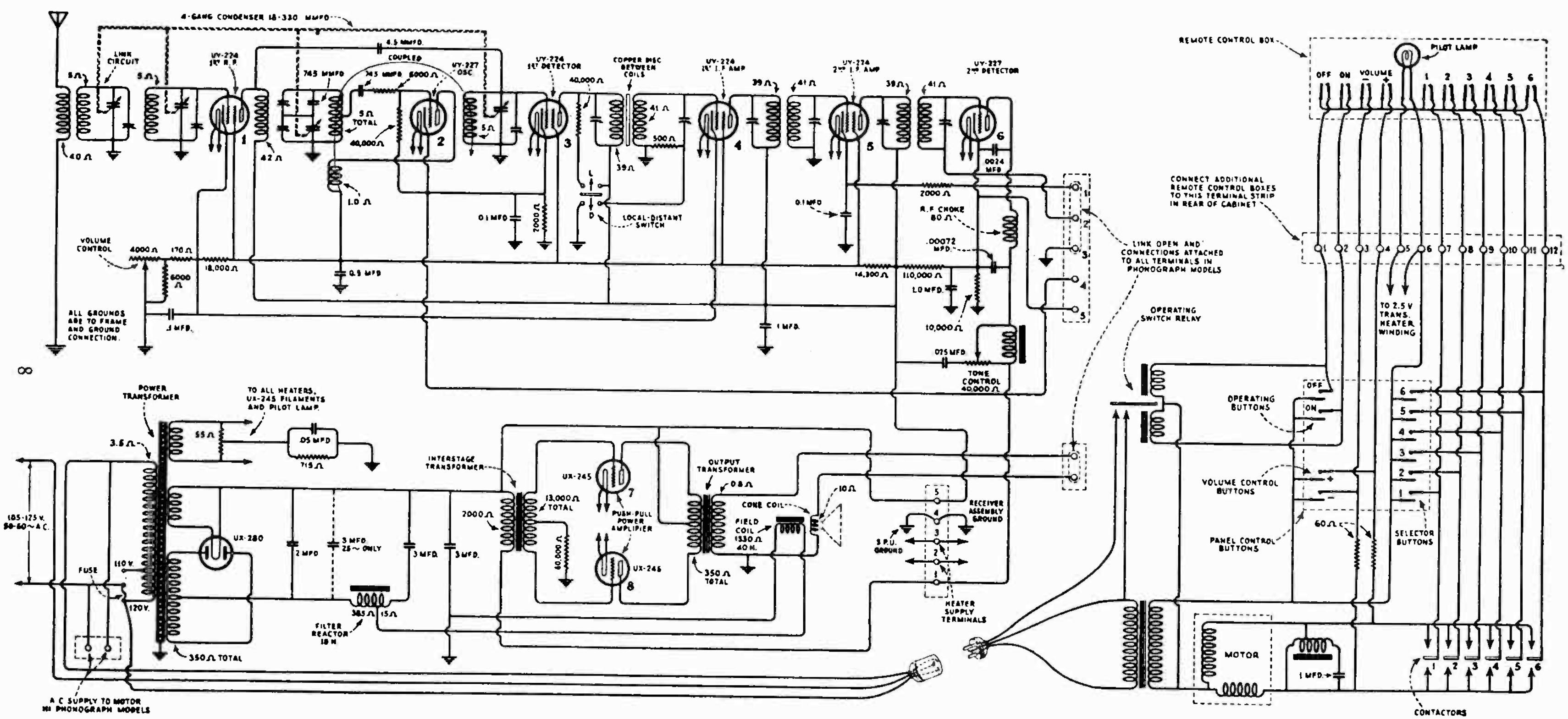


Figure 6—Schematic diagram of Radiola 82 with remote control

PART I—INSTALLATION

All the information contained in the regular Service Notes applies equally well to the remote control models. Reference to these booklets should be made when such information is required.

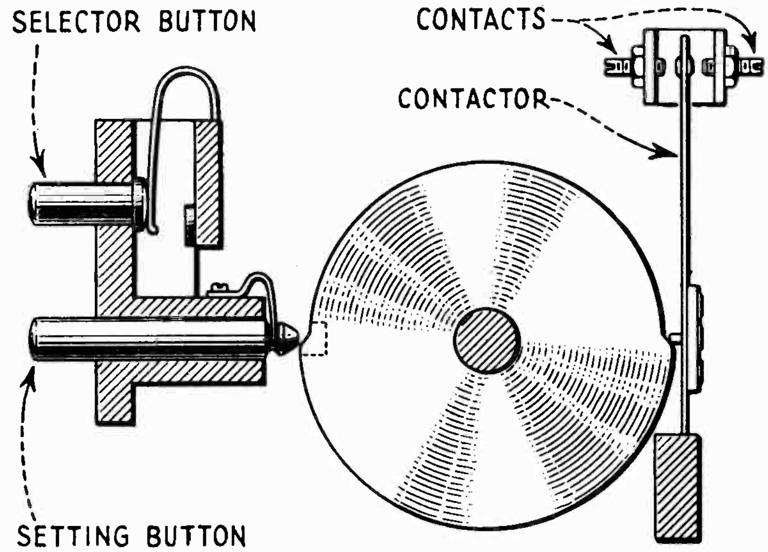


Figure 7—End view of drum and contactor

(1) INCREASING LENGTH OF REMOTE CONTROL BOX CABLE

The cable to the remote control box supplied with the remote control models is twenty-five (25) feet in length. This is ample for most rooms as it is very rare that a person wishes to listen to a program at a greater distance from the loudspeaker.

If, however, it is desired to place the remote control box at a greater distance from the set, any twelve conductor cable, the wires of which are No. 14 or larger in size, may be used to splice onto the regular cable and increase the total length up to seventy-five (75) feet. Figure 8 shows the method recommended for adding this additional cable.

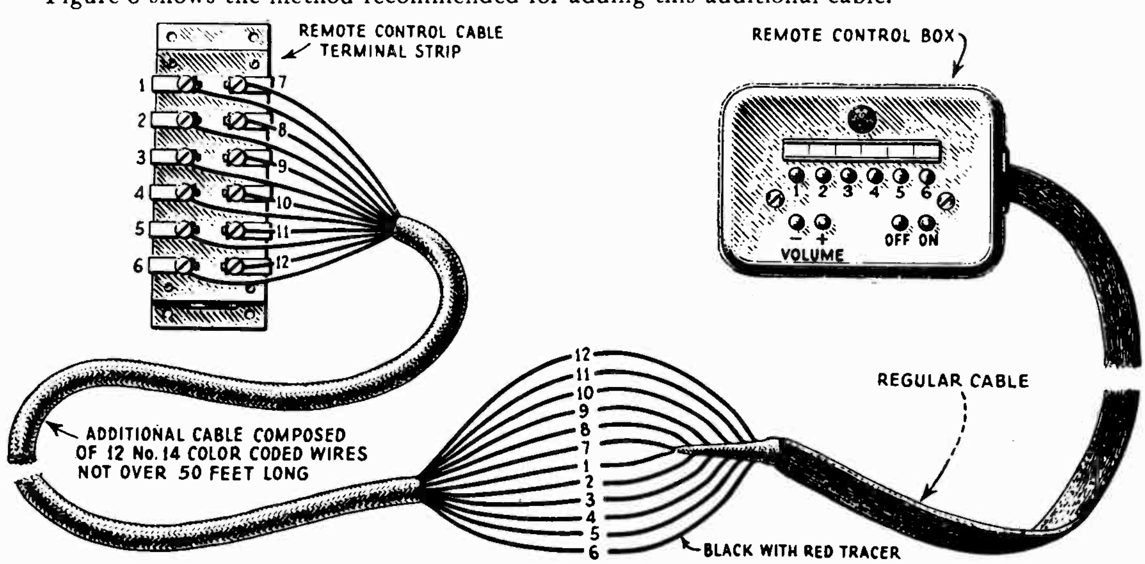
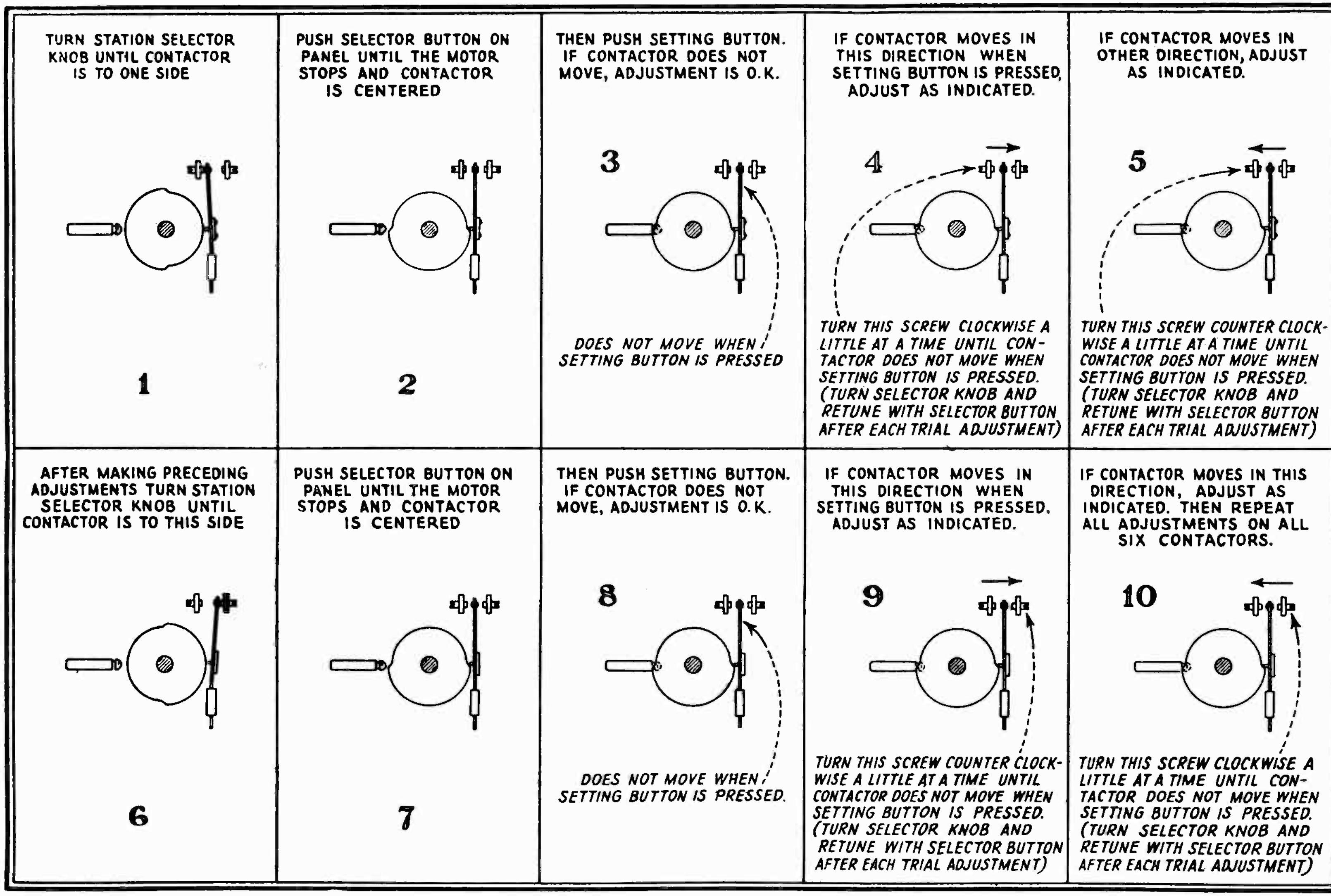


Figure 8—Wiring diagram of method for connecting additional cable

MOTOR CONTACTOR ADJUSTMENT CHART

Repeat Entire Procedure For All Contactors



(2) INCREASING NUMBER OF REMOTE CONTROL BOXES

One remote control box is supplied as standard equipment. Any number of additional boxes may be installed if desired although only one box can be used at a time for controlling the receiver. The boxes should be connected in parallel at the terminal strip on the rear of the Radiola. Figure 9 shows such a connection.

PART II—SERVICE DATA

(1) ADJUSTMENT OF MOTOR CONTACTORS

The six motor contactors located at the rear of the motor may require adjustment due to changes in the amount of friction in the entire drive assembly. Need for adjustment is evidenced by the motor failing to stop at the exact point for a particular station.

In order to make these adjustments two tools are necessary. They may be constructed, see Figure 11, or obtained as a spare part, the replacement parts catalogue listing them. The

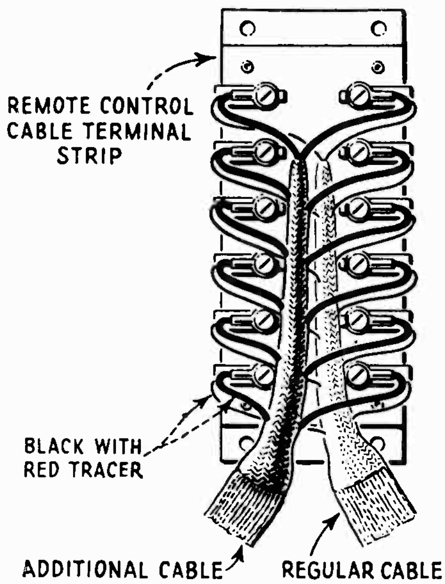


Figure 9—Connections for adding additional boxes

chart on page 10 gives the procedure to be followed for making adjustments. This procedure must be repeated on each contactor that is out of adjustment.

If all contactors are out of adjustment in a similar manner, then the friction screw, see Figure 12, requires adjustment. This should be either tightened or loosened, the exact adjustment to be determined by trial. The adjustment that is correct for one contactor will be correct for all, assuming the friction screw to be at fault.

(2) REPLACING OR ADJUSTING CONTACTORS

Six contactors are used for connecting the motor so that it rotates in the proper direction. To make this adjustment or replacement, a special offset screw driver will be required unless the unit is to be removed from the base. This is shown in Figure 11 and is also listed in the replacement parts catalogue.

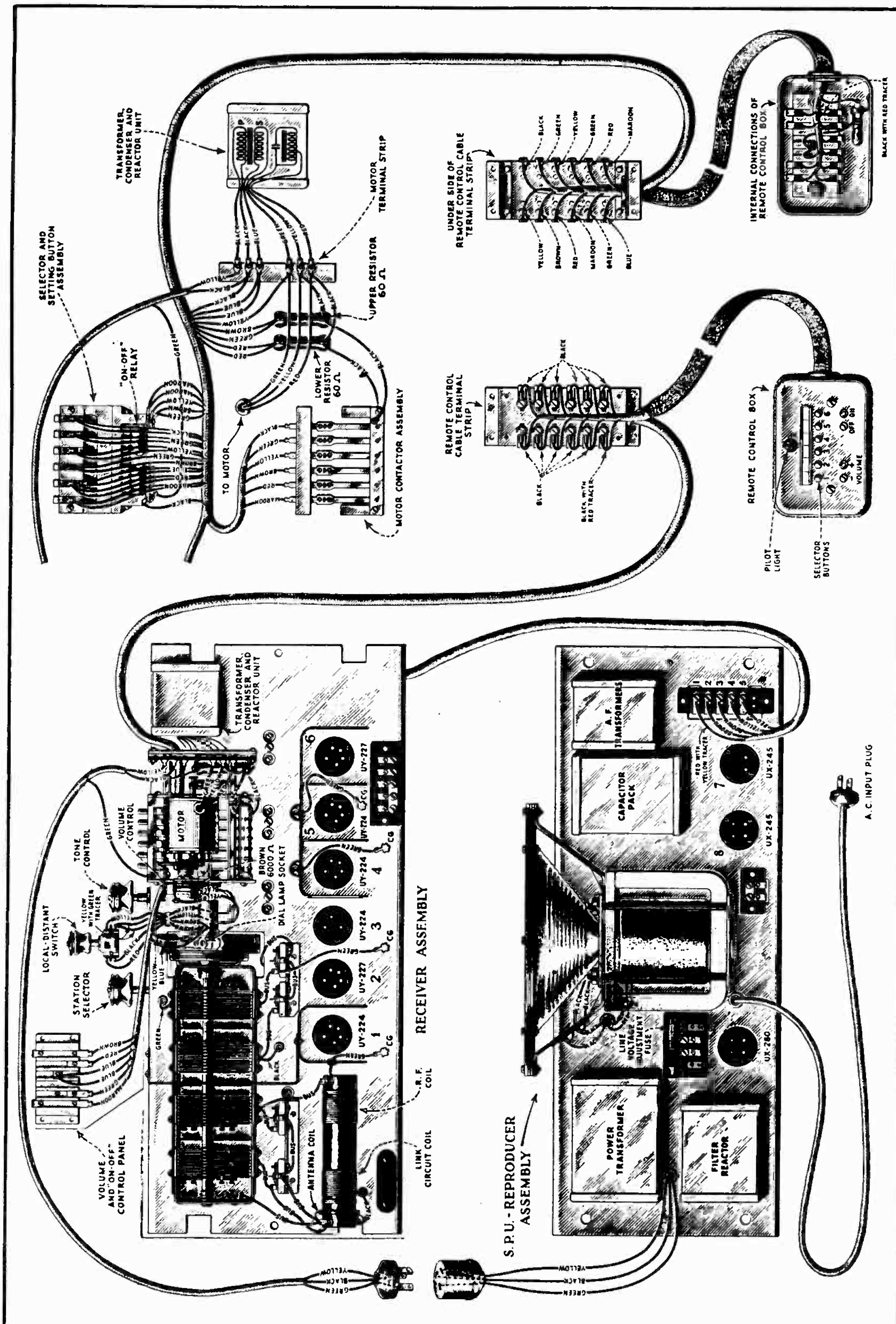


Figure 10—Complete layout and wiring diagram of remote control models

Referring to Figure 7 we see that when the setting button is in the hole in the drum, the contactor for that particular drum is exactly half way between the contacts. The holes that hold the contactors are elongated so that they may be raised or lowered until they rest exactly

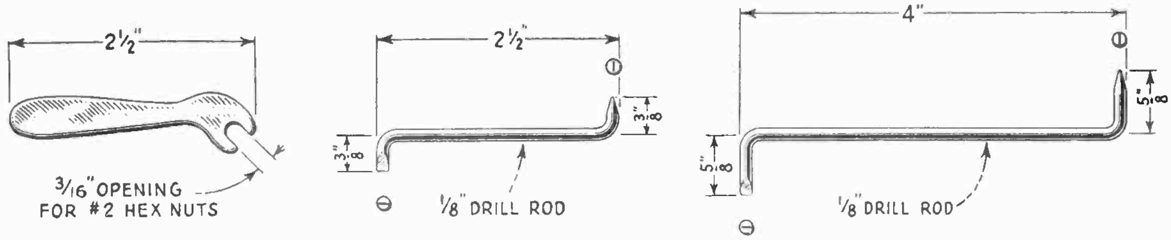


Figure 11—Constructional details of special tools used with remote control models

half way between the contacts when the setting button is inserted in the drum hole. This is the only adjustment required of these contactors, and with the special screw driver is quite easy to make.

(3) MAKING REPLACEMENTS

The operating relay, the resistors, the motor, the gears and other small parts may be replaced. The transformers when replaced must have the primaries so connected that the pilot light on the remote control box lights properly. If the transformers are improperly phased, the lamp will brighten instead of dim when a selector button is pressed. The drum assembly is specially fitted and assembled and any individual replacements can not be made. If trouble is experienced in this assembly, a complete replacement of the unit will be required. The parts replaceable are listed in the replacement parts catalogue.

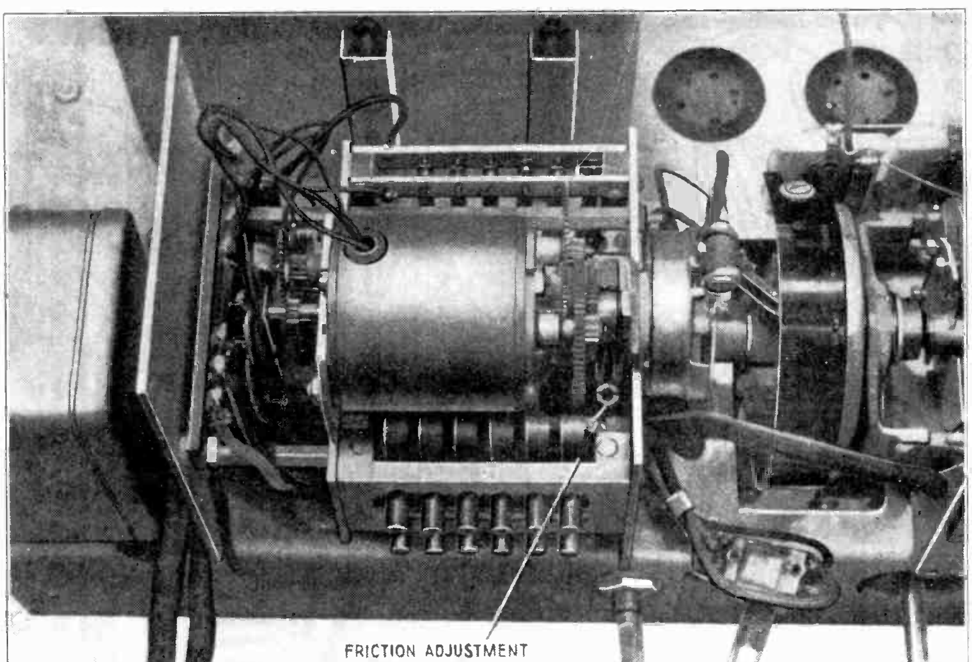


Figure 12—Location of friction adjustment

PART III—ELECTRICAL TESTS

The schematic circuit diagram is shown in Figure 6. The receiver assembly and S. P. U. wiring diagrams together with the complete layout diagram are shown in Figures 13, 14, and 10 respectively. These diagrams should be used for making any electrical tests necessary. All voltage readings, continuity tests and service information may be obtained from the service notes on the regular models of these receivers.

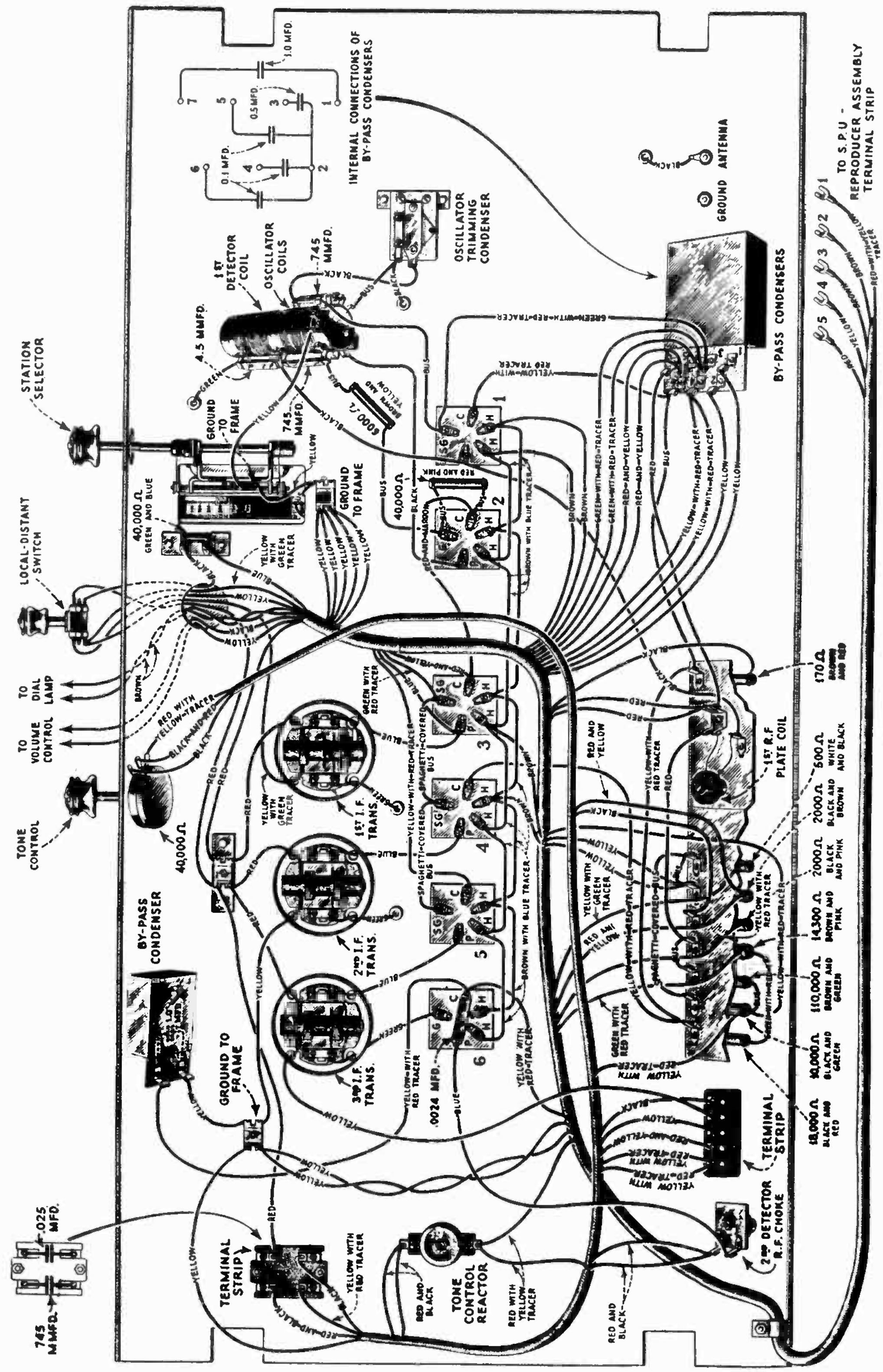


Figure 13—Wiring diagram of receiver assembly

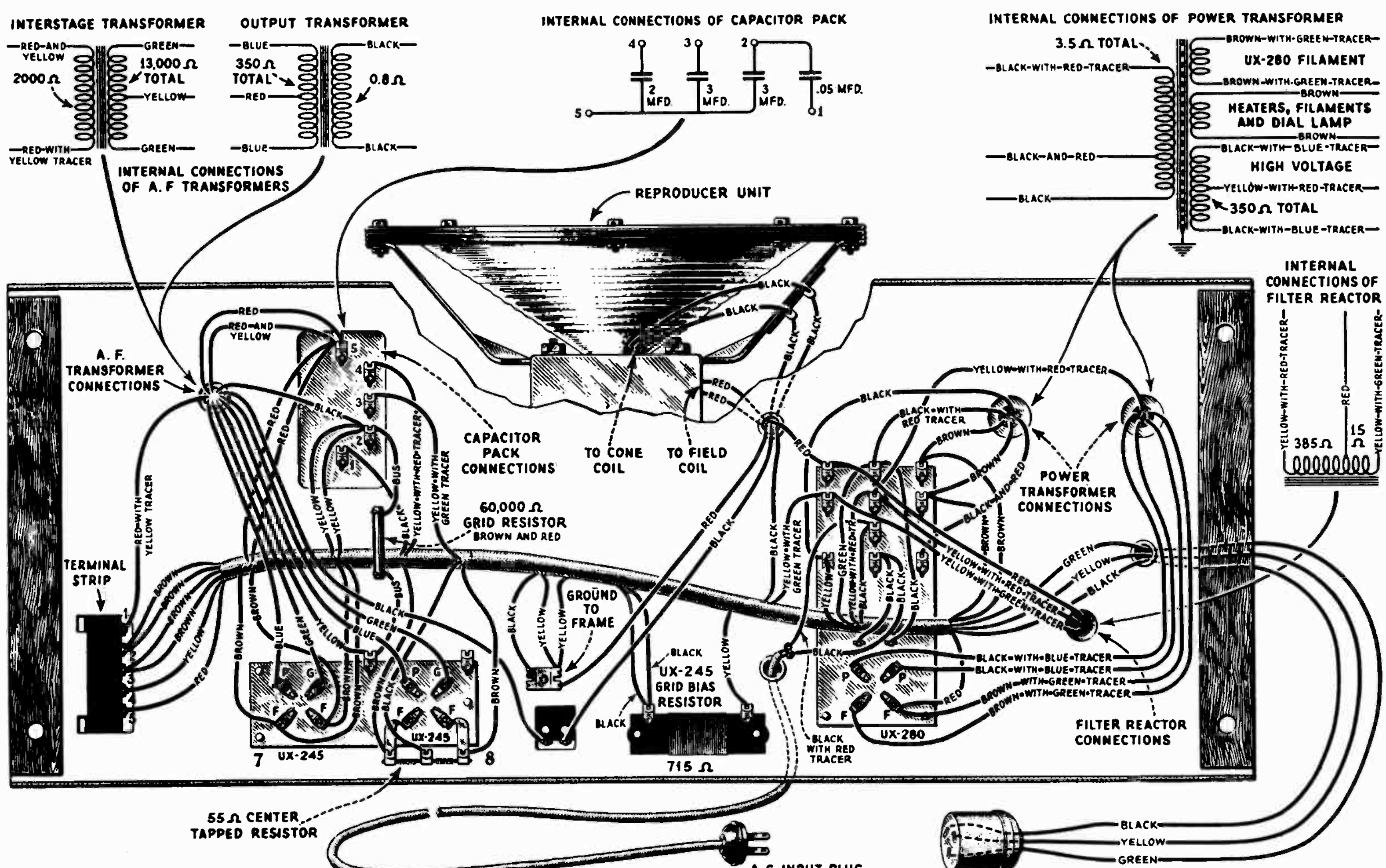
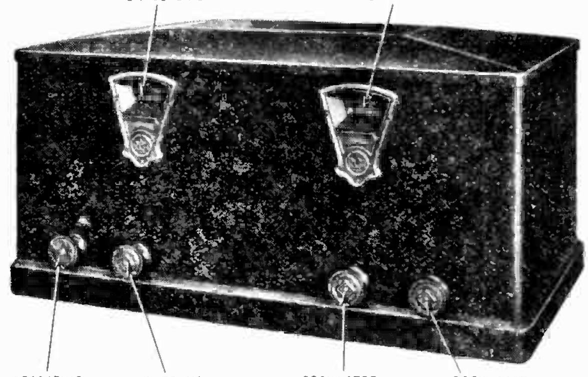


Figure 14—Wiring diagram of S. P. U. reproducer assembly

S. O. 7658

RCA Radiola Short Wave Adaptor

SERVICE NOTES



R C A Radiola Short Wave Adaptor

First Edition—2M

RCA Victor Company, Inc.

FOREIGN SALES DIVISION FOR RCA BRANDS

Camden, New Jersey, U. S. A.

CONTENTS

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

ILLUSTRATIONS

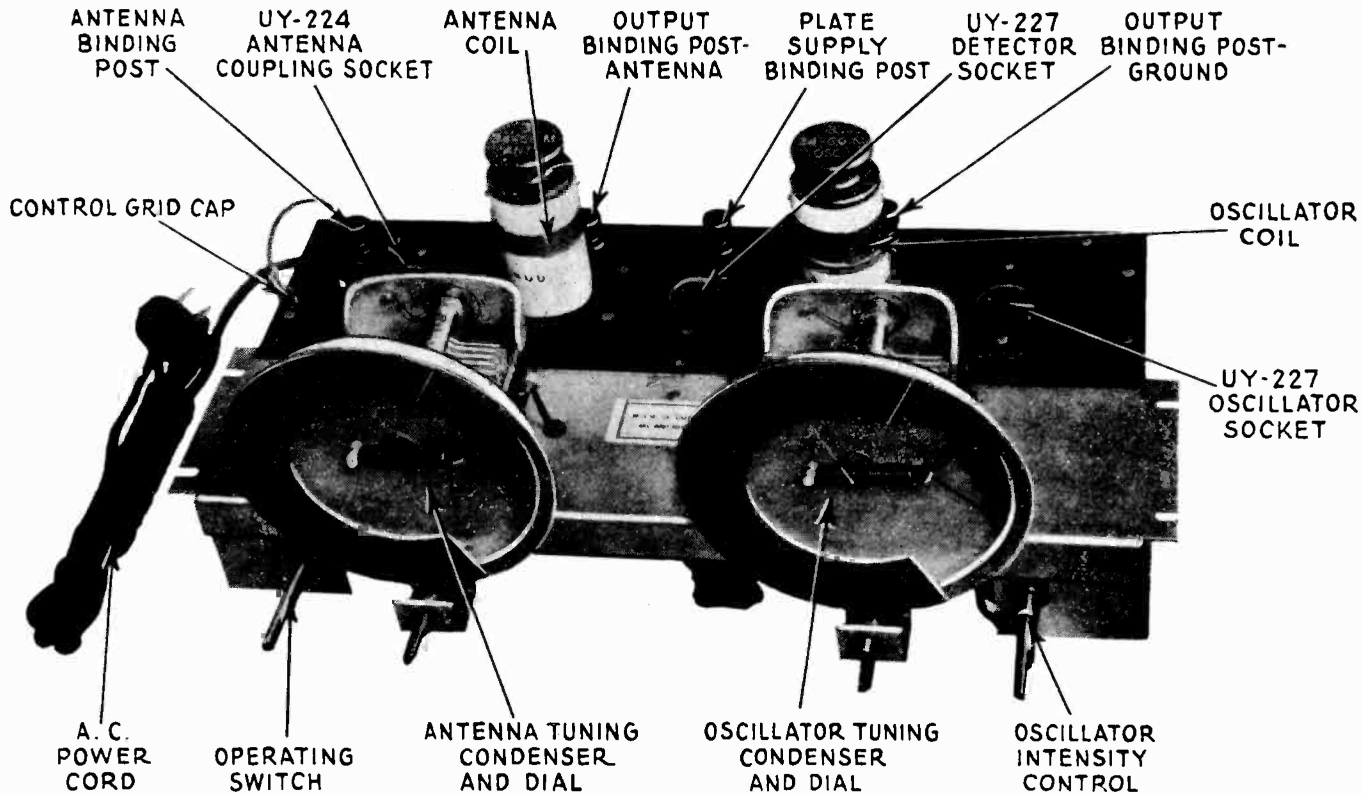


Figure 1—Top view of chassis

RCA Radiola Short Wave Adaptor

SERVICE NOTES

ELECTRICAL SPECIFICATIONS

Voltage Rating	105–125 Volts (200–250 Volts 60 Cycle A. C. Only)
Frequency Rating	25–40 Cycles and 50–60 Cycles
Power Consumption	15 Watts
Plate Voltage Supply	110–140 Volts D. C.
Recommended Antenna	Single Wire, 25–75 Feet Long
Recommended Ground	To Receiver Ground
Type of Circuit	Super-Heterodyne
Wavelength Range	16.5–110 Meters
Number of Plug-in Coils	8 (2 Per Set)
Recommended Output Frequency	1000 K. C.
Number of Tuning Controls	2
Number and Type of Radiotrons	1 UY-224 and 2 UY-227

PHYSICAL SPECIFICATIONS

Length	17 Inches
Width	10¼ Inches
Height	8¾ Inches
Weight Complete with Radiotrons and Coils	20 Lbs.
Shipping Weight with Coils	30 Lbs.
Shipping Carton Dimensions	12½ x 13½ x 20 Inches
Power Cord Length	8 Feet
Cabinet Material	Steel
Cabinet Finish	Crystalline Lacquer

INTRODUCTION

The RCA Radiola Short Wave Adaptor is designed for use in conjunction with an ordinary broadcast receiver to make possible the reception of signals from short wave transmitting stations. The construction of the instrument embodies compactness, simplicity and fine appearance. Its dimensions are ideal for convenient location atop, or in the vicinity of console cabinets, the dull crystalline finish blending with the usual cabinet colors. Unsightly wiring connections may be easily concealed in order to create an orderly installation that is capable of producing good results on weak signals. Figure 1 shows a view of the chassis removed from the cabinet.

All types of modern radio receivers can, if operating properly, be adapted to extend their usefulness to short wave channels. Adaptation requires little effort, since no changes are necessary in the receiver wiring. The small amount of power for the Radiotron heaters is secured from an alternating current line, while the higher voltage direct current for plate supply is taken from the radio receiver used.

The circuit is based upon the Super-Heterodyne principle and the device performs efficiently throughout an extensive wavelength range. A high degree of selectivity and good sensitivity are obtained.

Operation is consistent with the ability of an operator to carefully adjust the tuning controls and to recognize good signal quality. As with all short wave receiving equipment, practice is required in tuning before stations can be received without difficulty. Under average conditions, great distances may be spanned, but such performance can not be continuously realized because of the changing character of the medium through which the waves must travel. Different phenomena from that encountered in the present broadcast band exists in the short wave bands, hence discontinuities such as rapid fading, skip distance, and occasional heavy static are to be considered normal. Response is limited to modulated waves only, thus excluding unmodulated powerful radio-telegraph interference. These coded continuous waves may be detected, if desired, by attaching the Adaptor to a receiver having an autodyne detector.

ELECTRICAL DESCRIPTION OF CIRCUIT

When used with the RCA Radiola Short Wave Adaptor, the receiver functions as the I. F. amplifier and second detector of the usual Super-Heterodyne circuit. The function of the Adaptor is therefore to convert high frequency signals to lower frequency signals, without altering the audio modulation components. This renders the signal suitable for the amplifying and detecting properties of a broadcast type receiver. Such a frequency reduction is effected by use of a circuit combination of the Super-Heterodyne type. A local signal is produced and mixed with the desired distant signal, causing its intensity to wax and wane periodically, the frequency of variation being equal to the frequency difference of the two signals.

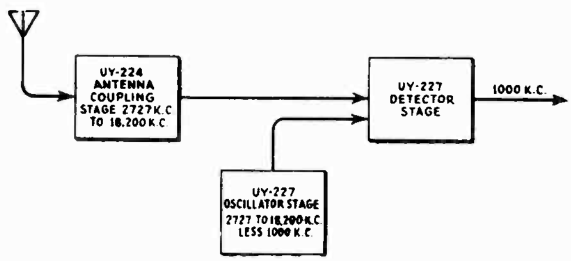


Figure 2—Path of various R. F. currents

Detection selects this difference and supplies it to the receiver where further operations transform the signal into sound energy.

In the diagram, Figure 2, each Adaptor stage is represented as a block. The evolution of signal frequency as it passes from the antenna into the system, to successive stages, and finally to the receiver is shown by the values marked at the transformation points. High frequency signals absorbed by the antenna enter the antenna coupling stage where unselective amplification increases the amplitude of any that range from 2727 K. C. to 18,200 K. C. (110–16.5 meters). The desired signal is picked out by an interstage tuning circuit and transmitted to the detector input. The locally generated signal is superimposed upon the same input, beating with the original signal to give the difference or beat frequency which is detected and impressed on the receiver input. The following mathematical example shows what happens to a signal having a carrier frequency of 10,000 K. C. when the receiver is tuned for an Adaptor output of 1,000 K. C. After reaching the detector the 10,000 K. C. signal is modulated with a frequency from the local oscillator which is tuned to 9,000 K. C. or 11,000 K. C., the resulting difference is 1,000 K. C. This 1,000 K. C. signal, as isolated from the others by the detector action, contains the original modulation. It is amplified in the same manner as other signals when introduced to the broadcast receiver.

Tracing the signal through the actual circuits it is seen from the schematic diagram, Figure 3, that it is intercepted by the antenna and applied across a portion of the resistance between the control grid and cathode of the untuned, screen grid, antenna coupling stage. The grid bias voltage is obtained by the voltage drop across the 1,000 ohm resistor in the cathode circuit. A by-pass condenser keeps this cathode at ground potential insofar as radio frequency is concerned. The coupling stage limits antenna effects upon the tuned circuit constants, amplifies the signal and prevents by its one way action any radiation of the local oscillator through the antenna. From the first stage, the signal voltage is applied between the terminals of a parallel tuned circuit and then onto the Radiotron UY 227 detector input. The grid leak condenser method of detection is used. Local oscillations from a Radiotron

UY-227 are coupled in series with the detector input. They react with the signal, giving a new frequency which travels to the output terminals.

The local oscillator stage has plate coil feedback, controllable by a variable resistor in the plate circuit. All heaters of the Radiotrons are supplied by A. C. from a small transformer. They are in parallel and are center tapped to ground by means of a resistor. The D. C. supply leads are well filtered by R. F. chokes and condensers, precluding reaction between the stages and excluding noises. Voltage for screen grid, oscillator plate and detector plate is supplied through a high series resistance to cause the required reduction. The coupling stage plate gets its voltage direct and separately from a higher potential junction.

Variable condenser rotors are grounded to minimize capacity effects from an operator's hand while the Adaptor is being tuned. Plug-in coils for both tuning circuits change the wave length ranges. The ranges overlap sufficiently to insure continuous capability from the lower to upper limits of response.

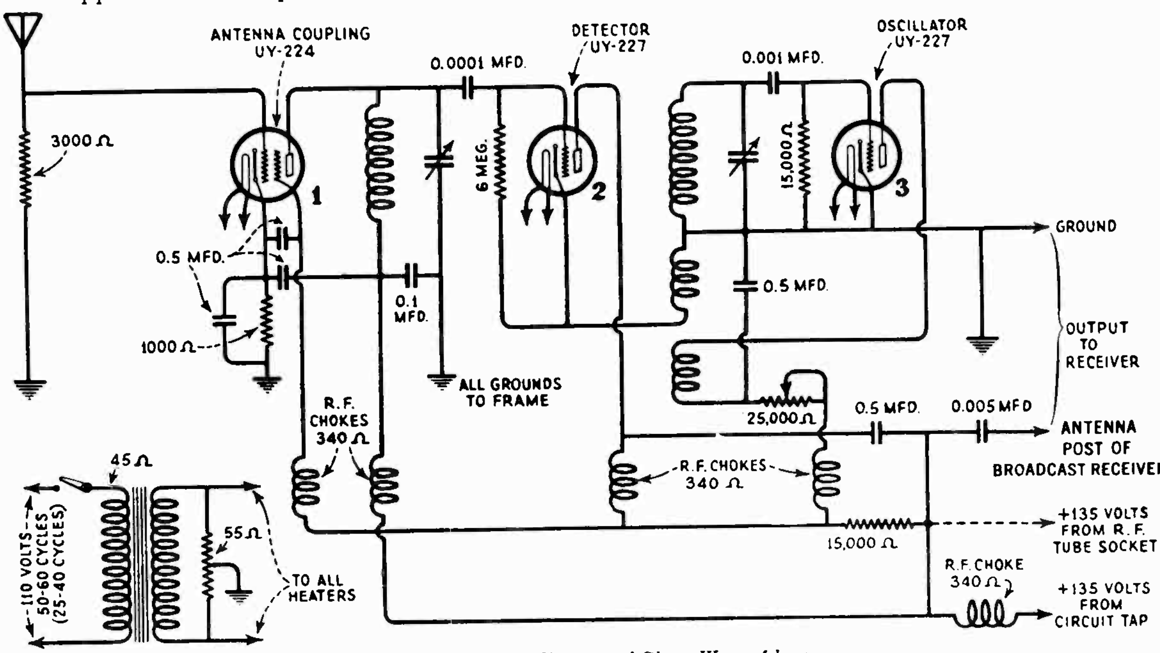


Figure 3—Schematic diagram of Short Wave Adaptor

MECHANICAL DESCRIPTION

The chassis supporting the electrical system is a removable unit, consisting of all necessary parts and apparatus mounted on a steel frame. The various stages are arranged to eliminate long connections as well as to avoid congestion of wires and parts. Each part is fastened rigidly to the chassis frame by rivets to prevent loosening by vibration. Variable condensers are substantially constructed and firmly mounted. Figure 4 shows a sub-chassis view of the Adaptor. Shafts of the controls project through the cabinet front, knobs being mounted on their ends. Uniformity is gained by incorporating UY sockets, wired to receive the plug-in coils. Markings stamped on the chassis indicate the position of the various coils and Radiotrons. The windings of the plug-in coils consist of silk covered copper wire, cemented to an Isolantite form. The cabinet bottom is wood, having four cushioned feet. Holes are provided in this base opposite the various connecting points of the chassis to insure a direct and short ex't for the leads. The base can be taken out of place quickly when access to the sub chassis is desired. The chassis top can be reached by merely lifting the lid from the cabinet. A large ratio of movement between the dial drum and the threaded pulley as transferred by a cord drive gives exact tuning. Material used in the cabinet is sheet steel, except for the wood base board of the bottom. This sturdy construction offsets danger of damage from careless handling. A crystalline-lacquer finish covers the entire surface of the metal.

PART I—INSTALLATION

(1) ANTENNA (Outdoor Type)

Satisfactory operation can be expected from the RCA Radiola Short Wave Adaptor where it is joined to the antenna that was in use on the broadcast receiver being adapted for short waves. A few constructional hints will probably aid in arranging an ideal antenna, and explain some sources of poor reception. A single wire 25 to 75 feet long located as high as possible above and away from surrounding objects, is recommended. Continuation of the antenna is the best lead-in possible. Keep the antenna short and run it in a direct line to the receiver. Swaying of the wires will give rise to fading, hence the antenna and lead-in should be taut. In cases where stray noises are present they may be reduced by using a shield on the lead-in, the shield being grounded or not as determined for best results by experiment.

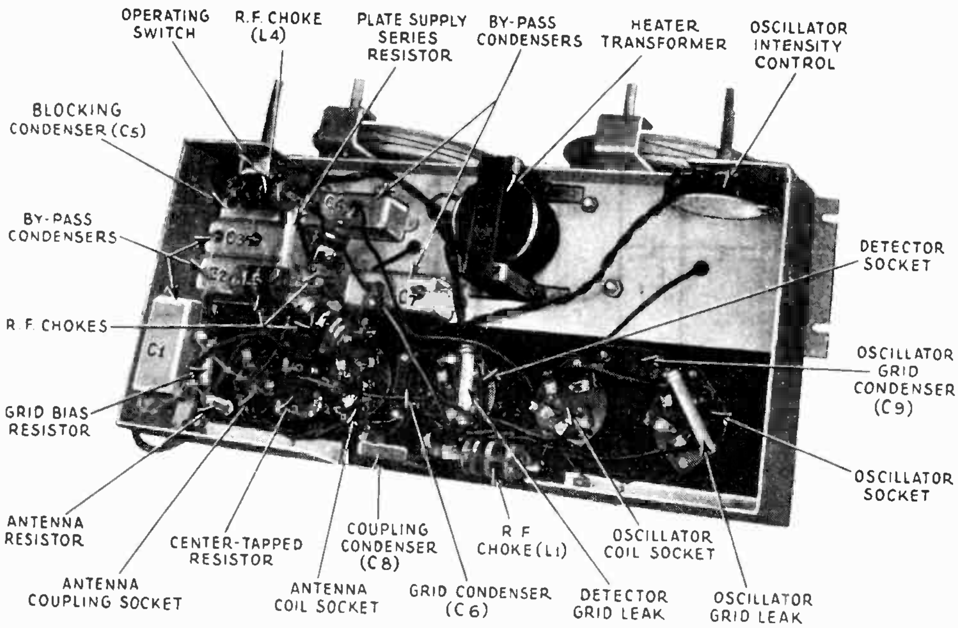


Figure 4—Sub-chassis view of Adaptor

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. Bring the lead-in wire from the outside through a porcelain tube or other approved insulator to the inside of the house for connection to the Adaptor.

The antenna should not cross either over or under any electric light, traction, or power line and should be a 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.

(2) 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 insulated wire strung around the picture moulding or placed under a rug. In buildings with steel framework or where metal lathing is employed, satisfactory results are not always possible with this type of antenna. In large buildings where the interference level is high, erection of an outdoor antenna may be necessary for satisfactory results.

(3) GROUND

No extra ground connection is needed for the Adaptor, other than the ground of the receiver with which it is used.

Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be as short as possible and connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds and employ the one giving the best results.

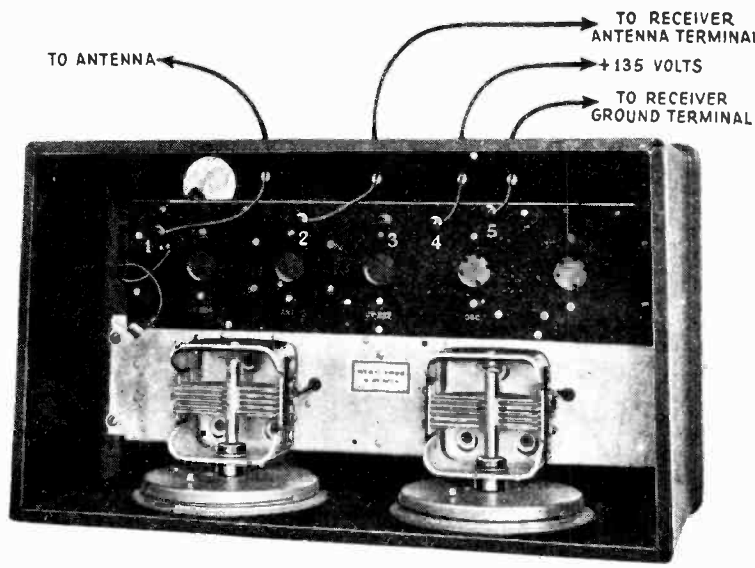


Figure 5—Connections for Method No. 1

(4) LOCATION

The primary consideration in locating the instrument is the length of the connections between the receiver and Adaptor. The length of the connecting leads should not be greater than six feet. Short direct leads give improved results over carelessly arranged ones. The receiver volume control must be within the operator's reach so that it can be regulated when tuning the Adaptor. The top of the receiver cabinet is a convenient location due to conditions mentioned. Howling is occasionally experienced due to acoustic feedback. This can be remedied by using a different support for the Adaptor.

(5) CONNECTING ADAPTOR TO THE RECEIVER

Two methods of connecting the Adaptor to the broadcast receiver are provided. In one, the D. C. voltage is taken from the voltage supply of the receiver at a point of zero R. F. potential, or as near to the filter system terminals as it can be attached. The alternative scheme utilizes the first R. F. stage plate contact as a source of D. C., as well as to couple the R. F. output of the Adaptor to the receiver circuit.

METHOD No. 1—110-140 VOLTS AVAILABLE AT RECEIVER

The following procedure should be followed when a connection can be made to a point in the receiver power system having a potential to ground of 110 to 140 volts. Figure 5 shows the connections.

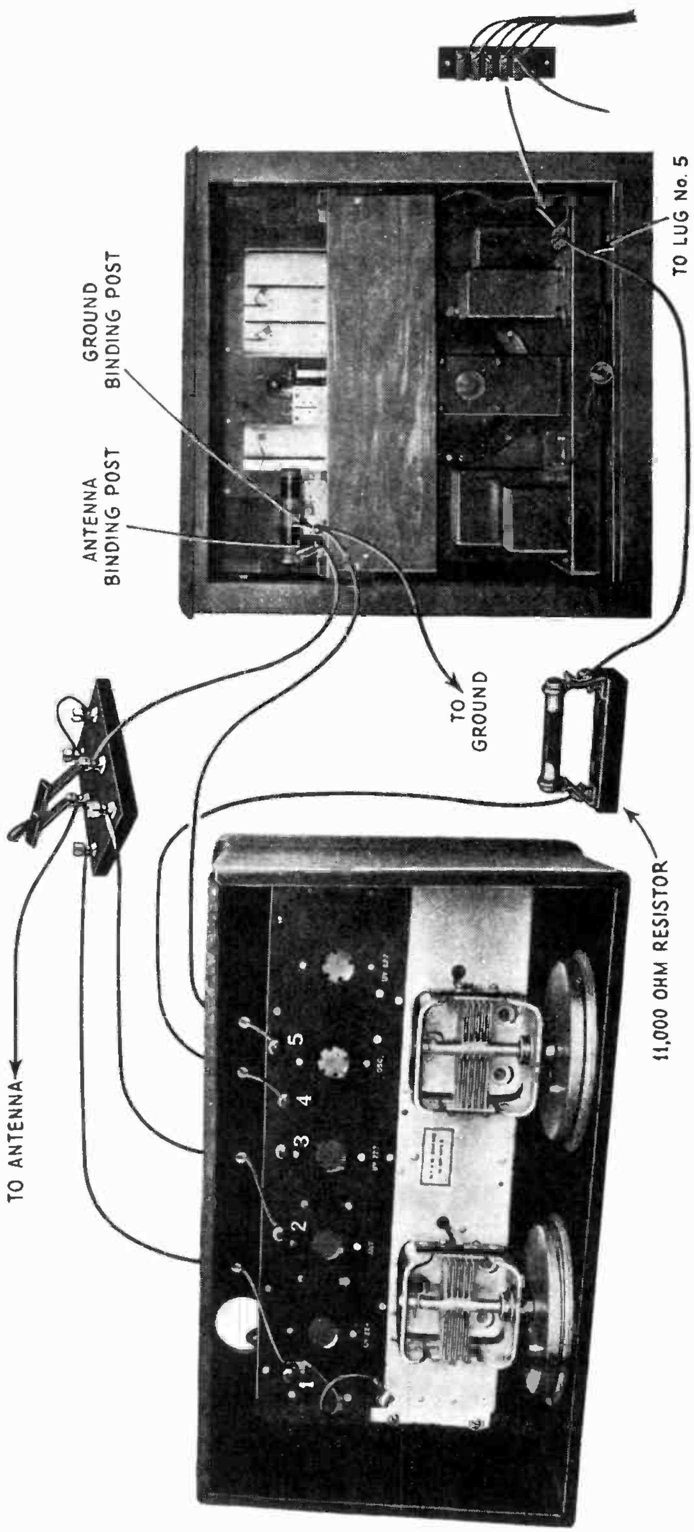


Figure 6—Connections of Short Wave Adaptor to Radiola 80

1. Remove the antenna lead from the receiver and let the ground lead remain as originally connected. Connect the antenna lead to Binding Post No. 1, the same binding post that holds the control grid lead.
2. Connect Binding Post No. 2 to the antenna terminal on the receiver. Special care must be taken to keep this lead away from all others.
3. Connect binding post No. 4 to the 110–140 Volt tap on the receiver. Voltages above 140 must be lowered by including a resistor of correct value in this lead. Approximately 7 M. A. will flow when the terminal is maintained at plus 135 volts. The series resistance necessary to bring the voltage to the normal value required can be computed by Ohm's law (Resistance equals 143 times Voltage Drop). A slight deviation in this calculated value from the actual measured value will be noticed due to voltage regulation in the power unit. It may be disregarded if the voltage at binding post No. 4 is within the limits stated above. Compensation for regulation error can be made by using a slightly lower resistance than the calculated one.
4. Connect Binding Post No. 5 to the receiver ground post. This should be connected to a good ground as described in Part I, Section 3.
5. Pass the A. C. power cord through the large hole in the Adaptor base. All other connections have outlet holes in the base board.

Changing from short wave reception with the Adaptor to long wave reception with the receiver can be simplified to a quick process with a double pole, double throw switch connected as shown in Figure 6.

When the switch is in the position to the right, the receiver will function in its usual fashion, picking up long wave stations only. Shifting the switch to the left side makes the connections required for the Short Wave Adaptor. This same shifting arrangement can not be used for Method No. 2 connection, where the output and voltage supply travel through the same interconnecting wire. Changing the wires and replacement of the first stage Radiotron restores the receiver to its original form in this case.

An example of Method No. 1 is illustrated by Figure 6, in which an RCA Radiola 80 is the receiving unit. The voltage available at the S. P. U. terminal strip lug No. 5 is about 220 volts. A 11,000 ohm resistor in the high voltage lead to the Adaptor reduces the voltage to 135 volts.

METHOD No. 2—OBTAINING PLATE SUPPLY FROM RECEIVER RADIOTRON SOCKET

Method No. 2 presumes that the plate voltage on the receiver's first R. F. tube is within the 110–140 volt limit.

The following procedure should be used for making connections. Refer to Figure 7.

a. Remove antenna lead from the receiver and let the ground lead remain as originally connected.
b. Connect the antenna lead to Binding Post No. 1. Connect a lead from Binding Post No. 5 to the receiver ground connection.
c. Insert the Adaptor plug into the first R. F. or antenna coupling Radiotron socket of the receiver and connect free end to binding post No. 3.

Binding Post No. 2 and No. 4 will have no connections.

If the plate voltage does not fall within the 110–140 volt limit a resistor of the value calculated by the method given in Method No. 1 should be connected in the following manner.

First—Connect resistor between binding posts Nos. 2 and 3.

Second—Connect free end of Adaptor plug lead to binding post No. 2 instead of No. 3

Then make other connections in the manner indicated under a, b and c.

(6) RADIOTRONS AND PLUG-IN COILS

Markings adjacent to each socket denote the Radiotron or coil to be inserted therein. Before inserting, make certain the prongs are clean and will form good connections to the socket contacts. Soldering flux or similar conductive material on the prongs can be removed by scraping with a knife or rubbing with sand paper. Remove all sand particles with a cloth. The lettering on the coil identifies it as ANT. or OSC. and it should go into the socket similarly labelled. Always choose the pair that have the same wavelength rating. If the signal lies within the overlap limits of two groups of coils, use the group having the highest wavelength rating. This discrimination facilitates tuning because less tuning capacitance spreads the overlap over a larger dial range. Interchanging the Radiotrons UY-227 may improve signals, but critical selection of Radiotrons is not essential. Remove coils and Radiotrons gently, so that they will not be damaged by striking the upper rear edge of the metal cabinet. Replace the cabinet lid before operating the Adaptor.

(7) A. C. POWER SUPPLY

After all connections are correctly made, and the Adaptor ready for operation, the power plug is inserted into an A. C. outlet. Radiola Short Wave Adaptor is available for three types of A. C. supply, namely; 105–125 volts, 50–60 cycles; 105–125 volts, 25–40 cycles; and 200–250 volts, 50–60 cycles. A rating tag on the base gives the power requirements. The difference in these various models is the heater transformer.

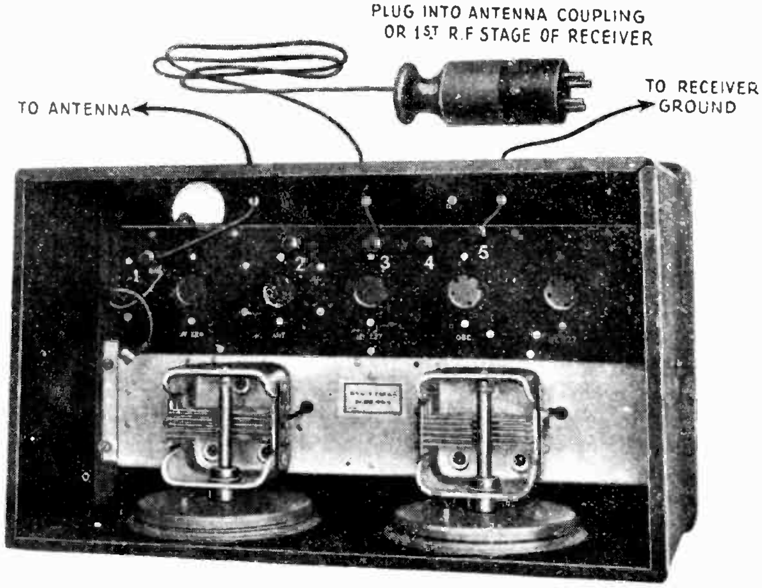


Figure 7—Connections for Method No. 2

PART II—SERVICE DATA

(1) FAILURE TO OPERATE

Failure to operate may be due to any of the following causes:

a. Not properly installed. Inspect all connections and make sure they are correct and make tight contact.

b. Radiotrons. Check the condition of each Radiotron by interchanging with others of similar type and known condition.

c. Inoperative receiver. The receiver with which the chassis is used must be in proper operating condition before any operation of the Adaptor may be expected.

d. Defective Adaptor. Check by means of socket voltage readings and continuity tests and make any repairs or replacements necessary.

(2) NOISY OPERATION

Noisy operation may be due to any of the following causes:

a. Poor joints. Repair any poor joints or connections.

b. Dirty Radiotron or Plug-In coil prongs. Clean any dirty prongs.

c. Loose or poorly made antenna and ground connections. Check and make any repairs necessary.

d. Noisy location. Disconnecting the antenna will indicate whether noise is coming in through the antenna. If noise still exists it may be coming over the supply lines or may be due to a faulty Adaptor. If Adaptor is found O. K. it may be necessary to use some form of line filter in the Adaptor A. C. supply. The fact that little or no interference is noted in broadcast reception is no proof that power supply noises do not exist when using the Adaptor.

e. Radiotrons. Check the condition of all Radiotrons both in the Adaptor and in the receiver.

(3) WEAK SIGNALS

High or low voltages on the Radiotrons will tend to decrease sensitivity of the Adaptor. When reception is limited to the strong signals, an investigation is sometimes necessary. See that the antenna is not in a shielded space, nor too near an object that will deflect or absorb the energy coming to the antenna. Rearrange the leads going to the receiver to assure a minimum of capacitance between them. When they are close together this capacitance lowers the signal intensity.

(4) DISTORTED SIGNALS

Distortion noticed at the loudspeaker may be due to one or more of the following causes:

a. Radiotrons overloading in Adaptor or receiver. In receivers where no input variation is included, the first stage will suffer from excessive signal on high powered local stations. A 50,000 ohm potentiometer placed across the Adaptor output will remedy the condition.

b. Defective Radiotrons. Check all Radiotrons carefully for loose elements and gas content.

c. Defective grid condenser or leak in either detector or oscillator stage. Check their values and replace them if they are not correct.

d. Detector stage oscillating. Check relation of grid and plate circuits to see that no coupling exists between them.

(5) ACOUSTIC HOWLING

Vibrations feeding back from the loudspeaker to tube elements will cause a howl that builds up in intensity. To overcome this objection, change the Radiotron causing it or use a different support for the Adaptor. Very strong continuous wave stations cause such acoustic interference in some cases. Also harmonics from a Super-Heterodyne receiver oscillator tube give a noise similar to an acoustic howl. This is due to the harmonics falling in the band being received. If the harmonics fall on the same frequency as the signal being received, a whistle will result. Slightly detuning the broadcast receiver will remedy this condition.

(6) LOOSE OR DIRTY INTENSITY CONTROL

A grating noise only when the oscillator intensity control is moved may be due to the movable contact being corroded or dirty. Rotate the control quickly throughout its range several times to wear away the foreign material. If this does not remedy the trouble the unit must be replaced.

(7) CROSS MODULATION OF STATIONS

A very strong local signal may be detected in the antenna coupling stage and will modulate the signal frequency being received. The effect is two audio signals in the loudspeaker, one of which is subdued. It is noticeable only when a station is tuned in. The remedy lies in changing the Adaptor response to the local interfering station, by use of a sharply tuned wave trap or some equivalent method of selective tuning ahead of the coupling stage.

A strong local station in the broadcast band is sometimes heard superimposed on the short wave channel, if the receiver is set near to such a station. The remedy is to change the setting of broadcast receiver (intermediate frequency) slightly.

(8) MAKING REPLACEMENTS

Due to the accessibility of parts, making replacements is quite simple. The following outline gives the suggested procedure for doing this work.

Remove the Radiotrons and Plug-In Coils. Unfasten all leads, pulling them free from the cabinet. With the lid removed, turn the Adaptor upon its top and take out the base board by unscrewing the four screws centered in the cushioned feet, thus exposing the entire sub-chassis assembly. If preferable, the chassis can be completely withdrawn from the cabinet by removing the four screws holding it, the screw heads of which are accessible from the top of the chassis. Slip the chassis out cautiously to prevent damaging the small choke coils and marring the tuning dials.

Substitution of a new part is essentially a question of maintaining the original relationship of the unit and its associated connections in the general assembly. Departure from the intended arrangement subtracts from the instrument's efficiency and may possibly lead to unsatisfactory operation. Workmanship is always a worthwhile consideration, since good electrical performance depends to a certain degree upon construction and mounting of the various parts. Perfect continuity in connections is obviously of equal importance. Every joint, after being cleaned thoroughly should be attached in an approved mechanical manner. Solder all joints and avoid leaving surplus solder or residue of resin on a connection. Note that choke coils should always be replaced with narrow coil section toward the same connection as originally connected.

PART III—ELECTRICAL TESTS

(1) VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron socket with the receiver in operating condition should prove of value when checking with test sets such as the Weston Model 547, Type 3, or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and line voltages. Therefore, the following values must be taken as approximately those that will be found under varying conditions. The numbers in column 1 indicate the tube socket numbers shown in Figure 3.

OSCILLATOR INTENSITY CONTROL AT MAXIMUM

Socket No.	Cathode to Heater Volts D. C.	Cathode to Control Grid Volts D. C.	Cathode to Screen Grid Volts D. C.	Cathode to Plate Volts D. C.	Heater Volts A. C.	Plate Current M.A. D.C.	Screen Grid Current M.A. D.C.
1	—1	—1	43	125	2.45	1.10	0.25
2	0	—1.3*	—	50	2.45	2.0	—
3	0	—0.4*	—	45	2.45	2.8	—

OSCILLATOR INTENSITY CONTROL AT MINIMUM

Socket No.	Cathode to Heater Volts D. C.	Cathode to Control Grid Volts D. C.	Cathode to Screen Grid Volts D. C.	Cathode to Plate Volts D. C.	Heater Volts A. C.	Plate Current M.A. D.C.	Screen Grid Current M.A. D.C.
1	—1.2	—1.2	54	127	2.45	1.25	0.28
2	0	0	—	56	2.45	3.0	—
3	0	—0.3*	—	23	2.45	1.7	—

*Measured on 50 volt range. Is inaccurate because of voltmeter resistance in shunt with grid circuit resistance. Actual grid voltage is slightly higher than the readings.

During observation of voltages, be alert for erratic readings which suggest the cause of failure. No voltage on plate or screen grid indicates an open circuit in an R. F. choke or the 15,000 ohm series resistor. Control grid bias on Radiotrons will be wrong or absent when the grid to cathode circuits are of improper resistance or open, respectively.

The oscillator will be generating a signal if a decrease occurs in the detector plate current when the intensity control is turned clockwise.

(2) PLUG-IN COIL CONTINUITY

The winding arrangement of the plug-in coils is given in Figure 8. Breaks in the windings can be detected by a continuity check between the base prongs. The windings are all wound in the same direction on the form.

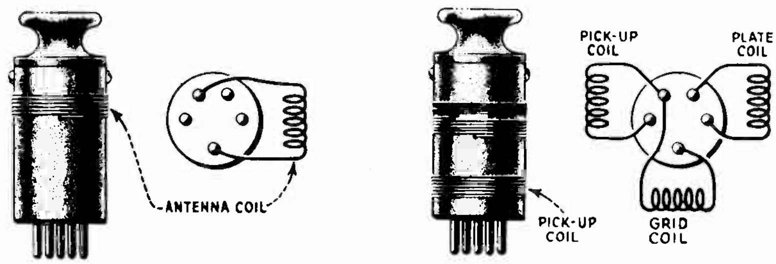


Figure 8—Internal connections of Plug-in Coils

(3) CONTINUITY TESTS

The table of possible faults is given here to assist in finding sources of trouble in the Adaptor. A direct reading "Ohmmeter," a Resistance Bridge or the voltmeter-ammeter method can be used to check resistance values. Also, the use of a Weston 301 or 280, 0–50 voltmeter which has 62 ohms per volt in series with a 45 volt "B" battery gives good indications. Two readings must be made, first by connecting the voltmeter across the battery, and second, by connecting the unknown resistance in series with the other two units. The following formula represents the desired resistance value.

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

The voltmeter should have higher internal resistance for measurement of higher resistances.

Before beginning the continuity test, remove all external connections from the Adaptor and remove the Radiotrons, antenna and oscillator coils. Turn the oscillator intensity control to maximum; unless noted otherwise.

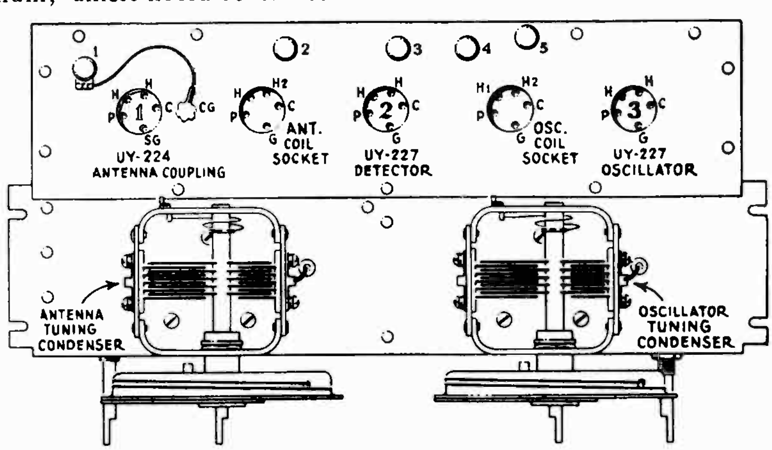


Figure 9—Test points of Short Wave Adaptor

Readings obtained on the meter used will in each case indicate whether that part of the circuit under test is normally intact or is failing. Indications for open circuit may be due to broken connecting wires. Also variations from the specified cause of shorts may come from wires being shorted to ground or to other conductors. The simplicity of wiring layout permits a ready discovery of breaks or shorts upon a visual inspection of the subchassis array. Refer to Figure 9 to see the designation of terminals. Figure 10 shows the wiring diagram of the Adaptor.

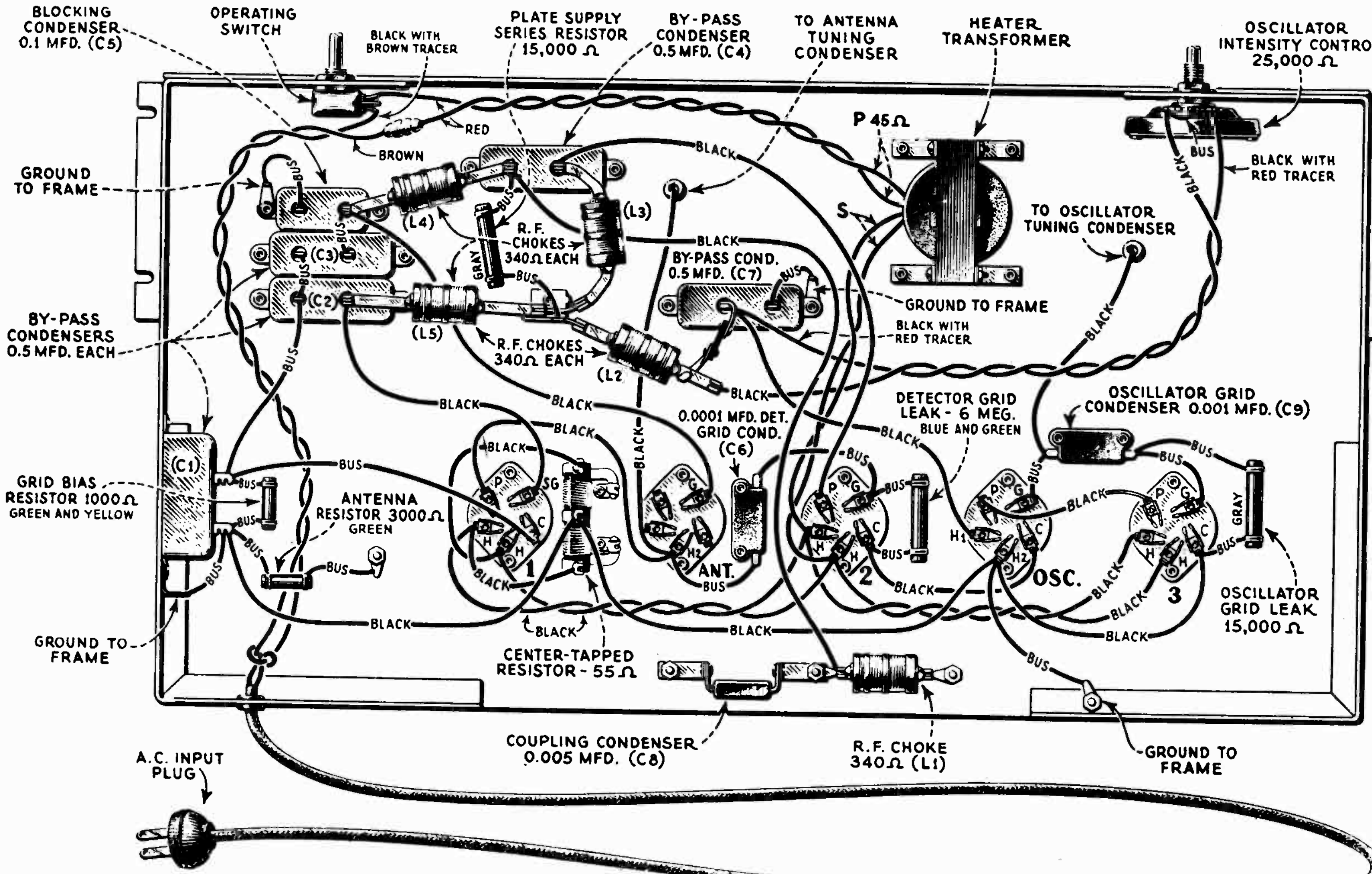


Fig. 10—Wiring diagram of Short Wave Adaptor

RCA RADIOLA SHORT WAVE ADAPTOR
CONTINUITY TESTS

Terminals	Correct Effect	Incorrect Effect	
		Indication	Cause
Gnd. to No. 1	Closed (3000 ohms)	Open Short	Open antenna resistor Shorted antenna resistor
Gnd. to C1	Closed (1000 ohms)	Open Short	Open bias resistor Shorted 0.5 mfd. condenser C1 or resistor
Gnd. to SG1	Open	1000 ohms 680 ohms 16680 ohms 15680 ohms	Shorted 0.5 mfd. condenser C2 Shorted 0.5 mfd. condenser C7 Shorted 0.5 mfd. condenser C3 Shorted 0.1 mfd. condenser C5
Gnd. to P1	Open	Short	Shorted antenna tuning condenser
Gnd. to H1	Closed (14 ohms)	Short 28 ohms	Shorted center-tap resistor Center-tap resistor open in one section or open secondary of heater transformer
Gnd. to G–Ant.	Open	Short 1000 ohms	Shorted 0.1 mfd. condenser C5 Shorted 0.5 mfd. condenser C3
Gnd. to G2	Open	Short	Grounded 6 meg. grid leak
Gnd. to C2	Open	Short	Grounded 6 meg. grid leak
Gnd. to G–Osc.	Open	Short 15000 ohms	Shorted oscillator tuning condenser Shorted 0.001 mfd. condenser C9
Gnd. to G3	Closed (15000 ohms)	Open Short	Open oscillator grid leak Shorted oscillator grid leak
Gnd. to H1–Osc.	Open	Short	Shorted 0. 5 mfd. condenser C7
No. 3 to No. 4	Closed (340 ohms)	Open Short	Open R. F. choke L1 Shorted R. F. choke L2

RCA RADIOLA SHORT WAVE ADAPTOR
CONTINUITY TESTS (Continued)

Terminals	Correct Effect	Incorrect Effect	
		Indication	Cause
No. 3 to No. 2	Open	Closed	Shorted 0.005 mfd. condenser C8
No. 3 to P2	Closed (15340 ohms)	340 ohms Open Short	Shorted series plate supply resistor Open series plate supply resistor Shorted 0.5 mfd. condenser C4
No. 3 to G–Ant.	Closed (340 ohms)	Open Short	Open R. F. choke L4 Shorted R. F. choke L4
SG1 to P2	Closed (680 ohms)	Open (340 ohms)	Open R. F. chokes L5 or L3 Shorted R. F. chokes L5 or L3
P2 to H1–Osc.	Closed (680 ohms)	Open	Open R. F. chokes L3 or L2
OSCILLATOR INTENSITY CONTROL AT MINIMUM (EXTREME COUNTER-CLOCKWISE POSITION)			
P2 to H1–Osc.	Closed (25680 ohms)	680 ohms	Shorted oscillator intensity control
P1 to G2	Open	Short	Shorted 0.0001 mfd. condenser C6
Tip to Tip of Power Plug	Closed 45 ohms	Open Short	Open heater transformer primary or power switch not making contact. Shorted primary winding
G3 to G–Osc.	Open	Short	Shorted 0.001 mfd. condenser C9
G2 to C2	Open	Short	Shorted 6 meg. grid leak

S. O. 7461

SERVICE DATA CHART

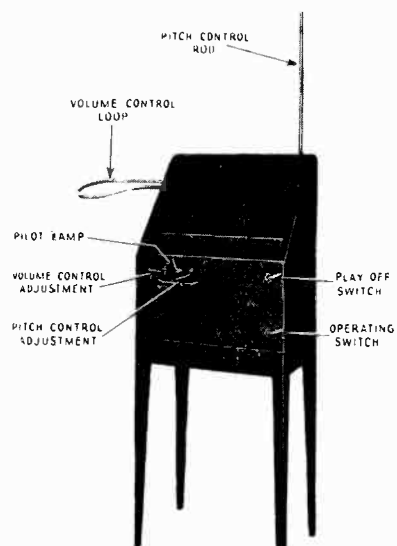
Before using the following Service Data Chart, when experiencing no reception, low volume, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, or a poor antenna system. If imperfect operation is not due to these causes the "Service Data Chart" should be consulted for further detailed causes. Reference to the text of this Service Note should be made for further details.

Indication	Possible Cause	Remedy
No Signals	Wrong or poor connections	Check and correct
	Inoperative receiver	Check and repair
	Defective Radiotrons	Check and replace
	Defective antenna or lead	Check and repair
	Radiotrons or Plug-In coils in wrong sockets	Check positions and correct
	No control grid connection	Place cap tightly on grid terminal
	Defective circuit	Check socket voltages and continuity
Weak Signals	Low emission Radiotrons	Check and replace
	High or Low Voltages	Measure and readjust
	Poor Coupling of Stages	Check condensers C4, C6, and C8
	Receiver subnormal	Check and repair
	Faulty antenna	Check and correct
	Defective Plug-In Coils	Check and replace
	Leads too long	Decrease length
	Defective choke	Check L3 and replace
	Loose intensity control arm	Replace intensity control
Distorted Signals	Defective Radiotrons	Check and replace
	Incorrect voltages	Measure and readjust
	Poor connections	Check all splices and terminals; correct defect
	Oscillator too strong	Change voltages on oscillator Radiotron
	Grid condenser or leak defective	Check detector and oscillator grid condensers and leaks; replace
	Receiver improperly tuned	Change setting away from broadcast station
Noisy or Intermittent Reception	Antenna or lead-in defective	Check all splices and connections; make good tight joints
	Dirty prongs	Check condition of Plug-In Coil and Radiotron bases; clean prongs thoroughly
	Radiotron elements loose	Check and replace any noisy Radiotron in Adaptor or receiver
	Loose intensity control arm or dirty contact	Check by varying and listening; replace defective control
	Loose connection in Adaptor	Check for poor connection and resolder
Howling	Microphonic Radiotron	Locate and replace Radiotron giving trouble
	Speaker too near Adaptor	Move Adaptor to a cushioned support away from speaker
	Receiver improperly tuned	Change selector setting slightly
Radiotrons Fail to Light	Heaters open	Check each Radiotron and replace all defects
	Power switch defective	Check, repair or replace if necessary
	Heater transformer defective	Check continuity of both windings and measure voltage values.

S. O. 7461

RCA Theremin

SERVICE NOTES



RCA Theremin

First Edition—5M

RADIO-VICTOR CORPORATION OF AMERICA

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PREFACE

The RCA Theremin is an electrical musical instrument played by the free movement of the hands in space. The actual production of sound is accomplished by means of a loudspeaker which must be connected to the RCA Theremin. The loudspeaker may be located close to the Theremin or at any convenient distance as required.

The electrical circuits incorporated in the instrument are designed to operate from the house lighting circuit controlled by a power switch mounted on the cabinet. Provision is also made for adjusting pitch and volume by suitable panel controls. A "play-off" switch provides for turning "On or Off" the Theremin with switching off the power supply.

A knowledge of the design and operation of the instrument is desirable if any service work becomes necessary. The present RCA Service Notes have been prepared to provide service personnel with practical helps and technical information in the performance of this service work. This information has been compiled from experience with the problems encountered 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 RCA maintains a corps of engineers who visit the trade at frequent intervals to advise and assist in the performance of Service Work.

CONTENTS

PART I—SERVICE DATA

PART II—MAKING REPLACEMENTS

ILLUSTRATIONS

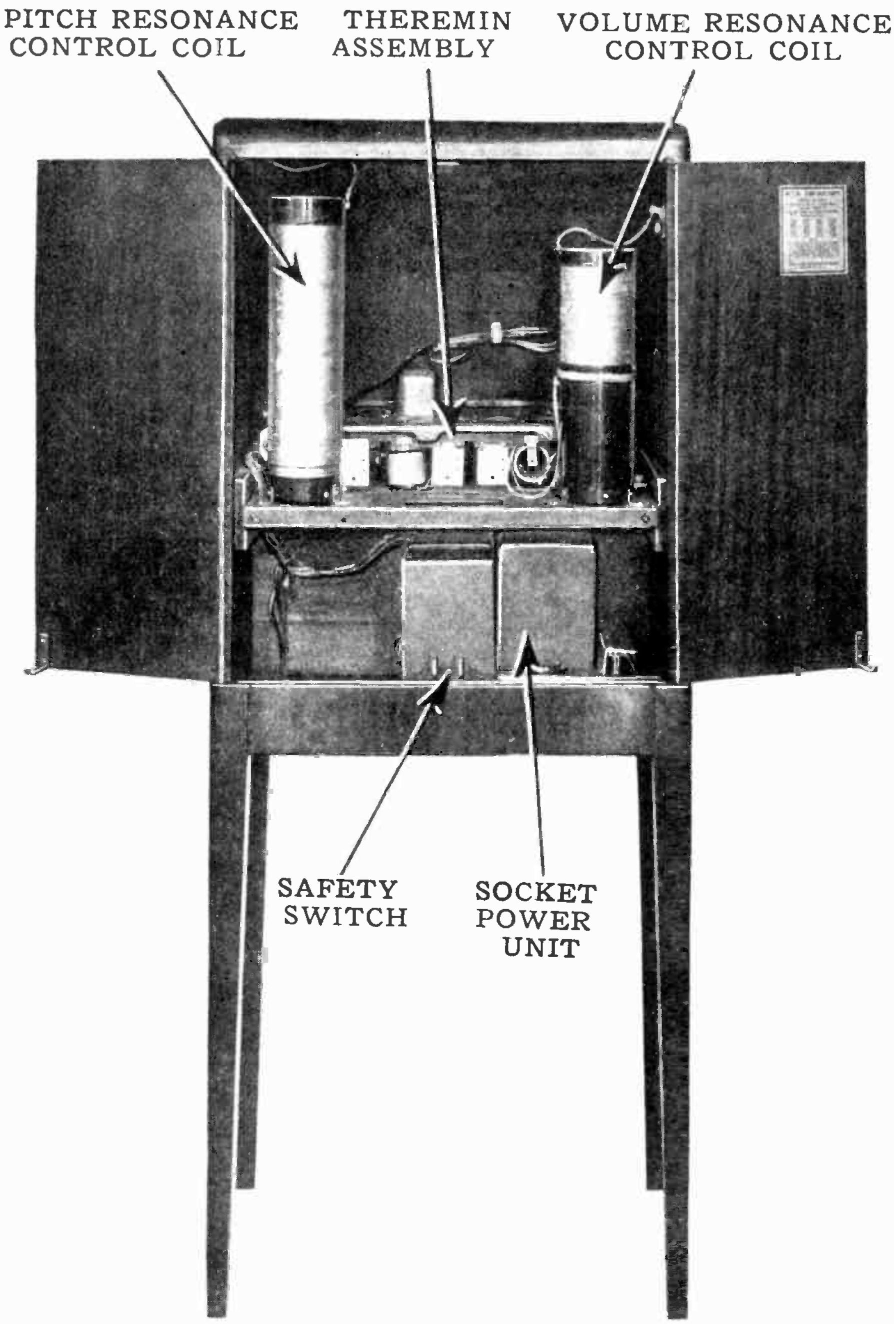


Figure 1—Rear interior cabinet view

RCA THEREMIN

SERVICE NOTES

Prepared by RCA Service Department

ELECTRICAL SPECIFICATIONS

Voltage Rating	105-125 Volts
Frequency Rating	50-60 Cycles
Power Consumption	90 Watts
Type of Circuit	Special beat frequency oscillator with audio stages
Number and Types of Tubes	Three UY-227, 1 UY-224, 1 UX-120, 2 UX-171A, and 1 UX-280—Total 8
Number of Oscillators	3
Type of Detector	Two-grid detector modulator
Number of A. F. Stages	2
Recommended Loudspeaker	RCA Loudspeaker 106
Musical Range—3½ Octaves	Lowest note of loudspeaker to 1400 cycles approximately

PHYSICAL SPECIFICATIONS

Height to top of Pitch Control Rod	64 in.
Height of Cabinet	46½ in.
Width, including Volume Control Loop	31½ in.
Width of Cabinet	19 in.
Depth	12 in.
Dimensions of Packing Case	14½ in. x 24 in. x 51 in.
Weight, Net	67½ lbs.
Weight, Shipping	99 lbs.

INTRODUCTION

The RCA Theremin is a musical instrument operating entirely on electrical principles and played by the movement of the hands in space. Having no limitations such as key boards, stops, etc., exceptional individuality of expression may be obtained. The instrument covers approximately three and one half octaves, the highest note being about 1400 cycles. Figure 1 illustrates a rear interior cabinet view and Figures 2 and 3 a top and bottom chassis view of the main assembly. The operation of this instrument is covered in the instruction book accompanying each RCA Theremin.

The principle of operation of the RCA Theremin is that of the beat frequency oscillator. The frequency of one oscillator may be varied by the capacity change caused in an associated circuit by the movement of the hand to or from a pitch control rod. Also an additional oscillator provides radio frequency current for heating the filament of a UX-120 arranged so as to control the volume of output, this control being due to the movement of the hand in relation to the volume control loop. A detailed description of the functioning of the various circuits follows:

ELECTRICAL DESCRIPTION OF CIRCUITS

As stated in the foregoing, the musical note of the RCA Theremin is produced by two oscillators of slightly different frequency beating together. This beat note is then amplified by two audio stages. The change of note caused by the movement of the hand is due to the change of capacity across what is known as the pitch coil, this slight change having sufficient effect on an adjacent oscillator circuit to change the frequency and thus the beat note, the amount of change depending on the position of the hand in relation to the pitch control rod.

Referring to the schematic circuit Figures 4 and 5 and starting from the pitch control rod we find the circuits functioning as follows:—

The pitch control rod is connected to a coil having a very high inductance. Connected to this coil is a small condenser and a small concentrated coil. This entire circuit is tuned by the distributed capacity of its coils and resonates at approximately 172 K.C. Not having any fixed capacitor connected across it for tuning, the ratio of inductance to capacitance is very high. Thus the small increase of capacity caused by the hand close to the pitch rod will cause the circuit to change its natural period considerably, a great deal more than if a large capacity and small inductance were used.

This pitch control circuit is connected to the grid side of the variable pitch control oscillator the frequency of which is slightly greater than that of the pitch control circuit. Bringing the hand close to the pitch rod will increase the parallel capacity in that circuit and thus reduce its frequency. As this capacity is reflected in the oscillator circuit a similar decrease in frequency will result in that circuit, **the amount of decrease depending on the closeness of the frequency of the two circuits.** Thus a greater decrease in frequency of the oscillator circuit is obtained when the pitch control circuit is close to the oscillator circuit in frequency than when it is at a greater frequency difference.

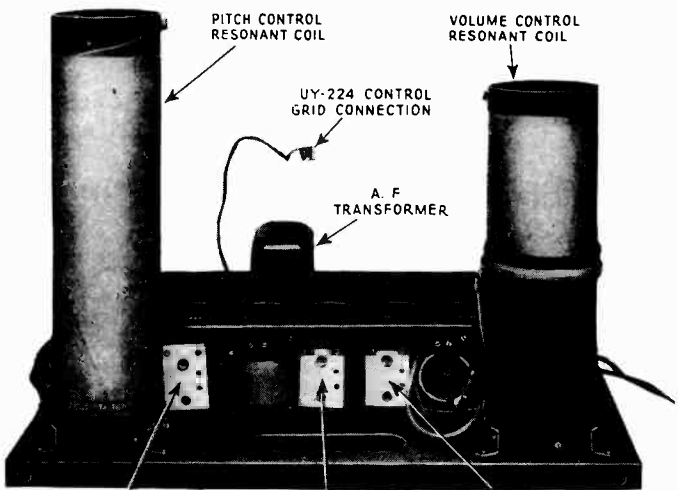


Figure 2—Top chassis view of the main assembly

The next circuit to examine is the fixed pitch oscillator. This circuit oscillates at a frequency, when correctly adjusted, at a maximum of 1400 cycles greater than the variable pitch oscillator. The amount of this difference is dependent on the frequency of the variable pitch oscillator the frequency of which is determined by the position of the hand in relation to the pitch control rod. The frequency of the fixed pitch oscillator does not change while playing.

An example of the functioning of these three circuits follows:—

The hand approaches the pitch control rod and increases the capacity across the pitch control circuit. This capacity is reflected across the variable pitch control oscillator and thus reduces its frequency. This causes an audible frequency difference between this oscillator and the fixed pitch oscillator, the frequency of this note depending on the position of the hand. Bringing the hand close to the rod will increase the capacity in the pitch control circuit, reduce the frequency of the variable pitch oscillator and increase the difference between the frequency of this oscillator and the fixed pitch oscillator. Thus an audible note is obtained, the note increasing in frequency as the hand approaches the pitch control rod.

Examining the circuit diagram we find that each oscillator grid is connected to the control and screen grid respectively of a Radiotron UY-224. As the screen grid has the largest area, a 10,000-ohm resistance is connected in series with it to balance the input to this tube and have each oscillator have the same effect on the detector action. This tube is a detector or combining tube that functions much in the same manner as the first detector in a super-heterodyne circuit. The output of the detector is then amplified by a two-stage audio frequency amplifier, the output of which goes to the loudspeaker.

The remaining two tubes, Radiotron UX-120 and UX-171A together with the first audio frequency amplifier constitute the volume control system. Examining the UX-171A we find that it is in an oscillating circuit that oscillates at about 420 K.C. Connected to the grid side of the oscillator is the volume control loop circuit. This circuit resonates at a frequency below the oscillator frequency when the hand is entirely removed from the volume control loop. This is done for two reasons. If the two circuits were in exact resonance, the load on the oscillator would be too great and operation would be unstable. Also the pick-up current would be high and might damage the tube. The ratio of inductance to capacity in this circuit is also quite high. A small pick-up coil is wound around the inductance coil of the volume control loop circuit and when both circuits are nearly in resonance (hand entirely removed) sufficient radio frequency current flows in this pick-up coil to light the filament of the Radiotron UX-120 to which it is connected. If the plate supply circuit to the Radiotron UY-227, that is the first audio frequency amplifier, is examined we see that the current for this tube is fed through the UX-120. Thus if the UX-120 were at maximum brilliancy, maximum

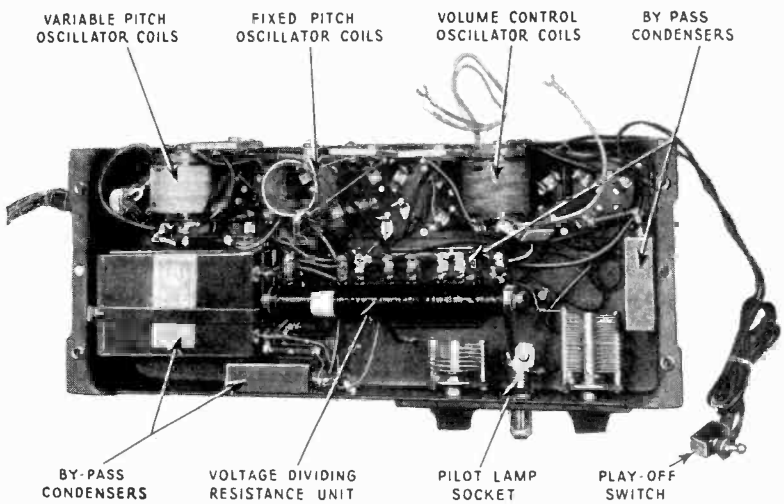


Figure 3—Sub-chassis view of the main assembly

volume would be obtained. Likewise if it were not lighted no signal output would be obtained due to no plate current flowing.

A condenser and resistor are placed in the plate voltage supply to the first audio tube which regulates the time constant of the volume control. They are adjusted to prevent any undue lag in operation of the volume control, while preventing quick accidental variations in volume due to a slight unsteadiness of the hand. The condenser also increases the efficiency of the audio amplifier by preventing a loss of A.C. voltage across the Radiotron UX-120. The low side of the resistance instead of being connected to ground is connected to a tap on the grid leak of the volume control oscillator. This supplies a small negative potential to the plate of the first audio tube and insures that zero volume is secured when the UX-120 emission is zero or nearly so.

Now getting back to the oscillator circuit that lights the filament of the UX-120 we see that if the load current is reduced, the brilliancy of the UX-120 will be decreased and likewise the volume. Thus when the hand approaches the volume control loop, the natural period of the circuit is decreased in frequency, the circuit is out of resonance with the oscillator by an amount depending on the position of the hand and less current is flowing in the pick-up coil with a consequent reduction in volume.

Thus we see from the foregoing explanation, a movement of one hand in relation to the pitch control rod will cause a variation in pitch and thus allow the playing of music. A movement of the other hand in relation to the volume control loop will cause an increase or decrease in volume. The combination of these two movements constitutes the technique of playing the RCA Theremin.

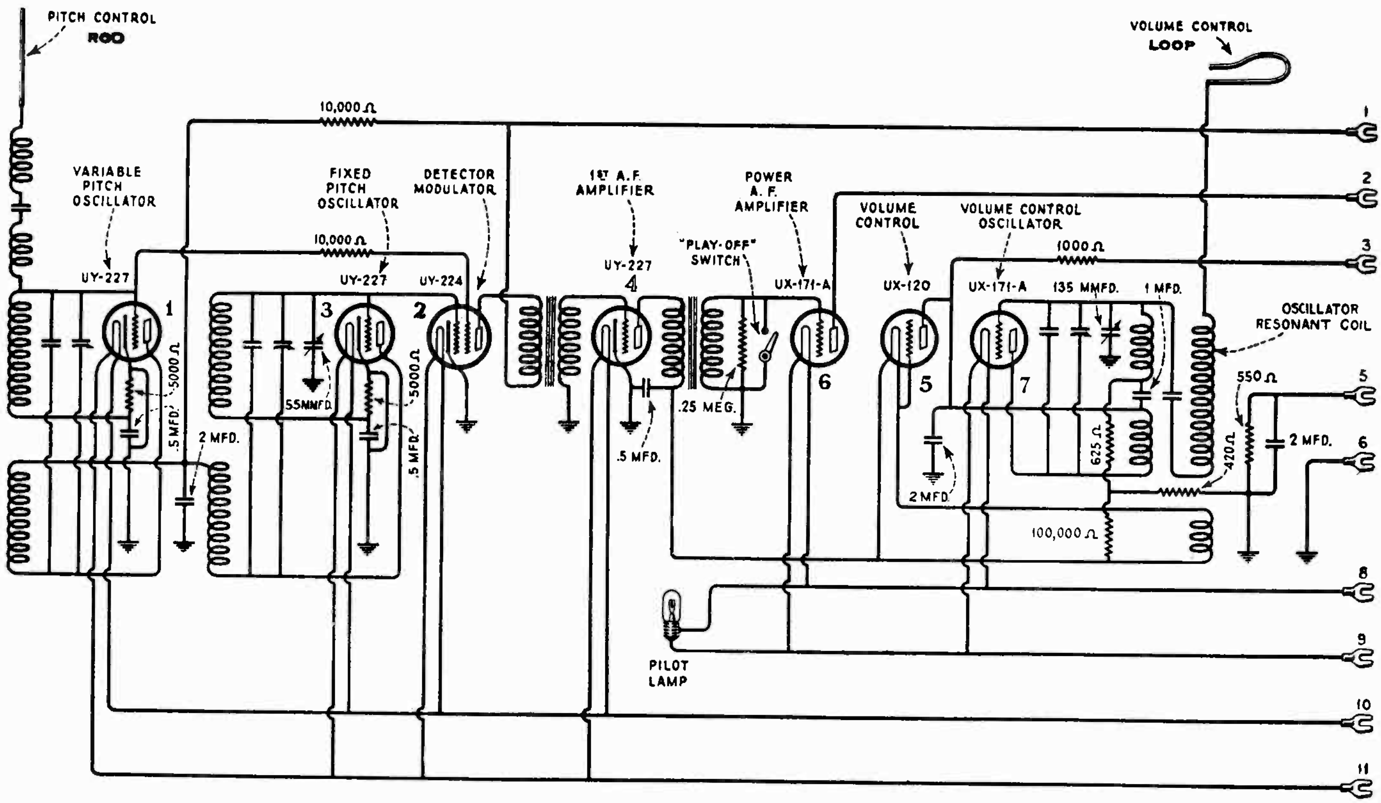


Figure 4—Schematic circuit diagram of the main assembly

PART I—SERVICE DATA

(1) INSTALLATION

The necessary instructions for installing the RCA Theremin are contained in the instruction book that accompanies each instrument. The notes on location with regard to metal objects and all other points should be carefully checked, as satisfactory operation depends on correct installation.

(2) NORMAL OPERATION

Normal operation of the RCA Theremin may be checked in the following manner:—

(a) Place the Theremin in operation by turning "On" the operating switch, turning the "Play-Off" switch to "Play" and making sure the rear doors are closed.

(b) Stand erect directly in front of the Theremin so that the body is at a distance from the cabinet determined by placing the right arm straight out from the shoulder with the hand closed. In this position the hand should just reach the pitch control rod.

(c) Now pull the right arm back to the shoulder. The Theremin should just approach zero beat in this position when the pitch adjustment condenser is at its mid-position. If zero beat is not obtained adjust the pitch adjustment until it is obtained with the hand in this position. Now extend the hand until it is one inch from the pitch antenna. At this point a note of from 1100 to 1400 cycles should be obtained. This may be checked with a piano. C sharp, two octaves above middle C is 1096 cycles and F sharp, two octaves above middle C is 1463 cycles. If these conditions are not fulfilled or the pitch adjustment condenser is not in the center, adjust as described in Part I, Section 4.

The volume control may be checked as follows:—

(a) With the Theremin in operation and an audible note obtained, a good loud signal should be obtained with the hand entirely removed from the volume

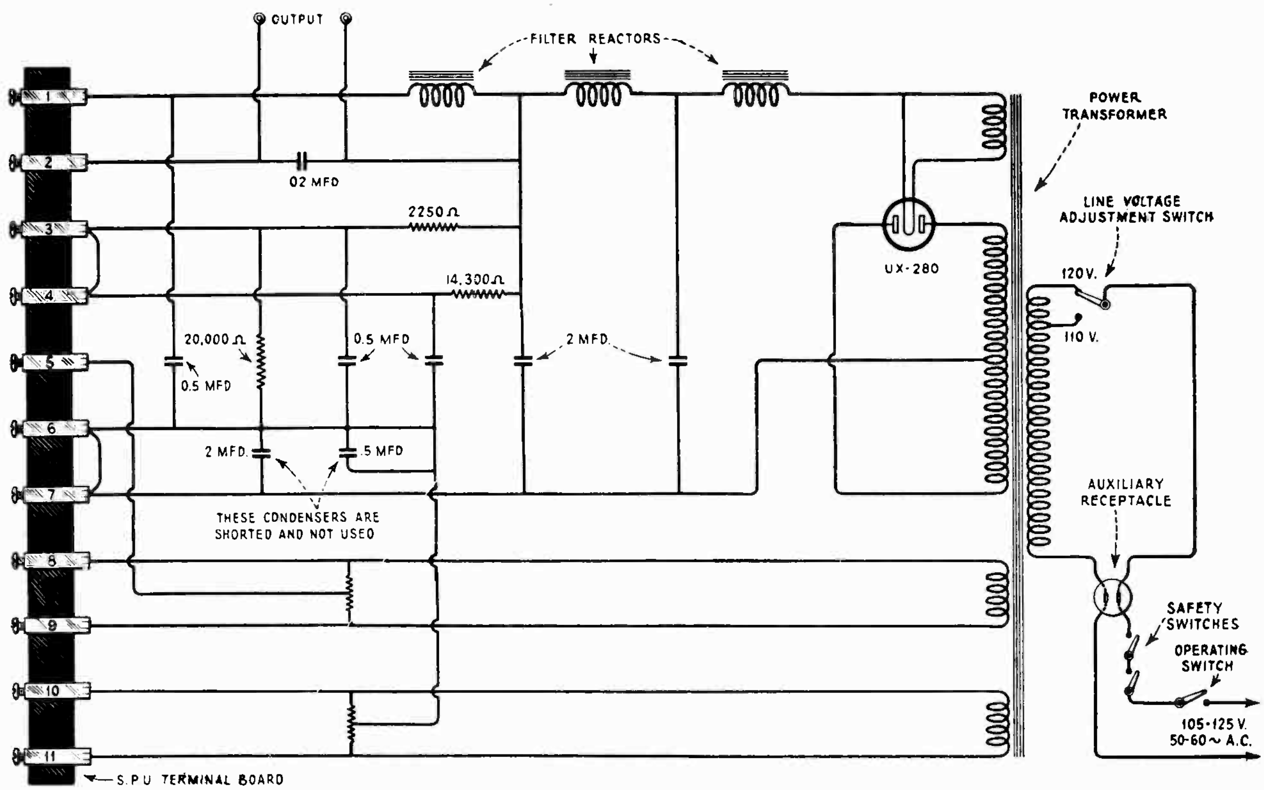


Figure 5—Schematic circuit diagram of the socket power unit

control loop and the volume control adjustment at maximum (To the right). Placing the hand close to the volume control loop should reduce the volume and give complete cut-off when the hand is three inches above the loop and the volume control adjustment is at maximum. If cut-off is not obtained until the hand is closer or at a greater distance, an adjustment such as described in Part I, Section 3, must be made.

(3) VOLUME CONTROL ADJUSTMENTS

Should normal operation of the volume control not be obtained proceed as follows:—

(a) Volume control cuts off when the hand is at a greater distance than three inches from the loop, the volume adjustment condenser being to the extreme right or maximum position. Also full volume is not obtained when the hand is completely removed. The remedy in this case is to increase the capacity of the volume control oscillator trimming condenser. This condenser is the extreme right one when looking at the Theremin from the rear with the doors open.

(b) Volume control cuts off when the hand is less than three inches from the loop, the volume adjustment condenser being at maximum. The remedy in this case is to reduce the capacity at the volume control trimming condenser on the rear of the chassis until a normal condition is obtained.

(c) Volume control has reversed action or goes from low volume to high and then low while the hand approaches the loop. This is due to being on the wrong side of the resonance curve or in the latter condition going from one side of resonance through resonance and then to the other side. The remedy in both cases is to reduce the capacity at the volume control oscillator trimming condenser until normal operation is secured.

(d) A more accurate method of adjusting the volume control is by the use of a milliammeter. An adapter is necessary, which may be either a UY or UX type and having means for breaking the plate circuit. This adapter may be placed either in the UX-120 socket in the case of the four-prong UX type or in the first audio UY-227 socket. A 0-5 milliammeter is placed in series with the plate of either tube through the connections provided in the adapter. The volume adjustment on the front of the Theremin is then set at maximum. The right rear door is now opened, the safety switch held down with one hand and the volume control oscillator trimming condenser adjusted until the milliammeter indicates 2 M.A. is flowing with door closed. The pitch should be around zero beat when making this adjustment. This is the correct adjustment provided the effect noted in (c) is not obtained, in which case the capacity should be reduced until another reading of 2 M.A. is obtained. Thus the correct adjustment is found when the milliammeter reads 2 with the least capacity at which such a reading may be obtained.

(4) PITCH ADJUSTMENT CONDENSER NOT AT CENTER

If the conditions indicated in Part I, Section 2 are fulfilled but with the pitch adjustment condenser off center, it may be corrected as follows:—

(a) If the pitch adjustment is too far to the right, indicating too much capacity, the remedy is to increase the capacity of the fixed pitch oscillator trimming condenser located on the rear of the chassis. This is the center of the trimming condensers.

(b) If the pitch adjustment is too far to the left, indicating too little capacity, reduce the capacity of the fixed pitch oscillator trimming condenser.

Both of these adjustments must be made by changing the trimming condenser a little at a time, closing the rear doors and checking from the front for normal operation.

(5) RANGE BELOW 1100 CYCLES

This indicates the fixed pitch oscillator and variable pitch oscillator are at too great a frequency difference from the pitch control circuit. The remedy is to increase both the fixed pitch oscillator and the variable pitch oscillator trimming condensers until the necessary high note is obtained. These are the left and center trimming condensers respectively at the rear of the Theremin. Care should be taken not to adjust the oscillators so that the note will be higher than 1400 cycles, as unstable operation may result. 1100 cycles is about C sharp, two octaves above middle C, and 1400 cycles about F sharp, two octaves above middle C on a piano. A tuning fork or piano —if available—can be used for a pitch standard. A reversal of connections to the concentrated coil located inside of the large tone coil will also reduce the range of the Theremin.

(6) REVERSED ACTION OF PITCH CONTROL

This condition is caused by the fixed pitch oscillator being at a lesser frequency than the variable pitch oscillator. Such action is caused by the fixed pitch oscillator trimming condenser having too much capacity, the variable pitch oscillator having too little capacity or both. The remedy is to decrease and increase the capacity of the respective trimming condensers until normal operation is secured.

(7) HIGH PITCHED NOTE

Should the Theremin give a high pitched squeal when no one is close to it the fixed pitch oscillator trimming condenser is adjusted to too great a capacity. Also too small an amount of capacity at the variable pitch oscillator, or both maladjustments, will cause the condition represented by the effects noted in Section 6—only to a lesser degree. Also this condition may be caused by the two pitch oscillators being too close to the frequency of the tone coil. This is caused by too much capacity at each of the two pitch oscillator trimming condensers. An open tone coil will cause a constant high frequency note with little variation caused by various positions of the hand in relation to the pitch control rod.

(8) SKIP EFFECT IN PITCH CONTROL

A pitch control abruptly changing from one frequency to another, instead of giving a smooth variation of tone indicates a poor Radiotron UY-227 in one of the pitch control oscillators. Usually in the three Radiotrons UY-227 used with each Theremin, there will be found two that will function satisfactorily in the pitch oscillator sockets. An erratic UY-227 in the oscillator socket will probably function normally as an audio amplifier. Too much capacity at each of the trimming condensers on the pitch oscillators may cause a skip effect in the range in addition to a greater than normal range. The effect noted in (7) may also be noted.

(9) SERVICE DATA CHART

Indication	Cause	Remedy
Radiotrons Fail to Light	No supply voltage	Test with A. C. voltmeter at loud-speaker auxiliary power receptacle (operating and safety switches should be closed)
	Defective safety switch	Test as above. Repair or replace
	Defective operating switch	Test as above. Replace
	Defective Power Transformer	Check by continuity tests (Section 13). Replace
	Defective Radiotrons	Replace
	UX-120 (only) fails to light	Low emission UX-280 or 171-A (No. 6) tube not oscillating. (A Neon glow lamp—such as the Cooper Hewitt type G10, 115-V—is a convenient test for oscillation. The brass base of the lamp should be held in the hand and the glass bulb near the pitch control rod or volume control loop). Circuits out of adjustment
	Defective wiring	Check by means of continuity tests, Sections 12—13
Tubes light—Theremin fails to play	Defective "Play-Off" switch	Replace
	Loudspeaker defective or disconnected	Connect O. K. speaker
	Tube Nos. 1, 3, or 6 not oscillating	Test tubes and continuity of circuits, Section 12
	Defective audio input transformer	Check with continuity test
	Grounds or opens	Check continuity Sections 12—13
	Control grid connection open at UY-224	Attach contact cap
Distorted Reproduction	Low emission or defective Radiotrons	Replace
	Poor wave form of A. C. supply current	Try resistances of from 500 ohms to 2000 ohms in series with control grid of UY-224
	Open 550-ohm resistor	Replace
	Defective audio transformer	Replace
	Open or imperfect chassis ground	Repair
	Improper voltages at audio sockets	Check with tables Sections 10—11, Isolate trouble by continuity test Section 12
	Defective Loudspeaker	Replace
Hum	Defective Radiotrons	Replace
	Open or shorted center tapped fixed condensers	Repair or replace
	Open by-pass or filter condensers	Test and replace
	Shorted filter reactor	Check by resistance measurement. Replace
	Open chassis grounds	Check from diagrams Figures 7—8
	Loose laminations in power transformer	Repair or replace

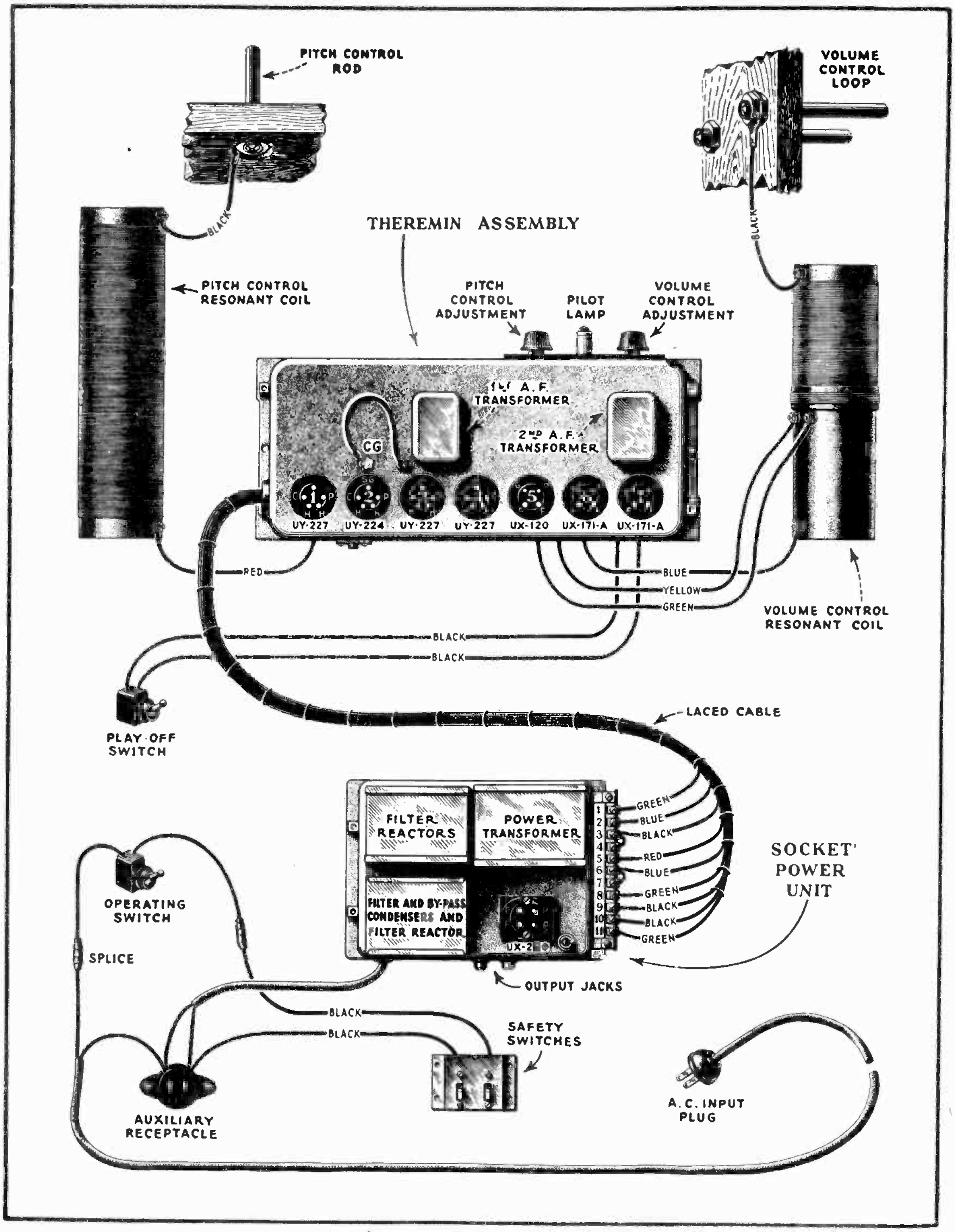


Figure 6—Complete layout and cable connections to the various assemblies

(10) S.P.U. TERMINAL STRIP VOLTAGES

Line 120 volts—Adjustment switch in 120-volt position

Use D.C. voltmeter with a 0-300 volt scale and at least 1,000 ohms per scale volt such as incorporated in Weston Model 537, Type 2, test set, for the D.C. voltage. The A.C. voltage may be measured with an A.C. voltmeter of suitable range. Refer to Figure 6.

Terminals Nos.	Cable on Tubes Lighted Volts	Cable Off Volts
1 to 6 (D.C.)	190	260
2 to 6*	190	260
3 to 6	140	230
5 to 6	29.0	0
8 to 9 (A.C.) rms	2.5	2.8
10 to 11 (A.C.) rms	4.7	5.0

* With Model 106 Loudspeaker connected to audio output pin jacks.

(These jacks may be shorted together for the purpose of taking a reading with negligible error in the result).

(11) THEREMIN RADIOTRON SOCKET VOLTAGES

Line 120 volts—Adjustment switch in 120-volt position

The following voltages taken at each Radiotron socket with the Theremin in operating condition should prove of value when checking with test sets such as the Weston Model 537, Type 2, or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and line voltages. Therefore the following values must be taken as approximately those that will be found under varying conditions. Refer to Figure 6.

Tube No.	Cathode to Grid Volts	Cathode to Screen Grid Volts	Cathode to Plate Volts	Plate Milamps	Filament or Heater Volts
1 UY-227	11.5	—	60.	7.1	1.95
2 UY-224	11.5	10.2	135.	0	1.95
3 UY-227	11.0	—	60.	5.5	1.95
4* UY-227	0	—	—2 to 40	Zero to 3.5	1.95
5* UX-120	0	—	110 to 64	0.5 to 4.1	unreadable
6* UX-171A	26 to 31	—	95.	12 to 17	4.6
7* UX171A	25 to 30	—	140 to 145	26 to 30	4.6

* The range of variation of the readings taken on Radiotrons Nos. 4, 5, 6 and 7 is caused by a change in the resonance point of the volume control loop circuit. Any object (such as the measuring instrument cable, body of the operator, etc.) coming in proximity to this circuit will give the variations noted above.

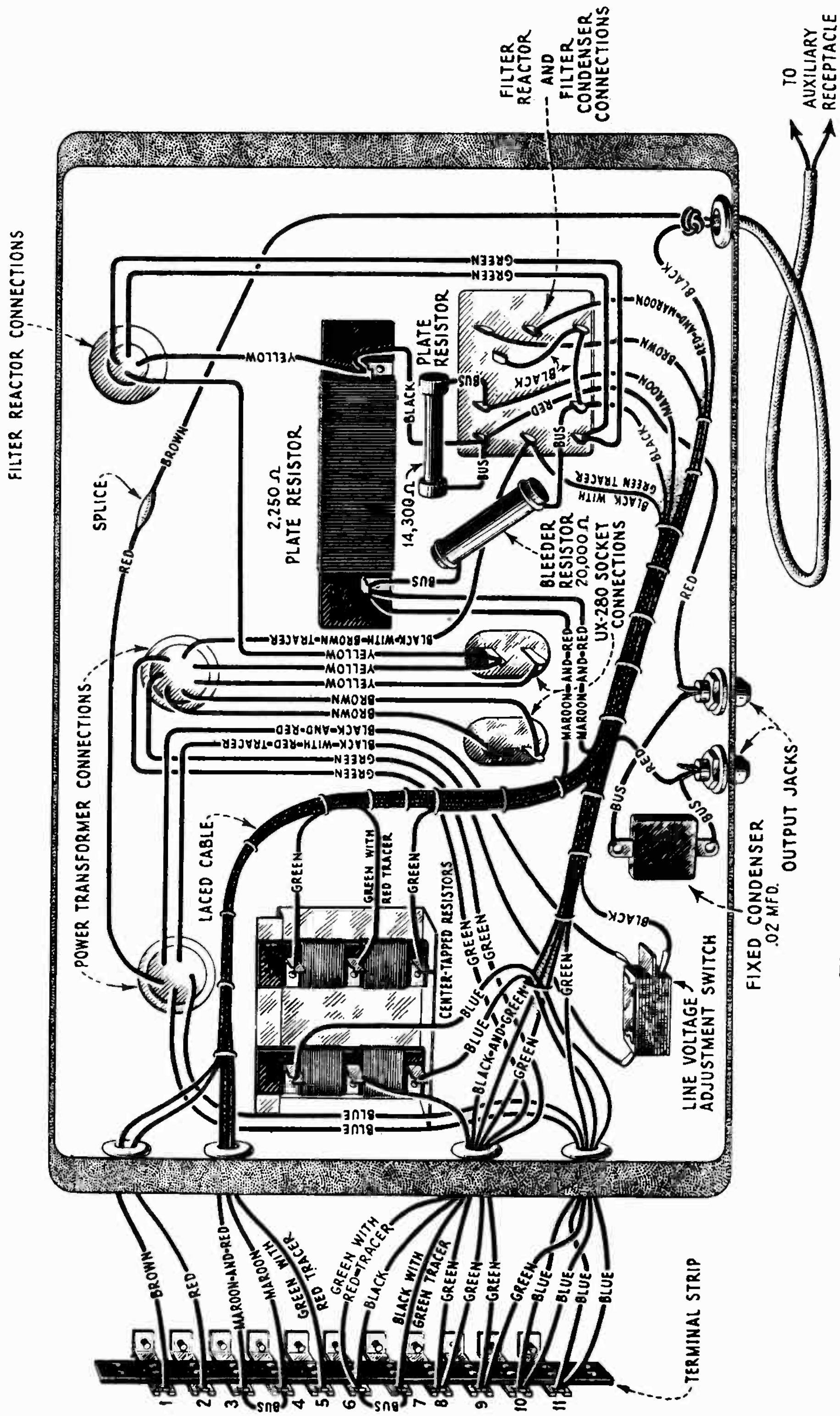


Figure 7—Wiring diagram of the socket power unit

(12) METHODS FOR CONTINUITY TESTS

In making a continuity test whether it be for the Theremin assembly or the S. P. U., the following procedure is recommended:

Disconnect the cable connecting the socket power unit to the Theremin assembly, the loudspeaker, and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series, or preferably a voltmeter with sufficient voltage to give a full scale deflection when connected across the battery terminals should be used in making these tests, for example, a 0-50 volt meter with a 45-volt "B" battery. The Radiotron socket contacts, numbers and lugs used in these tests are shown in Figure 6. The Theremin continuity wiring diagram is illustrated in Figure 8. The S. P. U. terminal numbers are shown in Figure 7.

Test leads should be of the flexible insulated type with partially insulated testing tips, so that false readings will not be obtained through contact with the hands. Similarly the hands should not touch the chassis or component parts.

The contacts of the test equipment should be placed across the terminals or leads indicated in the following test table under the column marked "Terminals." If the results are negative the cause of such negative effect will be found in the last column under the heading, "Incorrect Effect Caused By." The second column indicates the approximate correct resistance in ohms of most of the circuits tested.

(13) S.P.U. CONTINUITY TESTS

Remove UX-280 Radiotron and Disconnect Cable —Refer to Figure 8

Test Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused by
Terminal No. 1 to filament of rectifier socket	1000 ohms	Open	Open reactor
No. 1 to No. 7	22,000 ohms	Shorted	Shorted filter condenser
No. 2 to one loudspeaker pin jack	Closed	Open	Open lead
No. 2 to other pin jack	Open	Closed	Shorted 0.02 condenser
No. 3 to No. 4	Shorted	Open	Open connection
No. 3 to No. 1	2500 ohms	14,000 ohms 2250 ohms	Open 2250-ohm resistor Open 14,300-ohm resistor
No. 3 to No. 6	20,000 ohms	Open Shorted	Open 20,000-ohm resistor Shorted 0.5 mfd. condenser
No. 5 to No. 8 or 9	13 ohms	25 to 30 ohms	Open power transformer winding
No. 6 to No. 10 or 11	13 ohms	25 to 30 ohms	Open power transformer winding
No. 7 to either plate contact of rectifier socket	190 ohms	Open	Open connection or open winding in power transformer
No. 8 to No. 9	Shorted	60 ohms	Open 5-volt filament winding
No. 10 to No. 11	Shorted	60 ohms	Open 2.5-volt filament winding
Across contacts of auxiliary power receptacle	3 to 6 ohms	Open	Open primary of power transformer or open 110-120-volt switch
Across blades of AC input plug with auxiliary receptacle shorted	Closed	Open	Open operating switch, open safety switch, open lead or connection
From either contact of auxiliary receptacle to frame	Open	Closed	Grounded primary in power transformer

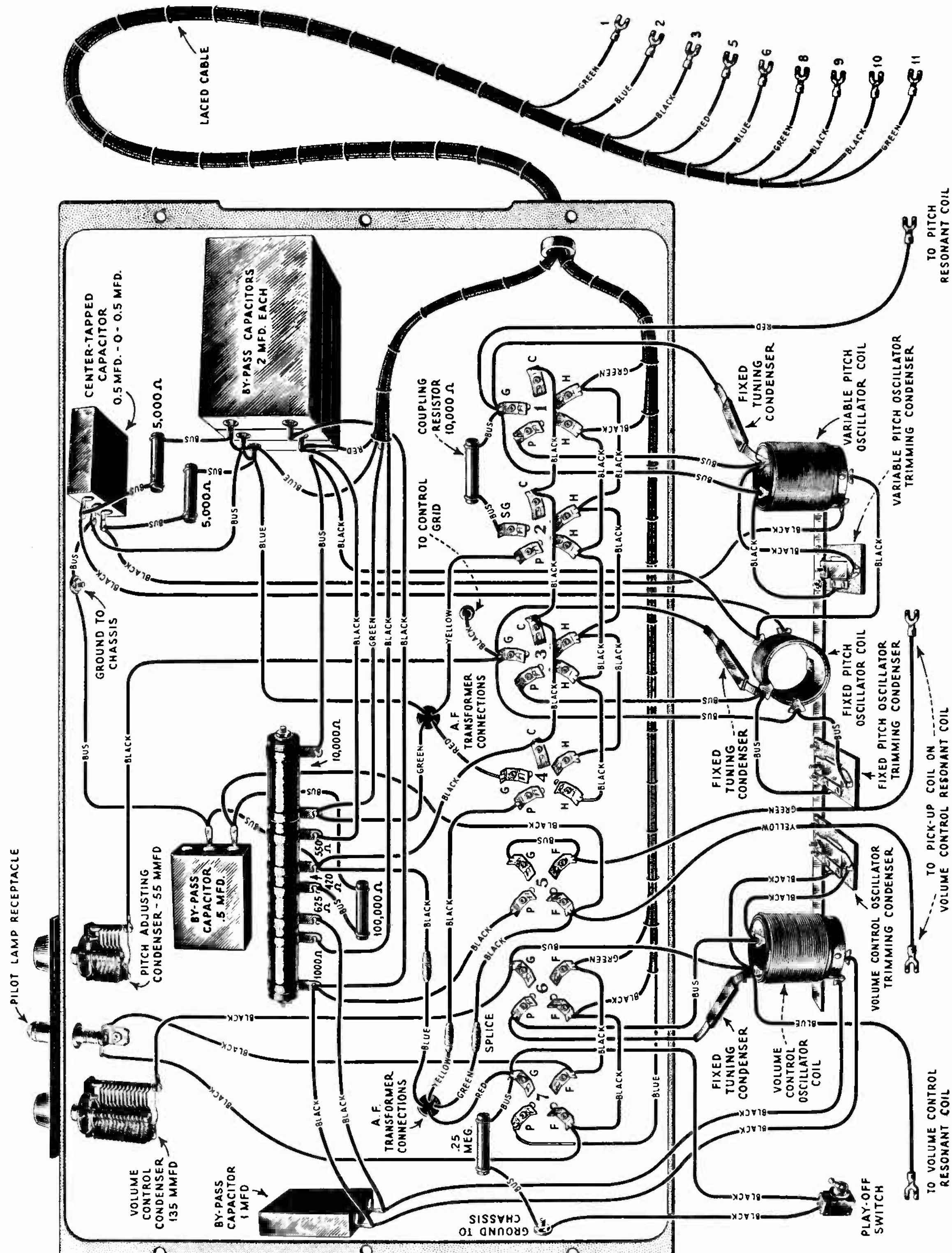


Figure 8—Wiring diagram and parts of the main assembly

(14) MAIN ASSEMBLY CONTINUITY TESTS

Remove Radiotrons and disconnect cable—Refer to Figure 8—A D.C. voltage is used in making the tests and the resistance values given are D.C.

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused By
Grid	G1 to frame	5000 ohms	Open	Open No. 1 oscillator coil or 5000-ohm resistor or both
			3 ohms	Shorted 0.5 mfd. condenser
	Control grid No. 2 or G3 to frame	5000 ohms	Open	Open No. 2 oscillator coil or 5000-ohm resistor or both
			Shorted	Shorted 0.5 mfd. condenser
	G4 to frame	5000 ohms	Open	Open secondary audio transformer No. 1, or open ground connection
			Shorted	Shorted or grounded transformer secondary
	G5 to filament 5	Shorted	Open	Open connection
	G5 to frame	100000 ohms	Shorted	Shorted 0.5 mfd. condenser or grounded lead
	G6 to frame	1100 ohms	Open	Open grid oscillator coil or 625-ohm resistor or 420-ohm resistor
			Shorted	Shorted fixed or trimmer condenser
	G6 to P6	Open	Shorted	Shorted fixed or trimmer condenser
	G7 to frame (Play-Off switch open)	5000 ohms	Shorted	Closed or defective "Play-Off" switch grounded or shorted secondary No. 2 audio transformer
			¼ meg-ohm	Open audio transformer secondary
Plate	P1 to frame	Open	Shorted	Shorted 2 mfd. condenser
	P1 to P2	11000 ohms	Open	Open 10,000-ohm resistor or No. 1 audio transformer primary
	P1 to P3	5 ohms	Open	Open plate coil of fixed or variable pitch oscillator
	P1 to Lug 1 (Green)	10000 ohms	Open	Open plate coil variable pitch oscillator or open 10,000-ohm resistor
	P2 to Lug 1 (Green)	1000 ohms	Open	Open primary first audio transformer
	P4 to frame	105,000 ohms	Open	Open primary second audio transformer or open 100,000-ohm or 420-ohm resistor
			1000 ohms	Shorted 0.5 mfd. condenser
	P5 to Lug 3 (Black)	1000 ohms	Open	Open 1000-ohm resistor
	P5 to frame	Open	Shorted	Shorted 2 mfd. condenser
	P6 to Lug 3 (Black)	1000 ohms	Open	Open plate coil of volume control oscillator
	P6 to frame	Open	Shorted	Shorted 2 mfd. condenser
			1000 ohms	Shorted 1 mfd. condenser
	P7 to Lug 2 (Blue)	Shorted	Open	Open connection
	P7 to frame	Open	Shorted	Grounded lead
Cathode or Filament	C1, C2, C3, or C4 to frame	Closed	Open	Open connection or lead
	F5 to frame	100,000 ohms	Open	Open connection or 100,000-ohm resistor or 420-ohm resistor
	F6 or F7 to frame	Open	Shorted	Grounded lead
Heater	H1, 2, 3, and 4 to frame	Open	Shorted	Grounded lead or connection
Miscellaneous	Pitch control rod to G1	Open	550 ohms	Shorted pitch coil circuit fixed condenser
	Volume control loop to G6	Open	150 ohms	Shorted oscillator resonant coil fixed condenser

PART II—MAKING REPLACEMENTS

The various assemblies of the RCA Theremin are readily accessible and replacements are easily made. However, there are some operations that require careful procedure as noted in the following paragraphs.

(1) REPLACING PARTS IN THE THEREMIN ASSEMBLY

All parts in the Theremin assembly are readily replaceable with tools ordinarily used in servicing radio receiving sets. However, the fixed condensers used across the variable, and pitch oscillator coils are somewhat more critical in values than other parts and may require some experimental work before a satisfactory replacement is made. These condensers are roughly adjusted to the pitch coil and after a replacement is made, the Theremin should be adjusted for correct operation by means of the trimming condensers. If this is not possible then a substitution for the condenser just replaced should be tried and one found that will allow a correct adjustment to be made by the trimming condensers. A condenser that does not function satisfactorily in one Theremin instrument may prove O.K. in another.

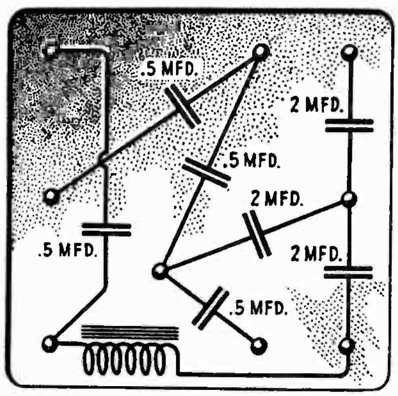


Figure 9—Internal connections of filter and by-pass condensers, and filter reactor

When replacing a pitch control coil, sometimes a similar condition will result. If after replacing a pitch coil it is found that the maximum range is not obtained by adjustment of the trimming condensers one of the following procedures must be used.

(a) Try several pitch coils. One may be found of the correct inductance for use in place of the defective one.

(b) If the range is low, that is less than 1100 cycles, try removing a few turns from the coil and readjusting the trimming condensers.

(c) Replace both the fixed condensers across the fixed and variable pitch oscillators with ones of a greater capacity. Replacing one without the other will not remedy the situation. Both must be replaced simultaneously.

(2) REMOVAL OF PARTS AND LOCATION OF CABLE

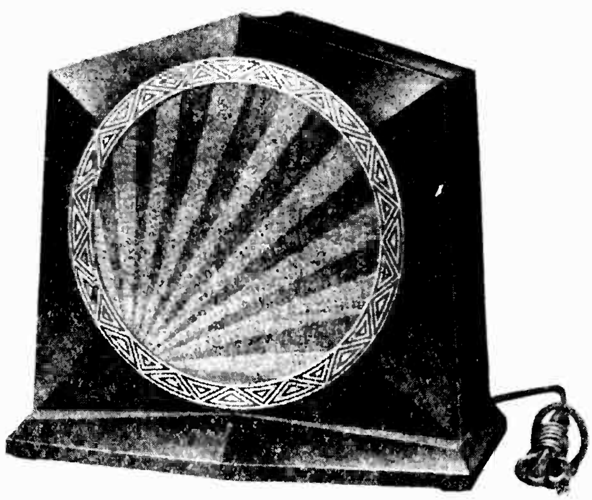
The cable that is used to connect the Theremin chassis and the S. P. U. is clamped securely in a definite place on the inside of the cabinet. Whenever any assembly is removed, and this cable is shifted from its position, it is very important that it be returned to its original position when the Theremin is returned to normal operation. Failure to have this cable in its normal position may result in inability to adjust the Theremin for normal operation.

Theremin

RCA

Loudspeaker 100B

SERVICE NOTES



RCA Loudspeaker 100B

First Edition—30M

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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

PART I—SERVICE DATA

PART II—MAKING REPLACEMENTS

ILLUSTRATIONS

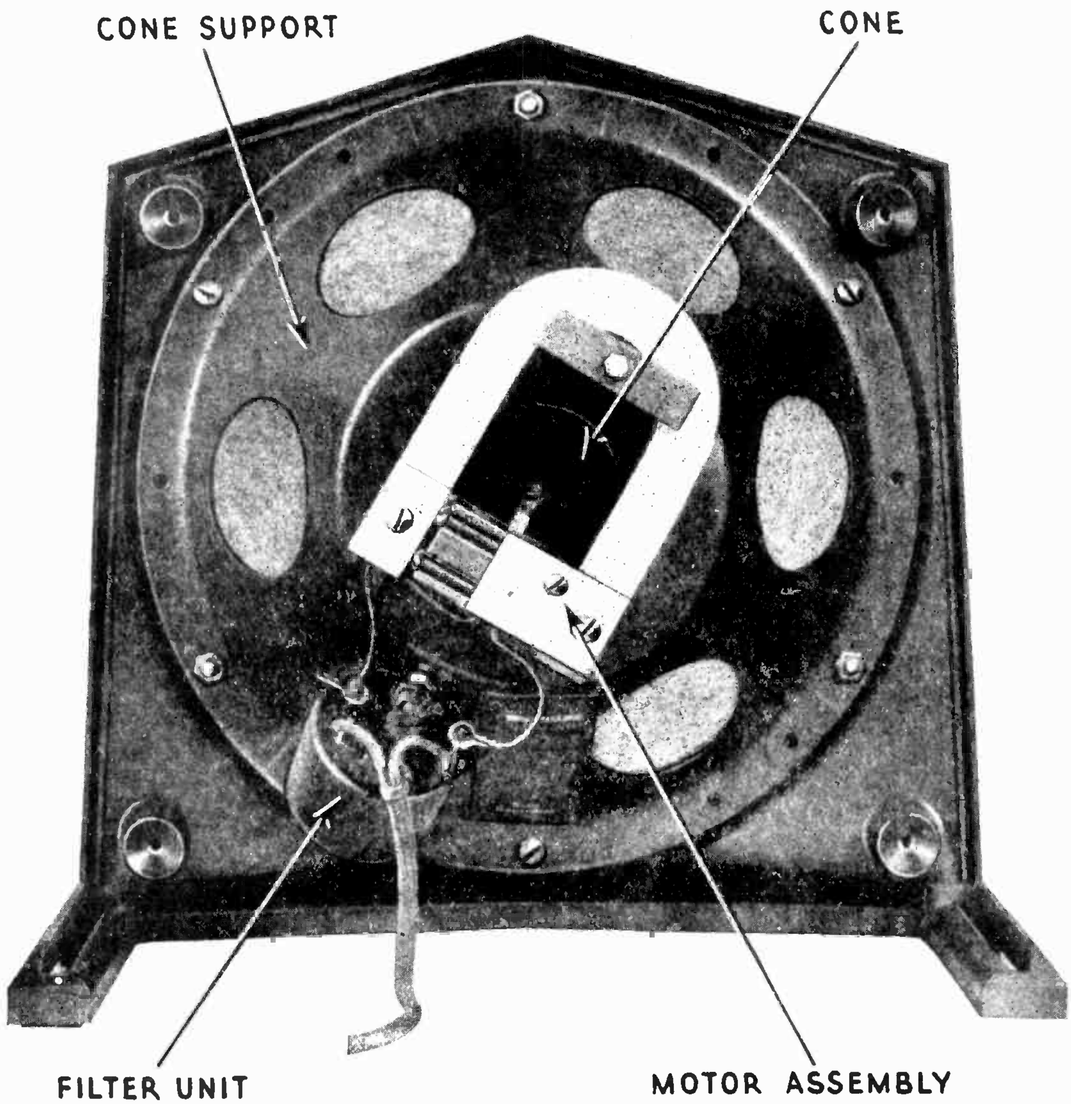


Figure 2—Rear view of mechanism with back and sides removed

RCA LOUDSPEAKER 100B

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Loudspeaker 100B is a simplified design of the famous model 100A. It is housed in a newly designed cabinet that fits in appropriately with home furniture and harmonizes in particular with Radiola 33.

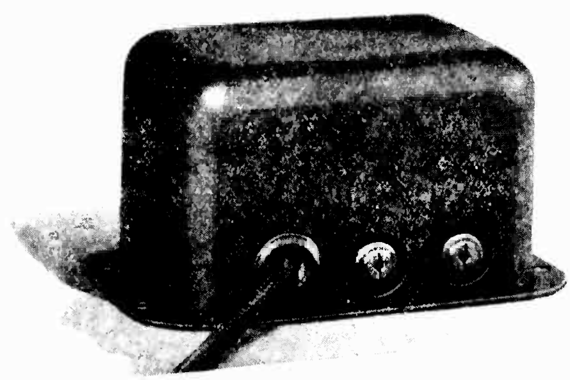


Figure 3—RCA Output transformer

Acoustically Loudspeaker 100B gives an excellent response to all frequencies employed in the broadcasting of both music and speech. Electrically it is of the electromagnetic type and is provided with a filter for eliminating high frequencies that are not in the acoustical range, which would be reproduced as noise and distortion if the filter were not used. Figure 2 shows a rear view with the various parts exposed.

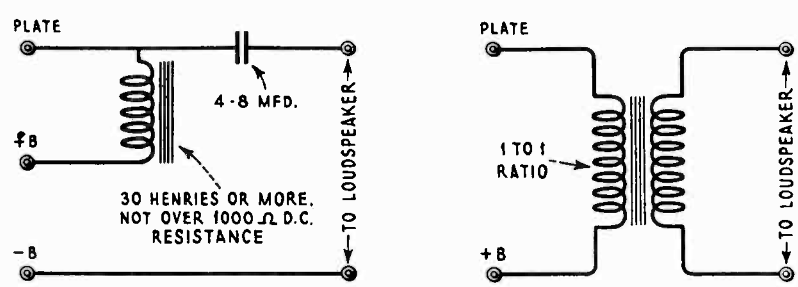


Figure 4—Schematic circuit diagrams of output devices

Some method of coupling the output of the receiver to the loudspeaker should be employed when Loudspeaker 100B is used in conjunction with receivers using output tubes. passing current in excess of 10 milliamperes through the loudspeaker windings. Such output devices are usually incorporated in modern receivers. However, if no coupling is incorporated in the receiver the RCA output transformer (Figure 3) may be used. It is especially designed for this purpose. A choke and condenser arrangement will also give satisfactory results for this purpose when properly connected. Figure 4 shows the correct values and connections of either a transformer, or choke and condenser to the loudspeaker.

PART I—SERVICE DATA

The service problems of loudspeakers deal with conditions evidenced by weak reproduction, no reproduction, distortion, noise and rattle. These conditions and their attending causes, while not common to Loudspeaker 100B, are explained in these notes and corrections noted so that service men may be provided with helpful information in any service work that may be required on Loudspeaker 100B.

[1] RECEIVER OUTPUT

Before inspecting the loudspeaker for imperfect reproduction check the receiver output with headphones or another loudspeaker known to be in good operating condition. Any

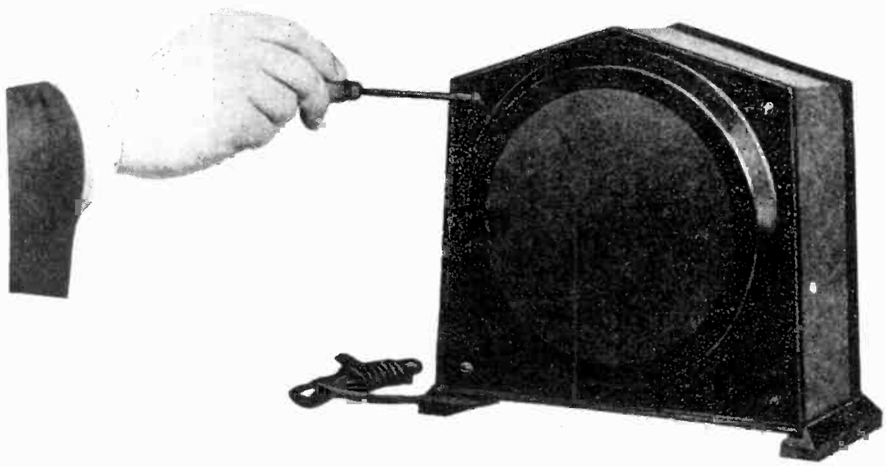


Figure 5—Removing the housing assembly extension bolts

distortion in the receiver will be faithfully reproduced in the loudspeaker. If a signal of good quality and volume is being delivered by the receiver, the loudspeaker must be examined for the cause of any imperfect reproduction that may occur.

[2] GAINING ACCESS TO MOTOR MECHANISM

To examine the motor mechanism it is first necessary to disassemble the housing so that the mechanism will be accessible. Proceed as follows:

(a) Turn the loudspeaker so that the rear is accessible.

(b) With a screw-driver remove the four screws that hold the housing together. (See Figure 5). The back, top and sides can then be lifted clear leaving the mechanism accessible for any adjustment or repair that is necessary. (See Figure 6).

[3] FOREIGN MATERIAL INTERFERING WITH ARMATURE ACTION

An inspection of the armature will generally disclose any foreign matter interfering with the armature action, resulting in poor reproduction. A small piece of heavy paper or a piece of copper or brass not over .010″ thick may be used between the armature and pole pieces to remove dirt, dust or other interfering substances. The spacer tool, described in Section 4 may also be used for this purpose.

[4] ARMATURE STRIKING POLE PIECES

Distortion and rattle may be caused by the armature striking either or both of the pole pieces. This is generally determined by inspection, though in some cases the contact may be so slight it may be necessary to adjust the armature to check on this condition. In any case an adjustment of the armature is necessary.

To adjust the armature use a set of spacer tools. Figure 7 illustrates the general appearance and correct dimensions of these tools. They may be purchased from the RCA Service Division (Stock No. 2321). The material—obtainable on the open market—should be phosphor bronze strip .010″ thick and .25″ wide. It is bent as illustrated and soldered to hold the ends fairly rigid. The two ends are tapered as illustrated to a .15″ width at their extremities.

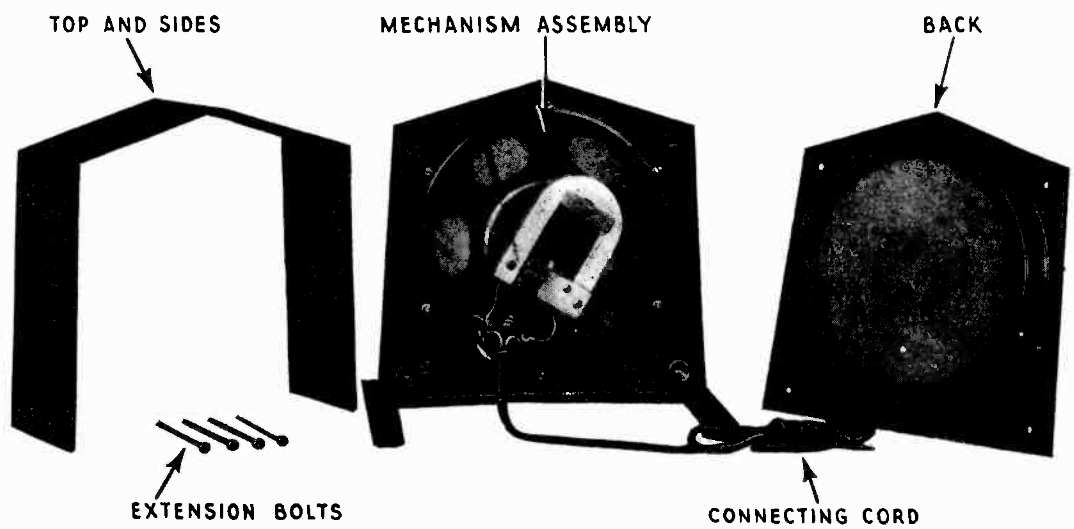


Figure 6—Housing dismantled

Two of these tools are necessary when adjusting the armature. Place one tool in the space between the armature and pole pieces of the motor mechanism at the end next to the filter unit. This is shown in Figure 8. The other tool is placed at the other end of the armature a little to one side in order to clear the drive pin located at this end of the armature. By loosening the two screws A and B, Figure 9, any tension in either direction, that may be on the armature is released, and the spacer tools will provide the correct clearance or spacing. Now while the spacer tools are in place apply a hot soldering iron to the drive pin thrust lever connection point C, Figure 10, and heat the solder sufficiently to allow the drive pin to find its normal position with regard to the thrust lever. The iron is then removed, screws A and B are tightened and the spacer tools removed. This adjustment correctly aligns and balances the armature so that no abnormal strain is imposed upon it in any direction.

[5] CONE IMPROPERLY SEATED

In order to inspect the cone it is necessary to remove the mechanism assembly from the front of the housing in the following manner:

(a) Remove the back, sides and top as described in Part I, Section 2.

(b) Remove the three screws that hold the mechanism to the front of the housing. (See Figure 11.) Be careful to support the assembly so that it will not fall and become damaged.

(c) Remove the mechanism assembly to a place convenient for work and repair.

A cone may be off center or improperly seated. This is most likely to occur when replacing a cone. Poor reproduction is the result and inspection of the armature drive-pin may indicate a slight torque or twist during operation.

The new cone should be carefully seated by placing the cone over the driving rod and adjusting the cone seating nut located on the driving rod next to the thrust lever. (See Figure 12.) Then attach the cone lock nut and washer lightly on the inside of the cone before fastening the edge of the cone. The holes on the edge of the cone can now be lined up with those of the metal frame and the three screws, washers and nuts placed in position, but not

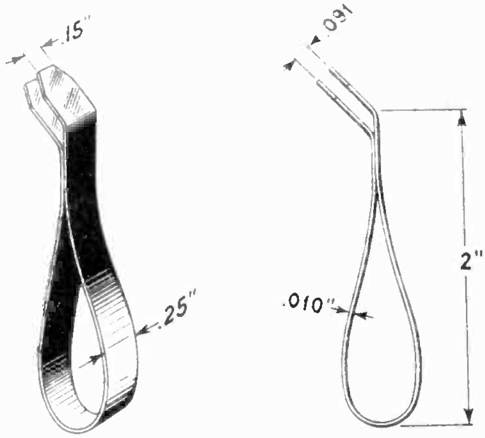


Figure 7—Dimensions of armature spacing tools

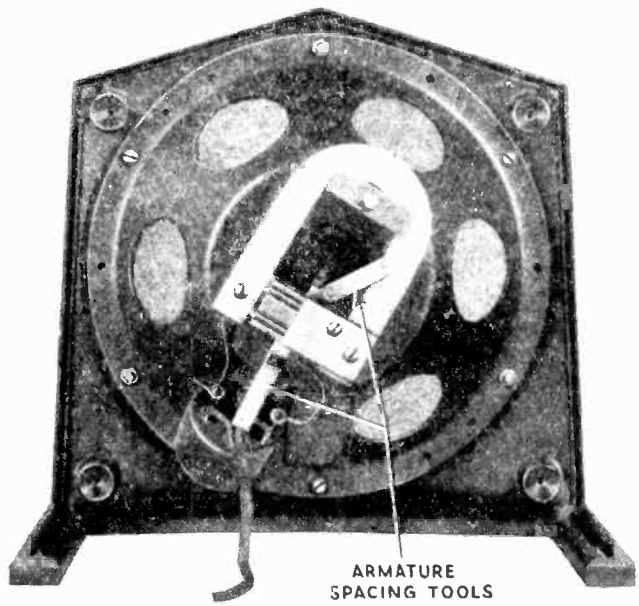


Figure 8—Armature spacing tools in place for adjustment of armature

tightened. (See Figure 13.) The cone lock nut is then tightened and sealed in place with ordinary sealing wax so that the vibration of the cone will not cause it to loosen. This nut can best be tightened by means of a small socket wrench made to fit a $\frac{5}{16}''$ hex nut. (Stevens "Spintite" No. 3 can be used.) The assembly should then be attached to the housing and the three mounting screws drawn tight. They also help clamp the cone in place. It is important to see that no foreign material lodges between the cone edge and the front of the housing to which it is clamped because an imperfect clamping of the cone may cause rattle.

[6] LOOSE THRUST LEVER, NUTS AND SCREWS

Rattle and noisy reception are sometimes caused by a loose thrust lever. To correct this condition tighten the thrust lever mounting screw by means of screw D, Figure 14. Sometimes when this is done a readjustment of the armature as described in Part I, Section 4, may be necessary. Any loose screw or nut in the motor mechanism may cause an audible rattle when the speaker is in operation. If any trouble is experienced along this line all the screws and nuts in the motor mechanism should be gone over and the loose ones tightened.

[7] FILTER UNIT AND MAGNET COIL TESTS

A defective filter unit, or a filter unit not properly connected in the circuit will cause distortion. Open magnet coils will cause no reproduction. The circuit diagram and correct connections are shown in Figure 15. The reference letters in the circuit diagram refer to the filter terminals shown in the small halftone illustration in Figure 15. These should correspond electrically, otherwise distorted or no reproduction will occur. A click test will indicate whether or not the unit is electrically O. K. The following continuity tests will indicate an electrical defect either in the coils or in the filter unit.

A pair of headphones and a 4½-volt battery connected together in series or a voltmeter and sufficient battery to give a full scale deflection should be used.

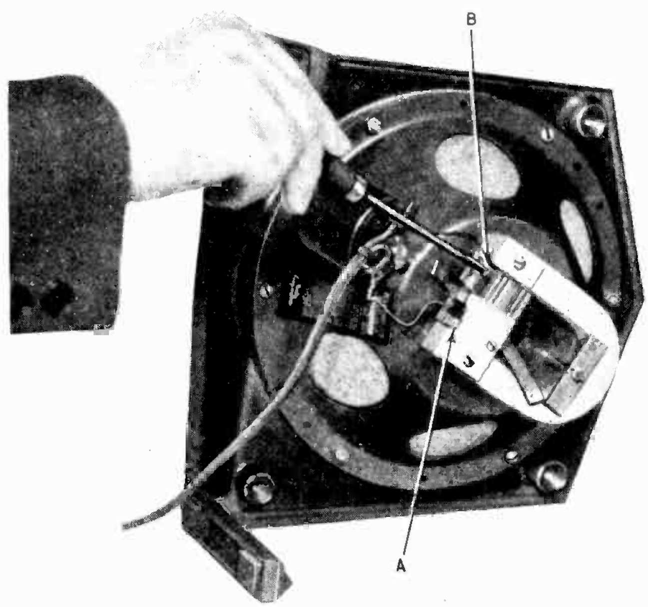


Figure 9—Loosening screws A and B to relieve tension on armature

FILTER UNIT CONTINUITY TESTS

Unsolder all connections and refer to Figure 15.

Test	*Correct Effect*	*Incorrect Effect Caused By*
G to *H*	Open	Shorted Condenser
F to *H*	Closed	Open Coil

A shorted condenser across the coil can be determined by checking the resistance of the coil with a resistance bridge. The correct resistance of the coil is approximately 230 ohms. If a resistance bridge is not available the following method may be used.

Use a voltmeter having a resistance of not greater than 100 ohms per volt. The Weston Meters, Type 301 or 280 both have a resistance of 62 ohms per volt and are satisfactory for this purpose. Use sufficient battery to give a good deflection of the meter, for example a

45-volt "B" battery with a 0-50 volt meter. Then take two readings, one of the battery alone and one of the battery with the unknown resistance in series, that is, the coil in the filter unit. Then apply the following formula.

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

The magnet coils may be checked for an open by testing from one lead to the other. An open indicates a defective coil which must be replaced. The coils should measure 1000 ohms D.C. resistance.

8] LOUDSPEAKER CORD AND CONNECTIONS

A defective connection, either in the loudspeaker cord or coil connections may cause distorted, noisy or no reproduction. As there is not much wear and tear on the coil connections,

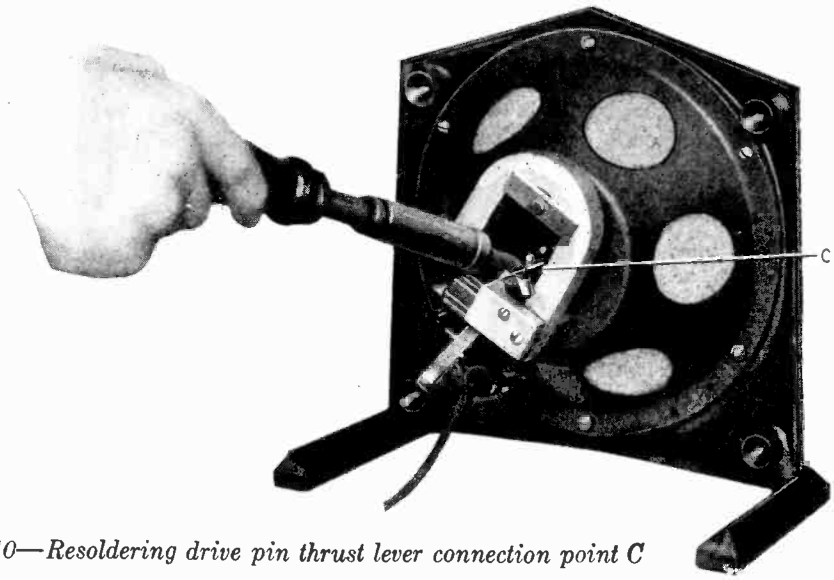


Figure 10—Resoldering drive pin thrust lever connection point C

the most likely place to find trouble of this nature is in the connecting cord. The point where the cord enters the loudspeaker housing and the ends on which the pin terminals are located may become frayed and worn, causing a possible short or open circuit. If these points prove O. K. and there are no indications of any defects external to the speaker housing, the cover should be removed and the lugs of the cord soldered to the filter unit examined. If there is no apparent defect the cord should be disconnected and tested by means of a battery and pair of phones. It should be click tested for the continuity of the leads and also for a short between the leads. Shake the cord while conducting the continuity test to disclose any breaks which will be indicated by interrupted clicks.

[9] REMAGNETIZING LOUDSPEAKER MAGNETS

At times there may be occasion to remagnetize the large permanent magnet used in Loudspeaker 100B. In order to do this a powerful electro-magnet is necessary. The construction of such a magnet is quite difficult and requires direct current of considerable amperage. It is suggested that this work be turned over to automobile or ignition shops specializing in the repair of magnets. Distributors maintaining contact with shops of this character are in a position to obtain immediate service on remagnetizing jobs.

[10] CHECKING OUTPUT OF REPAIRED LOUDSPEAKERS

After a repair job has been completed it is always desirable to have a definite means of checking the output of the speaker against a speaker known to be in good condition. Two general methods can be used to accomplish this—one by alternately connecting each speaker to a radio receiver tuned to a nearby broadcasting station, the other by alternately connecting each speaker to the output of a power amplifier being driven from a phonograph pick-up. The latter method is preferable as a standard record may be used that has a much wider frequency range than would be obtained by random tuning with a broadcast receiver. When checking a speaker under these conditions a volume control should be used and the speaker checked at both the soft and loud positions. At the minimum position the speaker under test can be compared with the standard for sensitivity and at the loud position a check can be made on its ability to handle volume without distortion or rattle. These

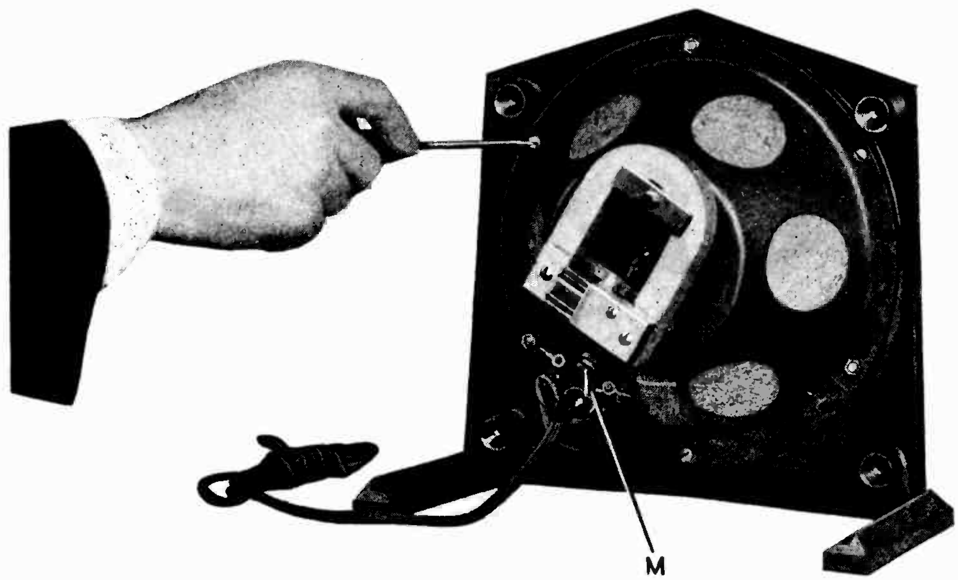


Figure 11—Removing mechanism from front of housing

checks should be made at both high and low frequencies. The sections of the record containing these frequencies can be indicated to run such a test.

A test of this kind is quite conclusive for quality and volume of reproduction and will indicate if further repair work or adjustments are necessary.

PART II—MAKING REPLACEMENTS

Due to the simple design of Loudspeaker 100B, replacement of any particular part is easily and quickly accomplished. The following detailed procedure should be used when performing work of this kind.

[1] REPLACING MAGNET COILS

If the magnet coils require replacement, proceed as follows:

(a) Remove back and sides of housing as described in Part I, Section 2.

(b) Remove the three screws that hold the mechanism assembly to the front of the housing and then remove the three screws, nuts and washers that hold the cone to the cone support. Then remove the center nut and washer that hold the cone to the driving rod.

(c) The motor mechanism may now be removed from the magnet by releasing nuts *I*, *J* and *K*, Figure 16. The magnet coil leads must be unsoldered from the filter unit before the motor can be cleared of the frame. Place a large nail or soft iron bar across the poles of the permanent magnet to act as a keeper. (See Figure 14.)

(d) Remove the thrust lever supporting screw *D*, Figure 14, and apply a hot soldering iron to the thrust lever armature drive pin connection point *C*, Figure 10. The thrust lever and driving rod may now be removed.

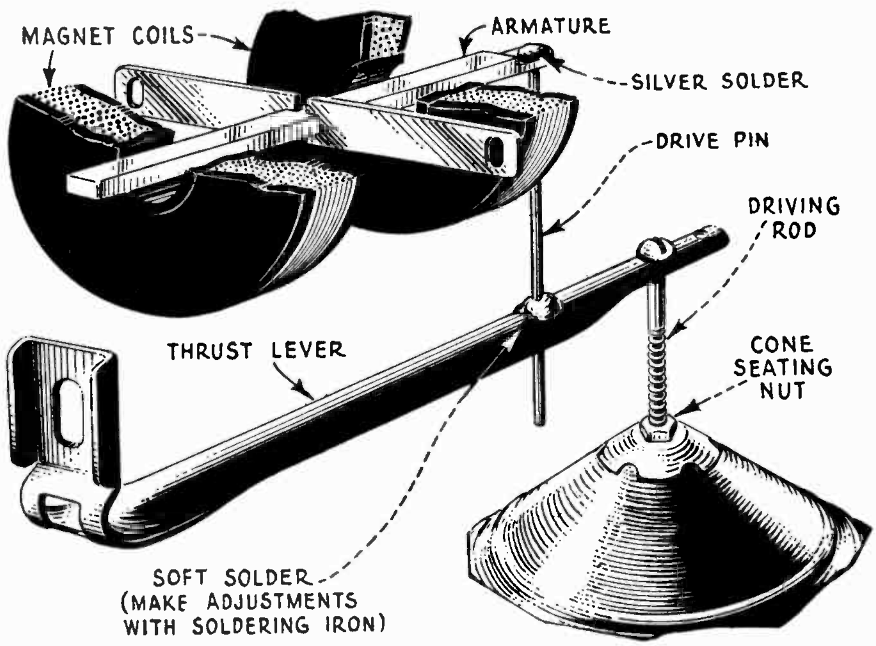


Figure 12—Constructional details and operating principle of the motor mechanism—Note cone seating nut

(e) Disassemble the motor mechanism by removing screw *L*, Figure 14, and the corresponding screw on the other side of the mechanism. Also remove screws *A* and *B*, Figure 14. The magnet coils may now be removed by slipping one off the armature and the other off the armature and drive pin.

To reassemble reverse the preceding operation.

(a) Place the new coils over the armature in the same position occupied by the old ones.

(b) Reassemble the motor mechanism and replace the thrust lever. Do not solder the thrust lever to the drive pin at this time.

(c) Remove keeper and replace motor mechanism on magnet with supporting screws and bushings. Mount the reassembled unit in its correct position on the frame.

(d) Replace cone and center carefully. Replace, but do not seat the three screws, nuts and washers around the edge. Tighten the cone lock nut and seal with sealing wax. Seat screws around edge.

(e) Place spacer tools in position to adjust the armature and tighten screws *A* and *B*, Figure 9.

(f) Resolder drive pin to thrust lever and allow it to find its normal position. Remove spacer tools.

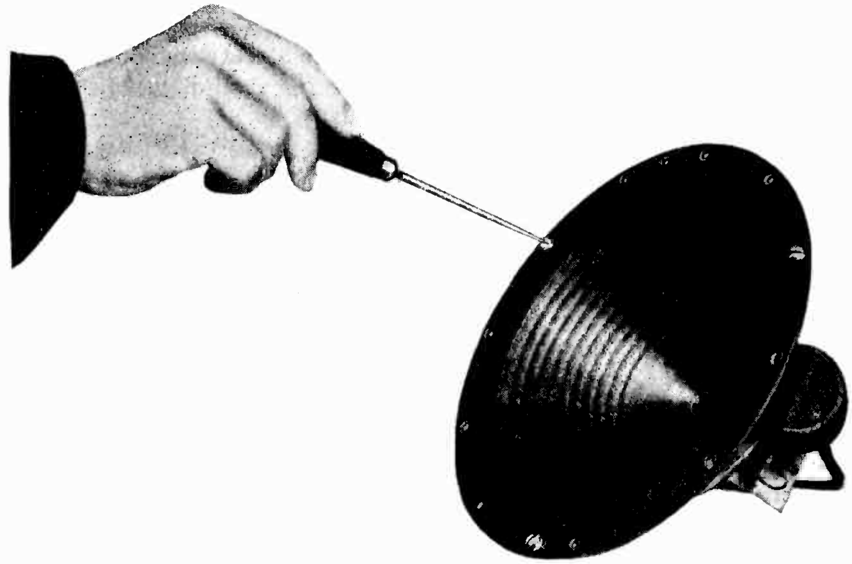


Figure 13—Tightening cone clamping screws

(g) Solder coil leads to filter unit as indicated in Figure 15. At this point it is good practice to test the mechanism on a receiver of good quality and make any further adjustments that may be necessary.

(h) Fasten mechanism to front of housing and reassemble the housing in the reverse manner of that used to disassemble it.

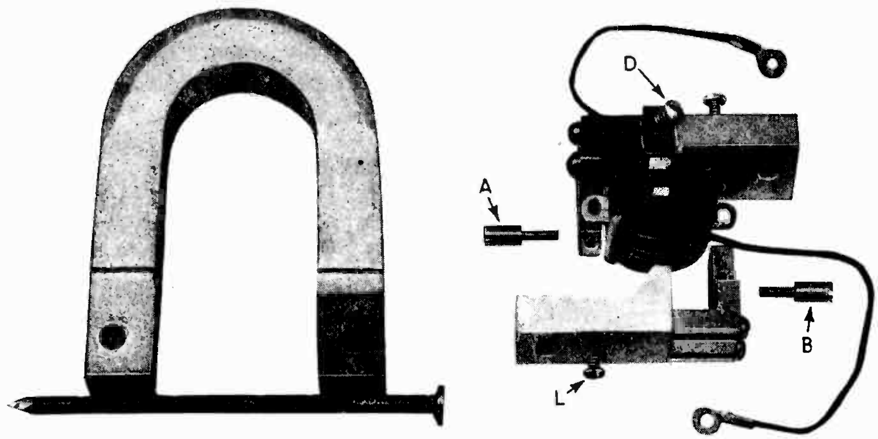


Figure 14—Motor mechanism partly dismantled

[2] REPLACING ARMATURE AND DRIVE PIN

The procedure for replacing the armature and drive pin is identical with that of replacing the magnet coils with the exception of the new part substituted. The new armature should be clean and free from any dust or dirt.

[3] REPLACING THE THRUST LEVER AND DRIVING ROD

Ordinarily the driving rod and thrust lever are not likely to become damaged or require replacement. However, should it be necessary, disassemble the housing and mechanism as described in Part II, Section 1, until the thrust lever and driving rod are removed. The new one should be placed in the position occupied by the old one and the mechanism reassembled in the reverse order of that used to disassemble it. The armature should be checked for adjustment as described in Part I, Section 4. The housing should then be assembled and the speaker returned to normal operation.

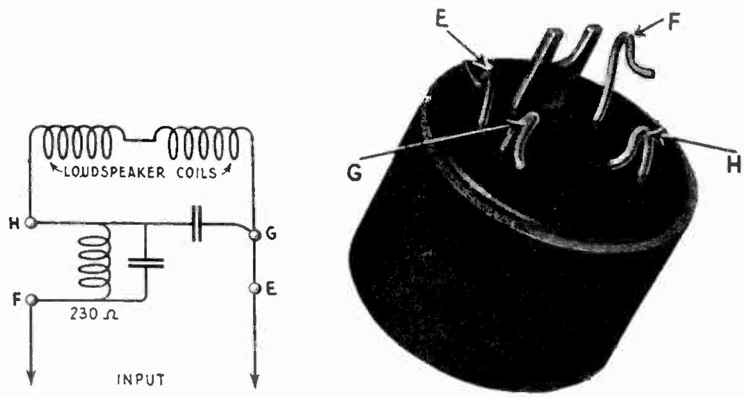


Figure 15—Schematic circuit of Loudspeaker 100B coils and filter and photo of filter unit

[4] REPLACING THE MOTOR ASSEMBLY COMPLETE

When replacement of the complete motor mechanism is necessary disassemble the housing as described in Part I, Section 2. Then remove the cone, the motor and magnet and install the new motor.

The reassembly will be a reversal of the foregoing procedure.

[5] REPLACING CONE

When replacing a cone remove the old one as described in Part II, Section 1. The installation of the new cone is a reversal of the removal procedure.

(a) Place cone over driving rod in center.

(b) Adjust the cone seating nut so as to properly seat the cone and provide clearance for the thrust lever from the pole piece.

(c) Tighten cone lock nut and then replace the three screws, washers and nuts that hold the cone to the cone support.

(d) Fasten mechanism to housing and reassemble housing in the reverse manner of that used to disassemble it.

[6] REPLACING FILTER UNIT

The following procedure should be used when replacing the filter unit.

(a) Remove back and sides from housing as described in Part I, Section 2.

(b) Unsolder all leads to the filter terminals.

(c) Remove the filter unit mounting nut and washer and the nut and washer on the opposite end of the filter unit. (See Figure 11.) The unit may now be removed and replaced by a new one.

(d) Replace the mounting nuts and washers previously removed. Then resolder the leads that were removed from the filter terminals.

(e) Reassemble the housing in the reverse manner of that used to disassemble it.

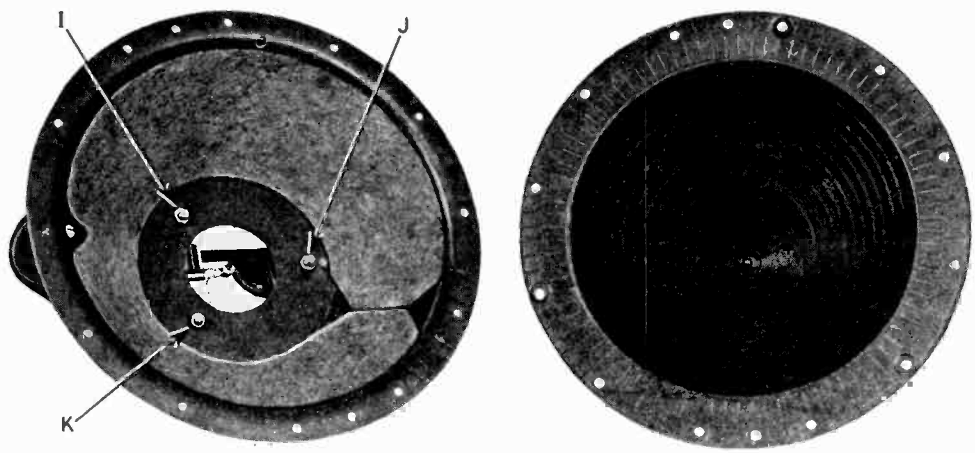


Figure 16—Cone support and cone

[7] REPLACING GRILLE CLOTH

Loudspeaker 100B has an ornamental grille cloth on both the front and rear. Should replacement be necessary proceed as follows:

(a) To replace the back grille, remove the back from the housing as described in Part I, Section 2. To replace the front grille remove the mechanism from the housing as described in Part II, Section 1.

(b) Remove the old grille cloth and cardboard ring by pressing the cloth away from its shellacked surface. That is if the housing were assembled the front cloth would be pressed toward the rear and the rear toward the front. Press close to the edge of the cardboard ring and it will break away easily.

(c) After the old cloth and ring have been removed,shellac the housing edge for mounting the cardboard ring and firmly hold the new cloth and ring in place until dry. Be sure and have the design of the front grille in the correct position.

(d) The housing should now be reassembled in the reverse manner used to disassemble it.

SERVICE DATA CHART

The following table of information provides a handy reference when servicing Loudspeaker Model 100B, and a working knowledge of it will enable service men to handle service problems readily and efficiently. Reference to Part No. and Section No. in the "Service Notes" is noted for detailed information.

Indication	*Cause*	*Remedy*
No Reproduction	No output from receiver	Examine receiver, Part I, Sec. 1
	Defective coils	Replace coils, Part I, Sec. 7; Part II, Sec. 1
	Defective filter	Replace filter, Part I, Sec. 7; Part II, Sec. 6
	Defective cord	Repair or replace cord, Part I, Sec. 8
	Loose or broken connections	Repair connections, Part I, Sec. 8
	Drive pin not soldered	Solder drive pin, Part I, Sec. 4
Weak Reproduc-	Weak receiver output	Examine receiver, Part I, Sec. 1
	Dirt interfering with armature action	Remove foreign matter from mechanism, Part I, Sec. 3
	Loose thrust lever mounting screw	Tighten screw and resolder drive pin, Part I, Sec. 6; Part II, Sec. 3
	Improperly aligned cone	Align cone correctly, Part I, Sec. 5
	Drive pin poorly soldered	Solder drive pin, Part I, Sec. 4
	Weak magnet	Remagnetize, Part I, Sec. 9
Distorted or Noisy Reproduction (Rattle)	Distorted output from receiver	Examine receiver, Part I, Sec. 1
	Improperly adjusted cone	Adjust cone correctly, Part I, Sec. 5; Part II, Sec. 5
	Filter incorrectly connected	Connect filter correctly, Part I, Sec. 7; Part II, Sec. 6
	Filter defective	Replace filter, Part I, Sec. 7; Part II, Sec. 6
	Loose screws or nuts in assembly	Tighten all loose screws or nuts, Part I, Sec. 6
	Armature striking pole piece	Adjust armature correctly, Part I, Sec. 4; Part II, Sec. 1
	Excessive pressure on drive pin	Resolder drive pin to thrust lever, Part I, Sec. 4; Part II, Sec. 1
	Filter unit not connected	Connect filter unit, Part I, Sec. 7; Part II, Sec. 6

Printed in U. S. A.

RCA

Electric Phonograph and Power Amplifier Equipment

MODEL AZ-774B

SERVICE NOTES

First Edition—2M

RCA Victor Company, Inc.
FOREIGN DEPARTMENT
233 BROADWAY, NEW YORK CITY

AZ-774B

CONTENTS

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAGNETIC PICK-UP SERVICE DATA

PART V—MAKING MAGNETIC PICK-UP REPLACEMENTS AND ADJUSTMENTS

ILLUSTRATIONS

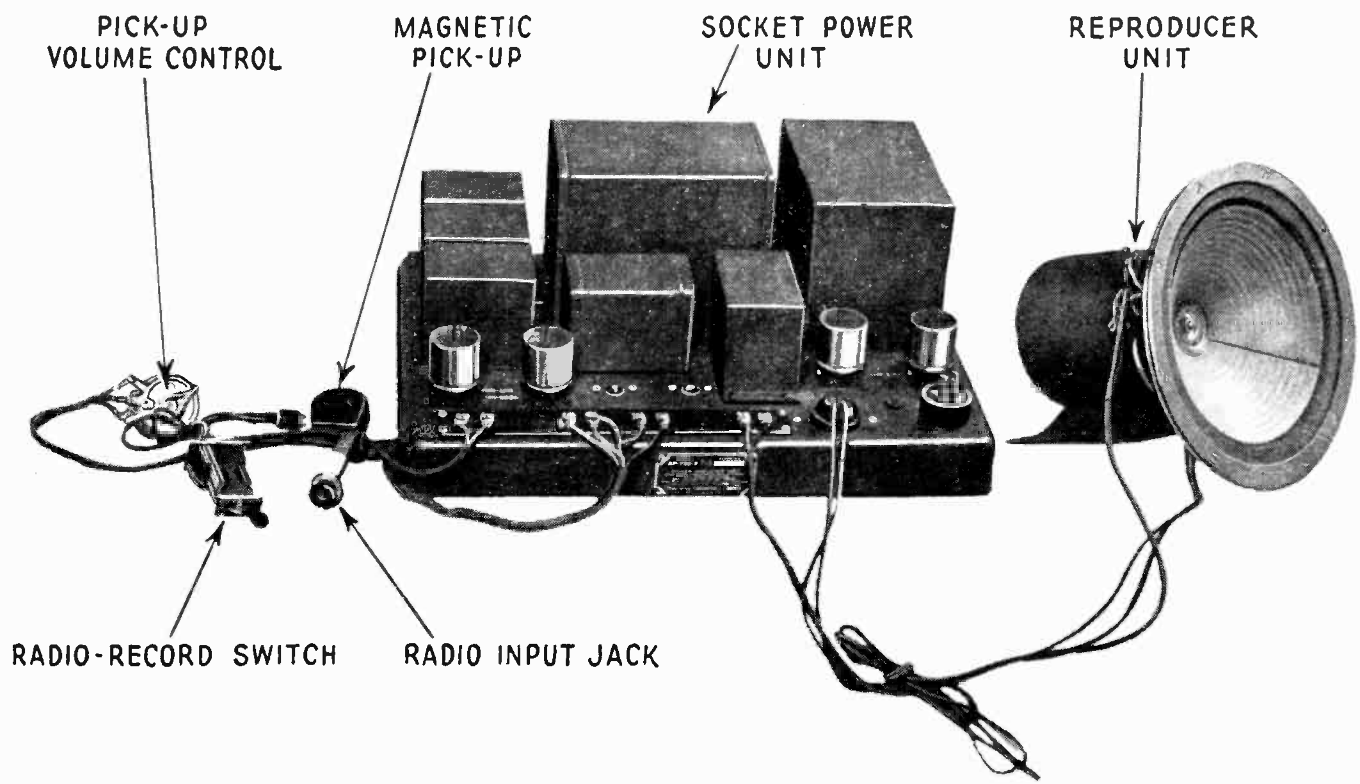


Figure 1—View of various parts comprising AZ-774B Amplifier Kit

RCA Model AZ-774B

Electric Phonograph and Radio Power Amplifier Equipment

SERVICE NOTES

Prepared by Radiola Division, Technical Service Department

ELECTRICAL SPECIFICATIONS

Rating—as connected	Voltage 220-230, Frequency 50 to 60 cycles
Ratings—different connections provided	Voltage 230 to 250, 200 to 220, 112.5 to 125 and 100 to 112.5, Frequency 50 to 60 Cycles
Power Consumption	140 Watts
Type of Circuit	Full wave, rectifying circuit providing plate and grid voltages to a two-stage A.F. power amplifier
Types and number of Radiotrons	2 UX-281, 1 UX-250 and 1 UX-226
Number of A.F. stages—Phonograph	2
Number of A.F. stages—Radio	1
Type of Rectifier	Full wave, using two UX-281 Radiotrons
Type of Pick-up	Low impedance, flexible armature

PHYSICAL SPECIFICATIONS

Dimensions of S.P.U.	18″ x 12½″ x 6½″
Weight of S.P.U.	47 lbs.
Dimensions of S.P.U. Packing Case	11″ x 15″ x 23″
Weight of S.P.U. Packing Case (All equipment included)	72 lbs.
Dimensions of Reproducer Unit	10½″ x 10½″ x 8¾″
Weight of Reproducer Unit	28 lbs.
Dimensions of Reproducer Packing Case	12″ x 12″ x 13″
Weight of Reproducer Packing Case (All equipment included)	45 lbs.

INTRODUCTION

The RCA Model AZ-774B Electric Phonograph and Radio Power Amplifier Equipment may be used for converting an old style phonograph to one using the electrical system of reproduction; or as a power amplifier to improve and increase the undistorted output of a radio receiver, or for providing both of these functions, with a switch for changing from one to the other. The undistorted output of the amplifier is approximately 4 watts. This provides an output of good quality in excess of the maximum requirements for home use. The additional power, however, gives a reserve that contributes to the quality of reproduction at any volume.

This equipment is supplied in kit form and consists of the following items:

(1) **Power Amplifier** using two Radiotrons UX-281, one Radiotron UX-226 and one Radiotron UX-250.

(2) **Reproducer Unit.** This is a large field (100 volts and 100 M.A.), 8-inch cone dynamic type reproducer. Leads and a female plug for connecting the field to the S.P.U. are provided.

(3) **Magnetic Pick-up.** The magnetic pick-up is of the low impedance flexible armature type which gives excellent reproduction and causes a minimum amount of wear on the record.

(4) **Phonograph Volume Control with Knob.** The volume control is a 60-ohm porcelain type potentiometer and gives a smooth control of volume from the phonograph.

(5) **Radio-Record Change-over Switch.** A special switch is provided for making the transition from an external radio receiver to record reproduction.

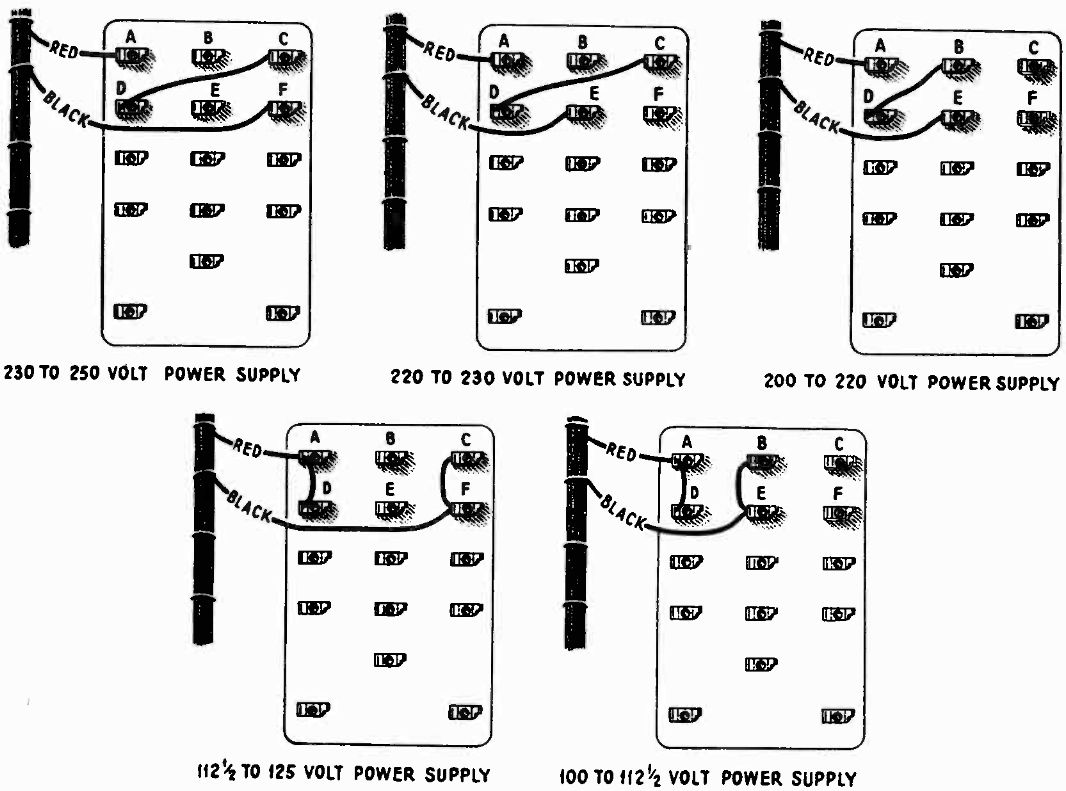


Figure 2—Connections to Primary of Power Transformer for different line voltages

(6) **Radio Input Jack.** A jack is provided for connecting the output of the first audio stage of an external receiver to the power amplifier.

(7) **Cable.** Connected to the "Radio-Record" switch and the radio input jack is a braided cable. One end of this cable has a four-terminal strip for connecting to the S.P.U. terminal board.

(8) **Cables.** Three additional two-wire cables are provided. These are for connecting the pick-up to the volume control, the volume control to the S.P.U., and the cone coil of the reproducer unit to the S.P.U.

(9) **Switch.** A single-pole, single-throw, tumbler-type switch is provided for connecting in series with the input A.C. circuit for complete control of the installation.

(10) **Power Transformer Instruction Tag.** A tag is provided that shows the correct connections for the power transformer for various line voltages. These connections are also shown in Figure 2.

PART I—INSTALLATION

The actual installation of this equipment will vary with each individual case. However, the wiring, regardless of the location of parts, must be as shown in Figure 3. It is desirable that the parts be located within the radius of the various cables used for connecting purposes. However, if placing a unit beyond the radius of a particular cable is desirable, an extension cable or cord may be spliced to the cable. This may be of ordinary lamp cord or any other suitable conductor.

In the case of the loudspeaker, it is essential that it be placed directly behind a nine-inch hole in a baffle board at least 24 inches square, or a cabinet that constitutes a baffle of similar dimensions.

The S.P.U. is to be located in a place or position that will give adequate ventilation. Also a location that will provide accessibility to the Radiotrons is necessary.

PART II—SERVICE DATA

(1) POWER TRANSFORMER

The power transformer used in the S.P.U. has a split primary winding, each section of which may be connected in parallel for 110-volt lines and in series for 220-volt lines. Also taps are provided for small variations of the above voltages.

Figure 2 shows the terminals of the power transformer and the correct connection for various line voltages. It is important that the line voltage be measured and the transformer connections changed accordingly. Otherwise damage to the various parts and tubes may result.

(2) ADJUSTMENTS FOR MINIMUM HUM

Two potentiometers connected across the UX-226 and UX-250 power transformer filament windings are provided for adjusting the grid and plate returns to the exact electrical center of the filament winding. This is the position that gives the least amount of hum in the loudspeaker. To properly adjust these potentiometers proceed as follows:

(a) Place the amplifier in operation with all tubes in place and the "Radio-Record" switch at the "Record" position.

(b) With a screwdriver adjust the potentiometer marked "UX-226" Figure 3 until a point is found that gives the least amount of hum.

(c) Now locate the potentiometer marked "UX-250" and with a screwdriver adjust this potentiometer until a point is found that gives a minimum amount of hum.

When both potentiometers are at the position of minimum hum, with the "Radio-Record" switch in the "Record" position, the adjustments have been correctly made.

(3) SOCKET POWER UNIT SERVICE DATA CHART

The following Service Data Chart gives the symptoms and remedies for failures that may be encountered during the operation of the AZ-774B amplifier kit. Troubles due to pick-up failure are listed under the Magnetic Pick-up Service Data Chart. Troubles in the radio receiver, or in the phonograph motor must not be confused with trouble in the amplifier unit and must be handled according to the requirements of the particular radio receiver or phonograph motor used.

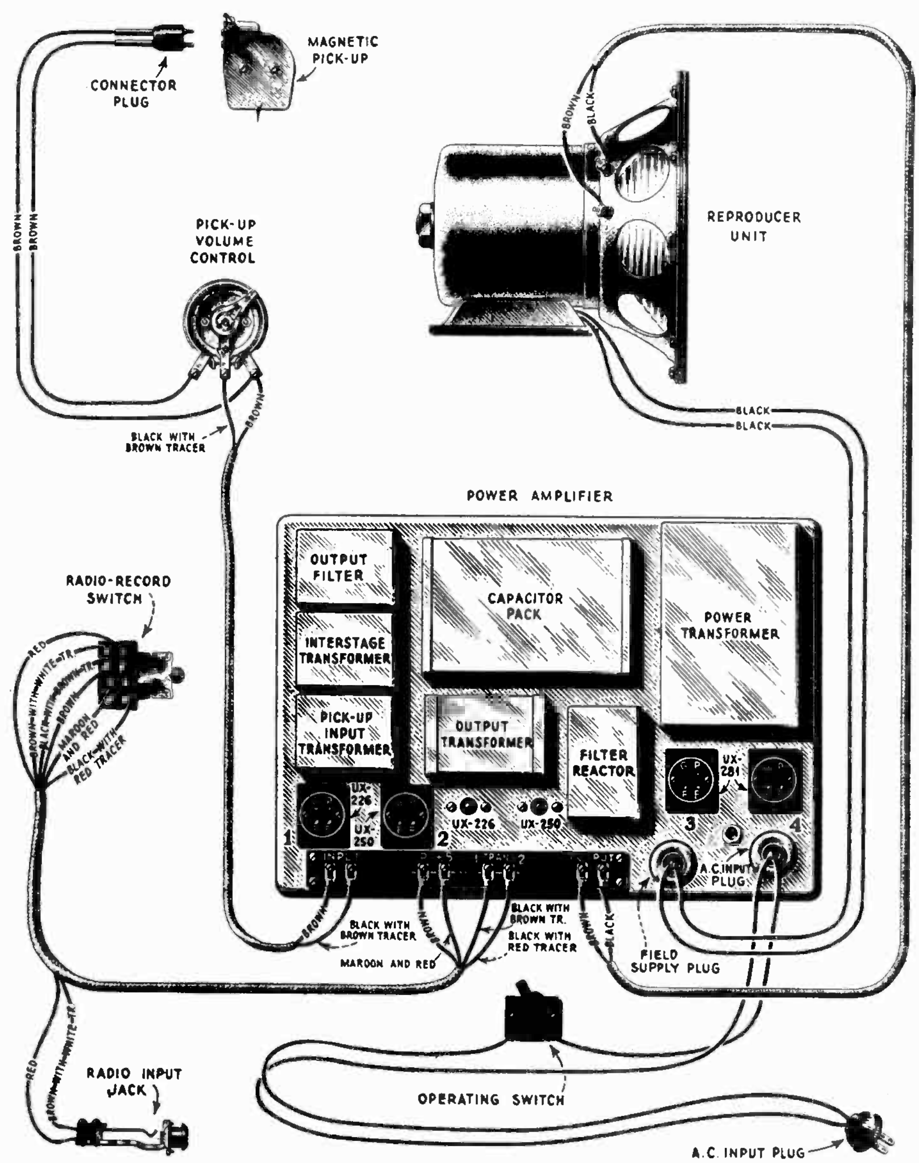


Figure 3—Layout and wiring to all units of AZ-774B Power Amplifier

Indication	Cause	Remedy
No reproduction ("Radio - Record" switch at either position)	No supply voltage	Turn supply voltage "On"
	Defective operating switch	Repair or replace defective operating switch
	Defective Radiotrons	Replace any defective Radiotron
	Defective "Radio-Record" switch. This will probably be evidenced by the amplifier functioning at one position of the switch	Repair and clean or replace defective "Radio-Record" switch
	Defective unit or part in S.P.U., or defective wiring	Test all units and wiring according to the continuity test, Part III, Section 2 and make any repairs or replacements necessary
	Defective cables connecting various units	Repair or replace any defective cable
	Open cone coil	Replace reproducer cone as described in Part II, Section 5
Low Volume ("Radio - Record" switch at either position)	Defective Radiotrons	Replace any defective Radiotrons
	Defective magnetic pick-up ("Record" position only)	Check magnetic pick-up according to Part IV, Section 1
	Low output from radio receiver ("Radio" only)	Repair defective radio receiver
	Defective or open reproducer field	Repair or replace field coil or connections
	Defective part in S.P.U.	Check according to continuity test and make any replacements necessary
Distorted reproduction	Defective Radiotrons	Replace any defective Radiotron
	Poor input from radio receiver ("Radio" only)	Repair any defect in radio receiver
	Poor output from pick-up—("Record" only)	Check magnetic pick-up according to Part IV, Section 1 and make any repairs necessary
	Defective part in S.P.U.	Check S.P.U. according to continuity tests and make any repair or replacement necessary
	Cone not properly centered	Center cone correctly according to Part II, Section 4
	Wires on side of cone vibrating	Fasten wires down with shellac or cement
Hum	Hum potentiometers not adjusted properly	Adjust potentiometers as described in Part II, Section 2
	Loose laminations in power transformer	Remove transformer from S.P.U., and place in slow oven bottom up for several hours. Cool for 24 hours and return to S.P.U.
	Low emission Radiotrons UX-281	Replace a low emission Radiotron UX-281
	Shorted or open filter condenser in S.P.U. or shorted condenser across UX-250 bias resistor	Replace any defective condenser in S.P.U.
	Open grounds in S.P.U. wiring	Repair any opens in S.P.U. wiring
	Hum originating in Radio receiver	Any hum present in the radio receiver will be amplified and reproduced through the loudspeaker. Remedy the hum in the receiver and it will not appear in the reproducer unit

(4) CENTERING REPRODUCER CONE

To properly center a cone when making a replacement or repair, proceed as follows:

(a) Remove reproducer to a position where the cone is accessible.

(b) Loosen cone centering screw.

(c) Place three small cardboard strips, about 1½" x ¼" and the thickness of a visiting card, through the center web of the cone into the space between the pole piece and cone. This will give the cone coil the same clearance on all sides of the pole piece. Figure 4 shows this operation.

(d) Tighten the center screw and the cone will be properly centered. Remove the three pieces of cardboard and return the reproducer unit to its normal position.

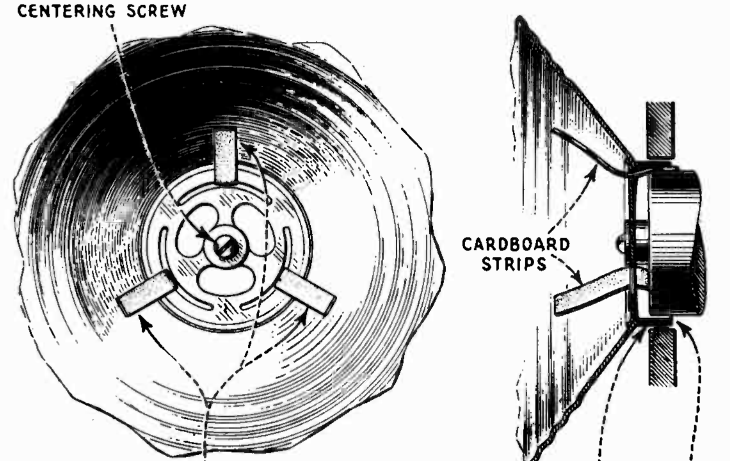


Figure 4—Location of cardboard strips for centering of cone

(5) TO REPLACE A CONE

Should it be necessary to replace a cone in the reproducer unit, proceed as follows:

(a) Remove reproducer unit to a position where the cone is accessible.

(b) Release the two cone leads from their terminal posts.

(c) Remove the screw that holds the center of the cone to the pole piece.

(d) Remove the nine screws, nuts and lock washers that hold the metal ring and cone to the cone support. The cone may now be removed and the new one placed in the position occupied by the old one. The parts removed should now be reassembled in the reverse manner of that used to remove them and the cone centered as described in Part II, Section 4.

PART III—ELECTRICAL TESTS

The following tests cover all the electrical circuits of the AZ-774B amplifier kit. The power transformer internal connections are shown in Figure 5 and the capacitor pack internal connections in Figure 6. The output filter connections are shown in Figure 7. Should the continuity tests show any unit to be defective, it is good practice to test the particular unit after disconnecting from the circuit. The values of D.C. resistance of all units are shown in Figure 8.

(1) VOLTAGE READINGS AT RADIOTRON SOCKETS

Socket voltage readings (which may be taken with a Weston Model 537 Set Analyzer or similar instrument) such as are given in the tables below are frequently helpful in locating trouble. It should be borne in mind, however, that it will be impossible in practice to duplicate these readings exactly, due to manufacturing tolerances, variations in line voltages and the use of leads and meters of different resistances.

The following measurements were made at a line voltage corresponding to the connections of the power transformer:

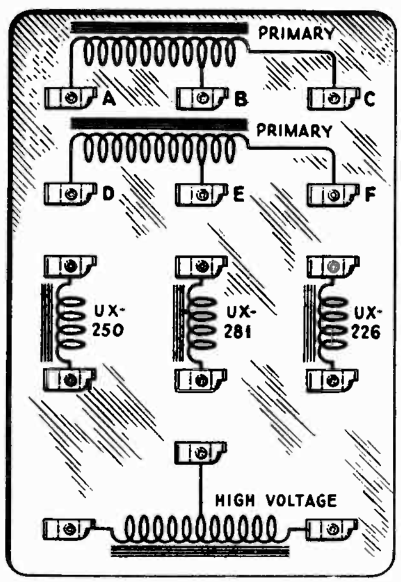


Figure 5—Internal connections of Power Transformer

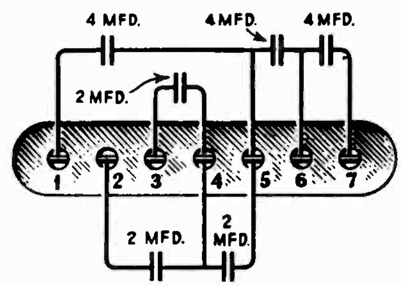


Figure 6—Internal connections of Capacitor Pads

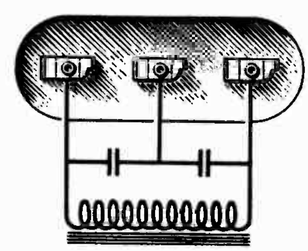


Figure 7—Internal connections of Output Filter

SOCKET VOLTAGE READINGS

	Filament Volts	Grid to Filament Volts	Plate to Filament Volts	Plate Current MA
UX-226	1.2	9	130	14
UX-250	7.2	70	420	55

(2) CONTINUITY TESTS

In making continuity tests of the entire S.P.U. or of an individual part, the following procedure is recommended:

Disconnect the A.C. input plug, the field supply plug and all connections to the terminal strip of the S.P.U.

A pair of headphones with at least 4½ volts in series, or preferably a voltmeter with sufficient voltage to give a full scale deflection when connected across the battery terminals, should be used in making these tests. A direct reading "Ohmmeter" is also useful for circuit testing.

The socket contacts, numbers and terminals used in these tests are shown in Figures 3 and 9.

Test leads should be of the flexible insulated type with partially insulated testing points to prevent false readings, which otherwise may be caused by hand capacity effect. Similarly, the hands should not touch the chassis or the terminals across which a test is being made.

The resistance of the various circuits are indicated and any large deviation from this value will indicate a defective part.

The resistance of a circuit may be calculated from the formula:

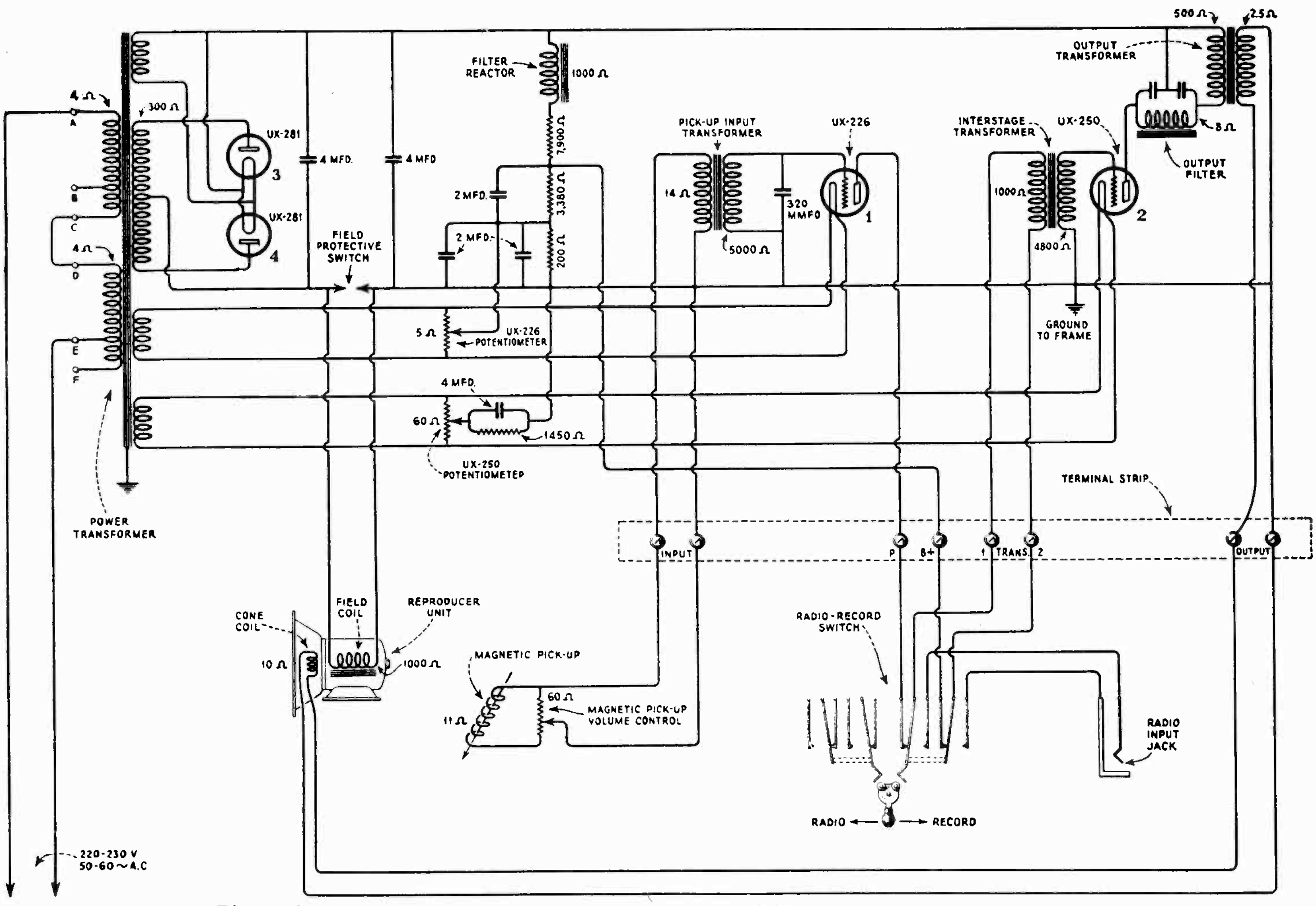


Figure 8—Schematic wiring diagram of RCA AZ-774B Amplifier and parts

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

Small condensers can best be checked by substituting one of known condition and like capacity. Large condensers, such as used in the capacitor pack, may be tested by charging with a D.C. voltage approximately the same as that used during normal operation and then discharged by short circuiting its terminals. An O.K. condenser will give a good spark, the size depending on the charging voltage and the capacity of the condenser. A leaky condenser will give no spark and a shorted condenser will give a spark when an attempt is made to charge it. Do not come in contact with a condenser charged with high voltage.

Test Terminals	Correct Effect	Incorrect Effect	
		Indication	Caused By
Across A.C. Input plug	Closed (2 or 8 ohms)	Open 2 ohms	Open primary winding of power transformer Open primary winding of power transformer
P contact of one UX-281 socket to P contact of other UX-281 socket	Closed (300 ohms)	Open	Open high voltage winding of power transformer
Across UX-226 filament contacts	Closed (.2 ohm)	5 ohms .2 ohm Open	Open UX-226 filament winding Open UX-226 potentiometer Open UX-226 filament winding and potentiometer
Across UX-250 filament contacts	Closed (.3 ohm)	60 ohms .3 ohm Open	Open UX-250 filament winding Open UX-250 potentiometer Open UX-250 filament winding and potentiometer
Across either UX-281 filament contacts	Closed (.2 ohm)	Open	Open UX-281 filament winding
One filament contact of either UX-281 socket to +B	Closed (9000 ohms)	Open	Open resistor R2 or filter reactor
+B to ground	Closed (3580 ohms)	Open	Open resistor R1
Either filament contact of UX-250 socket to ground	Closed (1480 ohms)	Open 30 ohms	Open 1450-ohm section of R1 or UX-250 potentiometer Shorted 4-mfd. condenser connected across 1450-ohm resistor
Across input terminals	Closed (14 ohms)	Open	Open primary of pick-up transformer
G contact of UX-226 socket to ground	Closed (5000 ohms)	Open Short	Open secondary of pick-up input transformer Shorted 320-mmfd. condenser connected across secondary of input transformer
Across terminals 1 and 2 of terminal strip	Closed (1000 ohms)	Open	Open primary of interstage transformer
G contact of UX-250 socket to ground	Closed (4800 ohms)	Open	Open secondary of interstage transformer
P contact of UX-250 socket to one filament contact of either UX-281 socket	Closed (508 ohms)	Open 500 ohms 8 ohms Short	Open filter coil or primary of output transformer Shorted condensers in filter unit Shorted condenser in filter unit Shorted condenser in filter unit
Across output terminals	Closed (2.5 ohms)	Open	Open secondary of output transformer
Across field supply plug	Closed (1000 ohms)	Open	Open field coil of reproducer unit
Across cone coil of reproducer unit	Closed (10 ohms)	Open	Open cone coil of reproducer unit
Across pick-up volume control (Pick-up disconnected)	Closed (60 ohms)	Open	Open pick-up volume control
Across magnetic pick-up	Closed (11 ohms)	Open	Open coil in magnetic pick-up

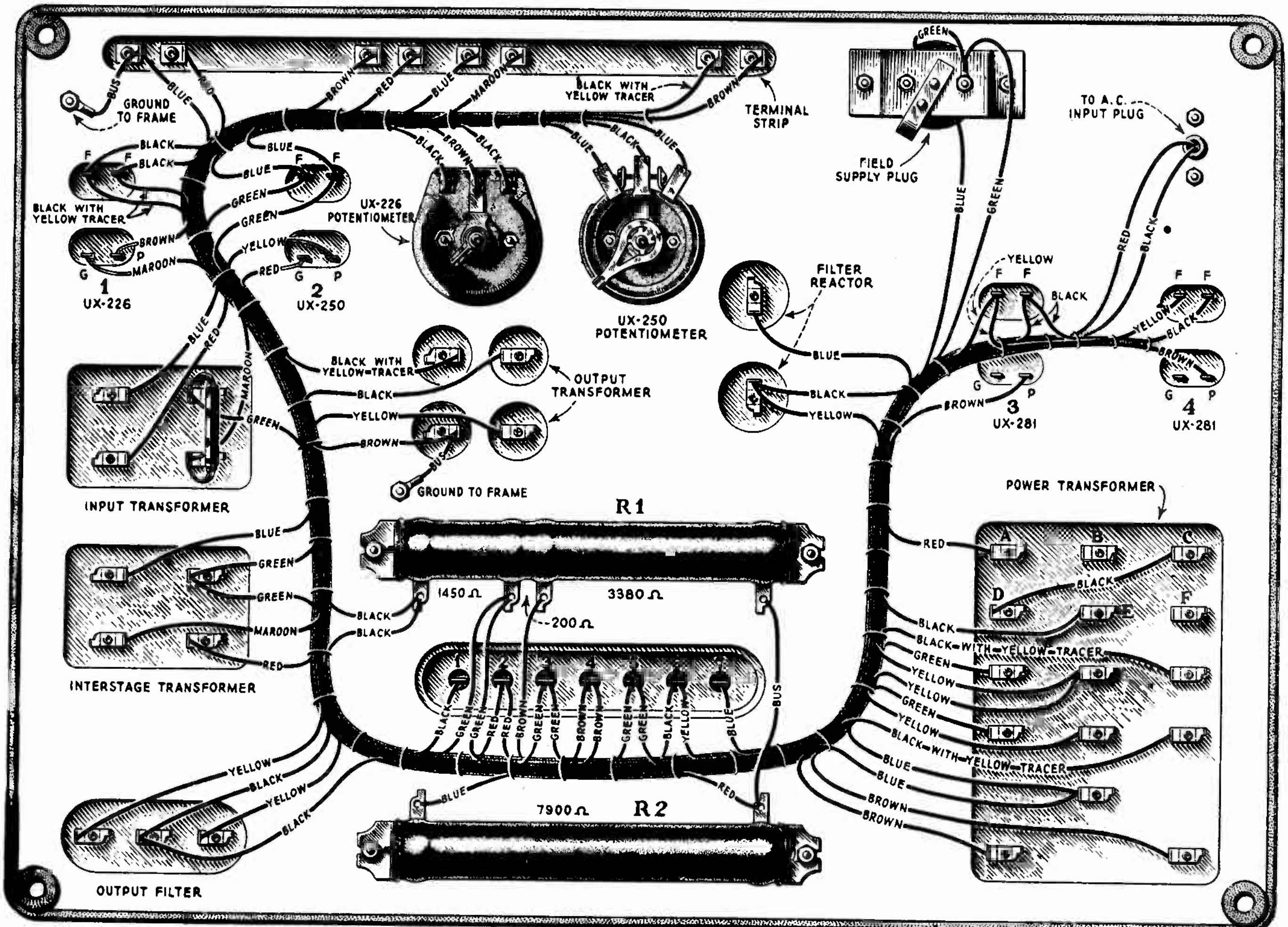


Figure 9—Wiring diagram of AZ-774B Socket Power Unit

PART IV—MAGNETIC PICK-UP SERVICE DATA

Weak, distorted or no reproduction at the "Record" position of the switch may be due to failure in the magnetic pick-up. This can be readily checked by throwing the switch to the "Radio" position. Normal reproduction of the radio input should be obtained. A further check can be made by connecting a pair of head telephones across the output of the pick-up while a record is being played. This can be done at the terminal strip across the terminals marked "input," and if no results are obtained there, across the two leads from the pick-up to the volume control, first disconnecting the volume control. If the pick-up is functioning normally the record will be heard in the phones playing softly. Any distortion present or lack of reproducton will be due to failure of some part or adjustment in the pick-up.

(1) NO REPRODUCTION

If no music can be heard in the phones when connected across the output leads of the pick-up look for:

(a) Poor contact or open connections at volume control.—The volume control resistance strip can be cleaned with a little of one of the various cigarette lighter fluids applied with a pipe-cleaner, and the volume control arm should be adjusted to wipe firmly on the edge of the volume control resistance strip.

(b) Open pick-up coil or connections.—Click test between the contacts in the pick-up contact plug. If no click is obtained the trouble is either an open coil or an open coil connection. If the first is true it will be necessary to replace the coil as outlined in Part V, Section 5. A loose connection may be resoldered. Before remounting the pick-up on the suspension arm, clean the contacts in the pick-up contact plug.

(c) Poor contact or open connections at the swivel arm contact plug.—Remove the pick-up wires from the volume control and check for open circuit from these leads through the pick-up. If open circuit is indicated, see that the contacts in the swivel arm contact plug are clean; are capable of free movement and have sufficient spring pressure to enable them to make firm contact. Inspect also the connections of the pick-up leads to the swivel arm contact plug, click testing from the free ends of the leads to the contact points. To remove the swivel arm contact plug for inspection it is simply necessary to remove the contact plug set screw and to pull the plug out of the open end of the swivel arm, using a pair of long-nosed pliers to grasp one of the contact pins. It may also be necessary to unsolder the pick-up leads at the volume control.

(2) WEAK OR DISTORTED REPRODUCTION

Weak or distorted reproduction may be due to:—

(a) Loose needle.—Noise will result if the needle is not clamped tightly in the armature needle socket. Before proceeding with any other service work tighten the needle set-screw and re-test operation.

(b) Dirty or loose contacts in the jack, at the volume control arm, or at the swivel arm contact plug.—Loose contacts generally result in periods of inoperation interspersed with periods of either normal or noisy operation.

(c) Armature out of adjustment.—If the vibrating armature is not in the electrical center of the air gap between the two pole pieces weak reproduction will result. For adjustment see Part V, Section 3.

(d) Defective rubber.—After a considerable period of time the rubber damping block and pivot cushions may harden, causing weak reproduction. Rubber so aged as to cause weak reproduction usually loses so much of its elasticity that the armature will stick to one or the other of the pole pieces if moved against it by hand. In this connection it may be pointed out that frequent use of the pick-up increases the normal "life" of the rubber damping block and pivot cushions. Never allow the pick-up to rest on a record for any considerable time when not in use, as this tends to produce a permanent "set" in the pivot cushions and shortens their "life." Should the rubber become sufficiently hard to prevent the armature from vibrating properly or to cause it to stick, it should be replaced as described in Part V, Section 7.

(e) Foreign material in the air gap.—Iron filings, rust or dirt in the air gap will cause weak reproduction usually accompanied by "raspy" noise. Filings or other loose material may be removed by an air blower, although it is sometimes necessary to disassemble the unit to clean it successfully. See Part V, Section 6. If the armature is rusty it should be replaced, but, as a temporary measure in case another armature is not immediately available, it may be removed, sand-papered smooth, and returned to the pick-up.

(f) Weak magnet.—The importance of placing a soft iron "keeper" across the poles of the magnet immediately before the disassembly of the pick-up and of allowing it to remain in place until the pick-up is reassembled cannot be over-emphasized. Generally speaking, a pick-up magnet will not become weak except as the result of careless handling when service work is being performed. If the magnet does become weak, however, it should be taken to the nearest magneto repair shop and re-magnetized, care being taken to place a "keeper" across the poles of the magnet before it is removed from the charging apparatus, and to leave it on the magnet until the magnet has been replaced against the pole pieces of the pick-up.

(g) Needle holder rattle.—If the pole pieces and armature are not centered on the front of the pick-up housing, the needle holder will rattle against the edges of the aperture provided for it in the cover. This trouble may sometimes be corrected by loosening the pick-up cover screws and shifting the cover slightly. To do this it may also be necessary to remove the cover and, by loosening the magnet clamping screw, shift the magnet clamping plate. If the cover cannot be shifted so as to center its aperture around the needle holder it will be necessary to shift the pole pieces. See Part V, Section 4.

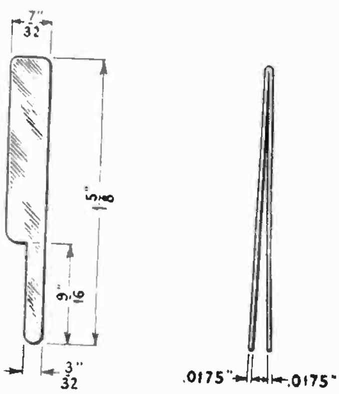


Figure 10—Magnetic Pick-up Spacer Tool Dimensions

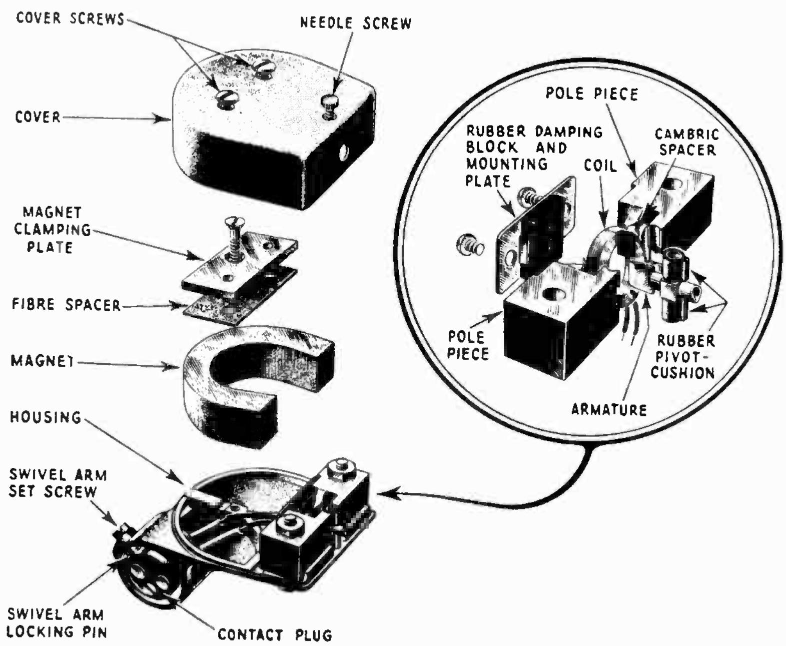


Figure 11—Details of the Magnetic Pick-up

PART V—MAKING MAGNETIC PICK-UP REPLACEMENTS AND ADJUSTMENTS

(1) PICK-UP FEELER GAUGE

To adjust the magnetic pick-up, but one special tool is necessary—a feeler gauge, shown in Figure 10. This gauge may be made from 20 mil phosphor bronze stock according to the dimensions given. This gauge is not used to center the armature, but to obtain the correct total air-gap between the pole pieces of the pick-up, in which space the armature vibrates. Therefore, each tip need not be exactly the same thickness if the combined thickness of the two tips is 35 mils, although in filing down the tips each tip should be filed approximately the same. This gauge—carried as RCA Replacement Part No. 2677—may be obtained from RCA Victor Co., Inc., Radiola Division, Technical Service Department.

Before bending the phosphor bronze stock it should be annealed at the point where the bend is to occur and tinned very slightly about 1/8 inch each way from the folding point. After bending it should be hammered together at the fold, and heated so as to "sweat" the two parts together at the tinnedsurfaces.

(2) TO OPEN THE PICK-UP FOR EXAMINATION

If the pick-up is located on a Victor tone arm, it may be removed in the following manner. If it has a special mounting or is mounted on some other tone arm, removing it will have to depend on the individual circumstances.

(a) Loosen the pick-up swivel arm set screw (see Figure 11) until the threaded position of the screw just shows above the shoulder in the pick-up housing socket. This should bring the lower end of the screw flush with the inner surface of the socket wall.

(b) Rotate the pick-up counter-clockwise (the needle holder traveling down and back) until the pick-up locking pin strikes the forward edge of the transverse portion of the slot in the swivel arm.

(c) Slip the pick-up off the end of the swivel arm.

(d) Remove the needle holding screw and the two cover screws.

(e) Remove the pick-up cover pivoting it about the front edge of the pick-up housing so as to clear the needle holder.

(3) TO CENTER THE ARMATURE

(a) Remove the pick-up cover as described in Part V, Section 2.

(b) Remove the magnet clamping screw, clamping plate and fibre spacer.

(c) Transfer the magnet to the opposite side of the pole pieces as shown in Figure 12, sliding it over the top of the pole faces so as to keep it as much as possible in contact with a magnetic material during the transfer.

(d) Loosen the screws holding the rubber damping block mounting plate just enough to make it possible to slip the plate back and forth under the screw heads.

(e) Slip the point of a knife between the pole piece towards the smallest gap and an end of the damping block mounting plate. (Figure 12.) Twist the knife, thereby slipping the plate towards the other pole piece and centering the armature. The center may be judged by eye with sufficient accuracy.

(f) Tighten the damping block mounting plate screws and examine the gap to see that the position of the plate is not changed.

(g) Replace the magnet. fibre spacer, magnet clamping plate and screw. Draw the screw up snug, but not tight.

(h) Replace the cover and observe which way it may be necessary to move the magnet clamping plate to line up the holes for the cover screws.

(i) Remove cover, line up clamping plate, and tighten the clamping screw.

(k) Replace the cover and cover screws, making sure that the needle holder is centered in the aperture provided for it in the pick-up cover. If the cover cannot be slipped sufficiently to center the needle holder aperture, put a full tone needle in the holder, replace the needle holding screw, tighten it and determine whether the pick-up will rattle against the case when in use by pulling the needle to either side with the fingers. If it is evident that rattle may result, the pole pieces must be slipped on the housing to center the needle holder in its aperture. See Part V, Section 4.

(l) Replace the pick-up in its position on the swivel arm in the reverse manner of that used to remove it.

(4) ADJUSTMENT OF POLE PIECES

(a) Remove the pick-up cover as described in Part V, Section 2.

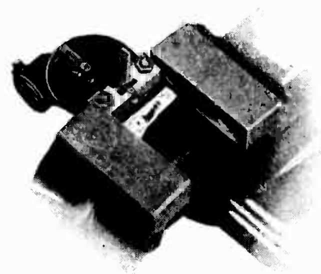
(b) Remove the magnet clamping screw, clamping plate, and fibre spacer.

(c) Place a soft iron keeper such as a ¼″ carriage bolt (or a piece of iron having an equivalent cross-section) across the ends of the magnet and remove the magnet, first marking with a pencil one end of the magnet and the corresponding pole piece.

(d) Remove the two screws holding the damping block mounting plate.

(e) Remove the damping block and plate and test the air gaps at the end of the armature between it and the pole pieces by means of the feeler gauge. The gauge should be inserted by placing the long edges along each side of the tip of the armature and moving the gauge into the gap toward the coil, and **not** inserted tip first. See Figure 13. The end of the armature is tapered and the air gap should vary from 15 mils near the pick-up coil to 20 mils at the end of the armature. The gauge should therefore stick about half way in the gap. If the gauge fits at the bottom of the gap the spacing at the center will be 20 mils, and if the gauge will just enter the gap the spacing will be 15 mils at the center of the gap. The spacing should not be greater than 20 mils nor smaller than 15 mils at the center of the gap, as weak reproduction or rattle will result. If the air gap is not of the correct width it may be adjusted as follows:

12—Centering the Armature



13—Adjustment of Pole Pieces

14—Replacing Pivot Cushions

AZ-774B Magnetic Pick-up Adjustments

(f) After having removed the cover, magnet, and rubber damping block and plate, place the pick-up in a bench vise in such a manner that the vise grips **only** against the ends of the pole pieces (See Figure 13), the pick-up housing being free of the vise jaws. Tighten the vise just sufficiently to hold the unit. The feeler gauge should **not** be left in the air-gap while tightening the vise.

(g) Slack up on the pole piece mounting screws, leaving the lock washers partly compressed.

(h) Adjust the width of the air gap, using the feeler gauge as described above, making sure that the pole pieces are flush with the raised portion of the front edge of the pick-up housing.

(i) When the correct gap has been obtained, slip the housing in the direction parallel to its front edge until the needle holder is centered over the notch in the raised portion of the edge of the housing.

(k) Tighten the pole piece mounting screws. Make sure that the raised front edge of the pick-up housing is back against the pole pieces so as to line them firmly against this edge.

(l) If the pole pieces do not grip the armature pivot firmly when the proper gap has been obtained, it will be necessary to replace the rubber pivot cushions. See Part V, Section 7.

(m) Replace the rubber damping block, and with a screw driver press the rubber about the slot well down around the end of the armature.

(n) Center the armature as outlined in Part V, Section 3, replacing the magnet so that the pencil marks, previously made, will coincide.

(5) TO REPLACE THE PICK-UP COIL

(a) Remove the pick-up cover, magnet, and rubber damping block as described in Part V, Section 2.

(b) Loosen both pole-piece mounting nuts, leaving the lock washers partly compressed.

(c) Slip the pole pieces apart as far as the clearance around the mounting screws will permit and remove the armature.

(d) Unsolder the coil leads and remove the coil.

(e) Place the new coil in position, being sure that the cambric spacer is in place. See Figure 10. The spacer around the defective coil may be used. Clean the tips of the coil leads with fine sandpaper back to the outer ends of the protective sleeves and solder in place. It may be necessary when replacing a coil to replace the rubber pivot cushions also. See Part V, Section 4, paragraph (1), and Part V, Section 7.

(f) Adjust the pole pieces and center the armature as described in Part V, Sections 4 and 3.

(6) TO REPLACE THE PICK-UP ARMATURE

(a) Follow procedure outlined in Part V, Section 5, paragraphs (a) to (c) inclusive.

(b) Insert the new armature and, if necessary, new pivot cushions. See Part V, Section 4, paragraph (1), and Part V, Section 7.

(c) Adjust the pole pieces and center the armature as described in Part V, Sections 4 and 3.

(7) REPLACING THE RUBBER

Replacing the rubber damping block requires no further description than that given in Part V, Section 4. Replacing the pivot cushions is more difficult and requires the following procedure:

(a) Follow the procedure outlined in Part V, Section 5, paragraphs (a) to (c) inclusive.

(b) Aged rubber may stick to the armature or pole pieces. Scrape these parts clean with the point of a knife.

(c) Slip the pole pieces (separated as far as possible) back on the housing and insert one rubber strip lengthwise between the two pole pieces and the raised front edge of the pick-up housing so as to bridge the lower pivot bearing surfaces. See Figure 14.

(d) Slip the pole pieces forward to grip the lower pivot cushion between the pole pieces and the raised front edge of the pick-up housing.

(e) With the front surfaces of the pole pieces in a horizontal position place the other rubber strip across the upper pivot bearing.

(f) Carefully insert the armature tip between the cushions to rest the pivots against them, and press the armature into place, thereby folding the rubber cushions about the pivots.

(g) The two ends of the lower pivot cushion will be held between the pole faces and the raised front edge of the housing. With the point of a knife or other sharp-pointed instrument pull out these two ends.

(h) See that the armature is vertically centered in the oblong space appearing in the front of the two pole pieces and adjust the pole pieces as in Part V, Section 4.

(i) With a pair of scissors or other sharp instrument cut off the excess rubber protruding from the pivot bearing.

(k) Center the armature as in Part V, Section 2, and replace the pick-up on the swivel arm.

MAGNETIC PICK-UP SERVICE DATA CHART

Indication	Cause	Remedy
No Reproduction	Poor volume control contact between arm and resistance	Clean volume control resistance with a pipe cleaner and any of the various cigarette lighter fluids
	Open pick-up coil or connections	Repair any loose connections by resoldering or replace an open coil as described in Part V, Section 5
Weak or Distorted Reproduction	Loose needle	Tighten needle in socket with needle set screw
	Dirty contact in volume control	Clean volume control resistance and contact arm
	Armature out of adjustment	Center armature as described in Part V, Section 3
	Defective rubber damping block or pivot supports	Replace rubber damping block and pivot supports as described in Part V, Section 7
	Dirt in armature air gap	Clean all dirt from air gap by means of a blower or disassemble pick-up and clean. Remove rust from armature if necessary.
	Weak magnet	Remagnetize magnet by taking to magneto repair shop. Place keeper across pole faces until magnet is again in place in the pick-up. Making repairs without placing a keeper on the magnet is the easiest way of having the magnet lose its magnetism
	Needle holding screw rattle	If the needle hole of the pick-up cover touches the set screw that holds the needle, a rattle will result. Relocate the cover by shifting the magnet clamp

RCA

MAGNETIC PICK-UP

MODEL AZ-1604

SERVICE NOTES

Prepared by

RCA VICTOR SERVICE DEPARTMENT

First Edition 500
March, 1930

RCA Victor Company Inc.

FOREIGN DEPARTMENT

233 BROADWAY----NEW YORK

RCA AZ-1604 MAGNETIC PICK-UP

SERVICE NOTES

Prepared by RCA Victor Service Department

TABLE OF CONTENTS

GENERAL DESCRIPTION

This pick-up is of the intermediate impedance type. It is intended for use with broadcast radio receivers which use the grid leak and condenser type of detection, and have two stages of audio frequency amplification. When used in this manner it gives excellent reproduction and ample volume. Figure 1 shows the schematic diagram of the pick-up connected to a radio receiver.

The kit consists of the pick-up, tone arm, supporting base, which acts as a pivot for the tone arm, a potentiometer type volume control mounted in the base, a two-conductor connecting cord and an adapter.

(1) ADJUSTMENT OF ARMATURE

Adjustment of the armature consists essentially of having it in its electrical center between the two pole pieces. Need for this adjustment is usually evidenced by distortion during phonograph reproduction with blasting, especially on the low notes. The following procedure should be adopted when making this adjustment.

(a) Remove the needle set screw. Remove the two screws in the face of the pick-up and remove the pick-up cover.

(b) Remove the nut "D" (see Figure 3) that holds the magnet bracket and fibre spacers. Mark the magnet poles and the pole pieces so that when they are replaced they will be in their original position. The magnet is now free to be released. Place a keeper such as a large nail across the magnet poles and remove it from the pole pieces.

(c) With a small screw driver loosen screws E and F. The small piece of metal that holds the clamping block may now be moved either way until the armature is approximately centered between the two pole pieces. Judging the center by the eye is sufficiently accurate for this adjustment.

(d) After the center has been located the two screws, E and F should be tightened. The magnet may now be replaced, the keeper removed and the pick-up re-assembled in the reverse manner of that used to remove it. While re-assembling be sure that all dirt is completely removed from any part of the magnet armature or other parts of the pick-up.

(2) RESISTANCE VALUES

Resistance of pick-up coil 55 ohms.
Resistance of volume control potentiometer 2350 ohms.

(3) REPLACING RUBBER PIVOT SUPPORTS AND DAMPING BLOCK

After considerable time, or due to climatic conditions, the rubber pivot supports and the rubber damping block may become hardened and require replacement. Such hardening is usually evidenced by the armature being set to one side and not moving easily. As with other rubber articles, these parts give best life when used frequently. Also the pick-up should not be supported by the needle resting against the record or turntable as such use will tend to set the armature to one side. The pick-up should hang free.

Usually the rubber pivot supports and damping block will require replacement at the same time and are therefore supplied in sets of three. When a replacement is necessary such a set should be procured. If such a set is not available and a repair is urgently needed the damping block may be cut from a piece of automobile inner tube. The pivot supports may be small strips cut from the thin portion of a baby's rubber nipple making sure it is the best quality obtainable.

Use the following procedure when making these replacements

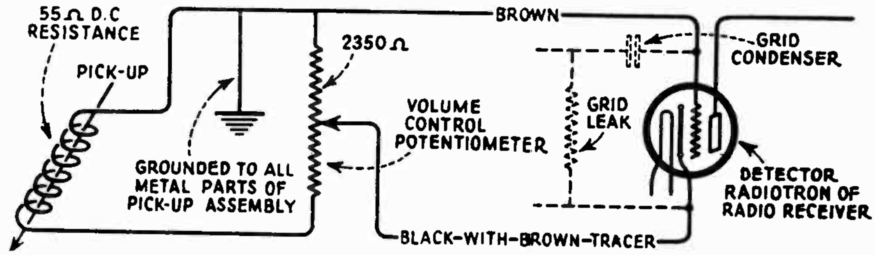


Figure 1—Schematic diagram showing connection of the pick-up in the circuit of a radio receiver

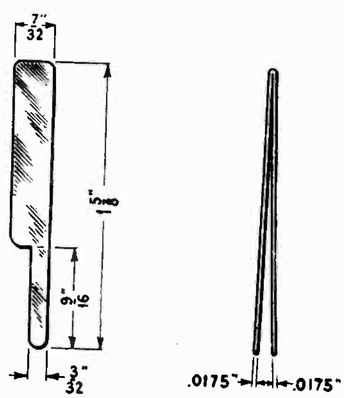


Figure 2—Magnetic pick-up armature spacing tool

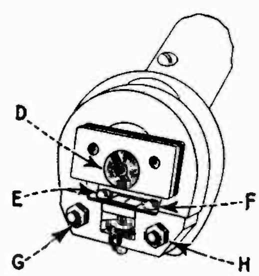


Fig. 3A

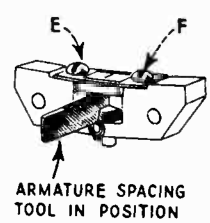


Fig. 3B

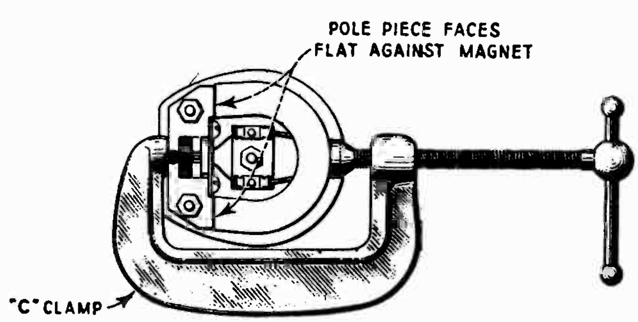


Fig. 3C

Figures 3A, B and C—Details of adjustment and replacement operations

(a) Procure an RCA magnetic pick-up feeler tool. This is RCA Part No. 2677, or it may be easily constructed by referring to Figure 2.

(b) Remove the pick-up case and the magnet from the pole pieces as described in Sec. 1.

(c) Disconnect the output leads and remove screw holding the pick-up to the tone arm and remove the pick-up.

(d) Unsolder the leads to the coil at the terminal strip inside of the pick-up case. Remove nuts G and H, Figure 3, and release the pole pieces from the back support. Now remove screws E and F and disassemble the pole pieces, armature and coil. The old rubber should be completely removed from all parts and the parts should be scraped clean with a knife.

(e) Place the new rubber pivot supports in their proper place. This may be either tubing or strips. Re-assemble the pole pieces and coil and new rubber damping block in place with armature spacing tool as shown in Figure 3. Hold together as tight as possible. Tighten screws E and F. Now remove tool. Be sure the cambric cover is in place between the coil and pole pieces.

(f) Place the assembled mechanism against the magnet, making sure the poles are against the proper pole pieces, and replace assembly on tone arm correctly. Put on the nuts G and H, but do not tighten. Place the magnet bracket and fibre spacers in place and tighten in their correct position. Now with 2-inch "C" clamp tighten the pole pieces as shown in Figure 3 until the faces of the pole pieces are flat against the magnet pole. Now tighten nuts G and H. The pick-up is now re-assembled and the cover may be replaced and the Radiola returned to normal operation. If the cover does not fit properly it may be necessary to relocate the position of the magnet clamp.

(4) <u>REPLACING PICK-UP COIL</u>

The pick-up coil may be replaced in the same manner as the rubber supports and damping blocks, the difference being that the coil is replaced instead of the rubber pieces. The cambric cover between the coil and pole pieces should be removed from the old coil and placed around the new one. All adjustments are the same.

(5) REPLACING PICK-UP ARMATURE

The pick-up armature may be replaced in the same manner as the rubber supports or coil, the difference being that the armature is the part replaced. All adjustments are the same. In some cases replacement of the armature is made necessary due to rust. If a new armature is not available, the old one may be temporarily repaired by removing all rust with sand-paper. This is not a permanent repair due to the fact that the sand-papered surface will rust quickly. Therefore a new armature should be installed as soon as available.

(6) REPLACING VOLUME CONTROL POTENTIOMETER

Remove pull-off knob. Remove the nut which holds the potentiometer in place. Remove washer. Disconnect the leads to the potentiometer and remove. Re-connect and re-assemble a new potentiometer in the reverse manner. The black with brown tracer lead of cord connects to the arm of the potentiometer and the brown lead should connect to the terminal near the arm of the potentiometer where the volume control is turned to the "off" position. (Turned to the extreme counter-clockwise position).

SERVICE DATA CHART

Indication	Cause	Remedy
No Reproduction	Poor volume control contact arm and resistance	Clean volume control resistance with a pipe cleaner and any cigarette lighter fluids Tighten contact arm by bending it slightly to make firm contact
	Open pick-up coil or connections	Repair any loose connection by resoldering, or replace an open coil as described in Sec. 4
Volume changes suddenly from no reproduction to maximum volume	Open volume control	Replace volume control potentiometer
Weak or distorted reproduction	Loose needle	Tighten needle in socket with needle set screw
	Dirty contact in volume control	Clean volume control resistance and contact arm
	Armature out of adjustment	Center armature as described in Sec. 1
	Defective rubber damping block or pivot supports	Replace rubber damping block and pivot supports as described in Sec. 3
	Dirt in armature gap	Clean all dirt from gap by means of a compressed air jet, or disassemble pick-up and clean. Remove rust from armature if necessary
	Weak magnet	Re-magnetize magnet taking to magneto repair shop. Place soft iron keeper across the poles until the magnet is again in place in the pick-up. Making repairs without placing a keeper on the magnet will cause the magnet to lose a large part of its strength
	Needle holder rattle	If the edge of the needle hole in the pick-up cover touches the needle set screw, a rattle will result. Re-locate the cover by shifting the magnet clamp

VICTOR MICRO-SYNCHRONOUS RADIO
R-32, R-52, RE-45 and RE-75

The Victor Micro-Synchronous Radio is a power operated tuned radio frequency receiver of the antenna type, employing an antenna coupling stage and four stages of tuned and neutralized radio frequency amplification, a detector, a first stage audio, and a power stage of push pull amplification.

A high degree of sensitivity is made possible by means of a system of micrometer adjustments on the tuning condensers, permitting precision automatic alignment or synchronization of the tuned radio frequency stages thruout the entire tuning range at all times. Each set of condensers is thus properly aligned at the factory and locked into position. A new method of stabilizing the radio frequency circuit permits a high degree of selectivity without causing any decrease in sensitivity.

The instrument comprises three standard units as follows:

(1) Radio, in which are contained the R. F. stages and the detector; (2) Power Amplifier, containing the first audio, the power stage of push pull amplification, and the rectifier; (3) Electro Dynamic Reproducer. The units are so designed that all parts are readily accessible for servicing.

Six Radiotrons UX-226 are used in the R. F. and first audio amplifier stages, a UY-227 detector, and two UX-245 in the power stage. The Radiotron UX-280 is used as a rectifier.

The Victor Radio is designed for operation on 105 to 120 volts, 50 to 60 cycles, alternating current. Special equipment is available for operation on 105 to 120 volts, 25 to 40 cycles. The power consumption when operating the radio is approximately 105 Watts, and approximately 160 watts when operating the Electrola.

PARTS LIST RADIO UNIT.

Name of Part

1. Twin Binding Post (Antenna and Ground)
2. Nut
3. Lock Washer
5. Cable Clamp
6. Nut
   Lock Washer
7. Screw
   Nut
   Lock Washer
8. Tuning Condenser Spring
9. Cam Adjusting Screw
10. By-Pass Condenser (3 of .25 Mfd. each)
11. Twin Pin Jack, Input Unit
12. Rivet
13. Detector Input R. F. Transformer Coil
14. Rivet
15. By-Pass Condenser, Plate Circuit UY-227 (.001 Mfd.)
16. Rivet
17. Grid Leak (½ Meg.)
18. Grid Condenser (.00025 Mfd.)
19. UY-227 Hum Control with Bracket
20. Rivet
21. Detector Plate Choke Coil
22. Rivet
23. Tuning Lever Roller
24. Transfer Switch (complete)
25. Nut
26. Washer
27. Nut
28. Knob
    Set Screw
29. Nut
    Lock Washer
30. Pilot Lamp Socket Cover
31. Pilot Lamp Socket Screw
32. Pilot Lamp
33. Pilot Lamp Socket
34. Pilot Lamp Socket Insulating Strip
35. Pilot Lamp Socket Base
36. Stabilizer Resistor (800 Ohms)
37. R. F. Transformer (Volume Control) (2nd R. F.)
38. Nut
39. Knob
40. Nut
41. Washer
42. Volume Control (Radio) (complete)
43. Mid-Tap Resistor Across UX-226 Fil. (20 Ohms)
44. UX-226 Grid Bias Resistor
45. Rivet
46. Antenna Choke Coil
47. Nut
48. Lock Washer
49. Tuning Condenser (One Complete)
50. R. F. Coil (3 per Unit)
51. Radio Panel (Wood Only)
52. Toggle Switch Insulator
53. Nut
54. Toggle Switch (Off and On)
    Metal Shield for UY-227 (RE-45 only)
    Tuning Dial Scale
    Multiple Plug (12 Prong)

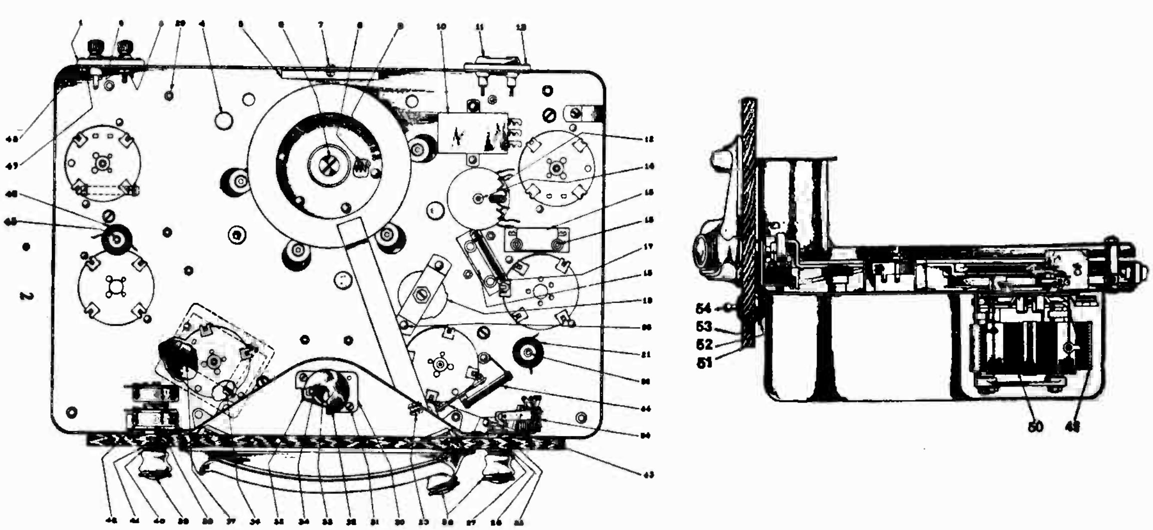


Fig. 1—Top and Side Views of Radio with Cover Removed, Showing Parts

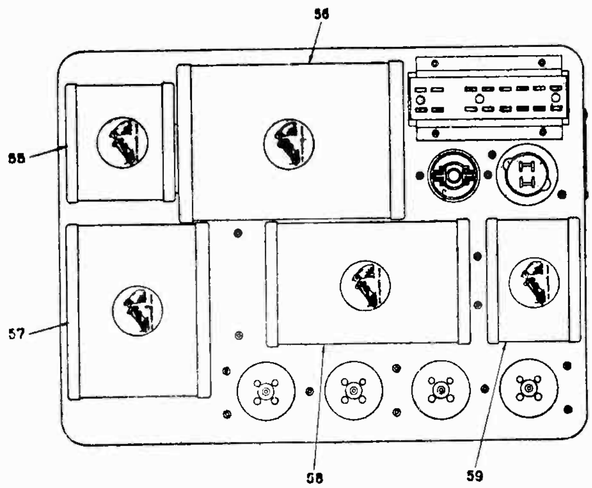


Fig. 2—Top View of Power Amplifier Unit, Showing Parts

PARTS LIST POWER AMPLIFIER UNIT

55. Filter Choke Coil
56. Filter Condenser Bank
57. Power Transformer (60 Cycles)
    Power Transformer (25 Cycles)
58. Interstage and Output Transformer
59. Input Transformer

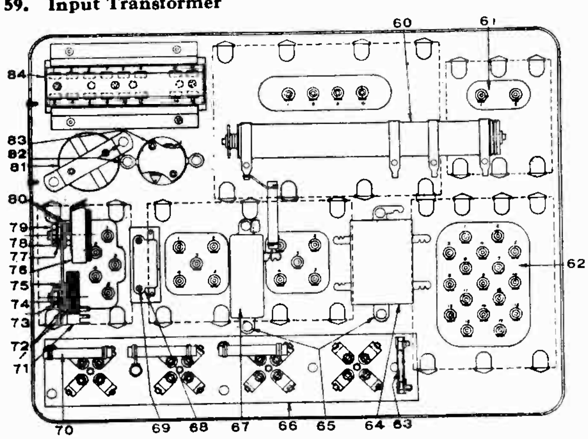


Fig. 3—Bottom View of Power Amplifier Unit, Showing Parts

60. Voltage Divider Resistor
61. Filter Choke Coil (Same as 55)
62. Power Transformer (Same as 57)
63. 2 Ampere Fuse
64. By-Pass Condenser (Two of .1 Mfd. each and one of .125 Mfd.)
65. Rivet
66. Socket Strip
67. By-Pass Condenser (½ Mfd.)
68. By-Pass Condenser (.002 Mfd.)
69. Rivet
70. Grid Leak, ½ Meg. (3 Used)
71. Hum Control Potentiometer (20 Ohms) UX-226
72. Fibre Washer (2 Used)
73. Nut
74. Washer
75. Lock Washer
76. Tone Control
77. Lock Washer
78. Washer (Same as 74)
79. Nut
80. Fibre Washer (Same as 72)
81. Power Input Plug
82. Rivet
83. Motor Plug
84. Multi-Plug Socket
85. Clamp (2 Used)

1. ANTENNA—For best average sensitivity and selectivity the antenna should be from 50 to 75 feet long including the lead-in and ground wires, and should be as high above ground as possible. A short antenna tends to decrease the sensitivity and increase the selectivity) a long antenna tends to increase the sensitivity and decrease the selectivity. For local reception sufficient sensitivity can usually be obtained except in shielded locations by using a five or six foot length of wire as an antenna.

2. GROUND—A good ground connection is highly important for the proper operation of the instrument and must be used at all times. The connection should be made to a well scraped and cleaned portion of a water pipe by clamping with a ground clamp. If such a connection is not available, a pipe or metal rod may be driven three or four feet into the ground, preferably where the soil is moist. Attention is called to the fact that a spark may be produced if the ground is connected to the instrument while the power plug is attached. This condition, which is caused by the condenser discharge from the power line, is quite normal and will cause no harm to the instrument.

3. POWER LINE VOLTAGE—The power line voltage should be measured with an A. C. voltmeter at the time of installation; If the voltage is above 125 volts, a tapped resistor such as stock No. A-310 should be connected in series with one side of the power line and the resistance varied until input voltage at the instrument is 115 volts. If the voltage fluctuates badly, the co-operation of the power company should be secured, and an attempt made to eliminate such fluctuation.

4. ADJUSTING HUM CONTROLS—The two hum control potentiometers, should be adjusted at the time of installation in the following manner:

a. Place the transfer switch in the "record" position to the right.
b. With a small screw driver turn the UX-226 hum control in the base of the power amplifier unit slightly in either direction as required until the hum is a minimum.
c. Turn the transfer switch to the left to the "radio" position, turn the radio volume control to minimum, and adjust the UY-227 hum control near the UY-227 in the radio set until the hum is a minimum.

5. ADJUSTING HARMONIC MODULATOR—The harmonic modulator or tone control in the bottom of the power amplifier controls emphasis on the bass section of the scale, increasing the bass and decreasing the high notes as the adjusting screw is turned to the right. Ordinarily, the control will not require any change in setting from that made in the factory.

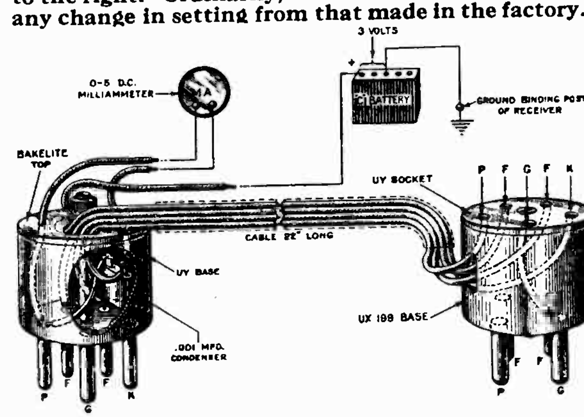


Fig. 4—Circuit for Tube Voltmeter, Na-Ald. No. 982

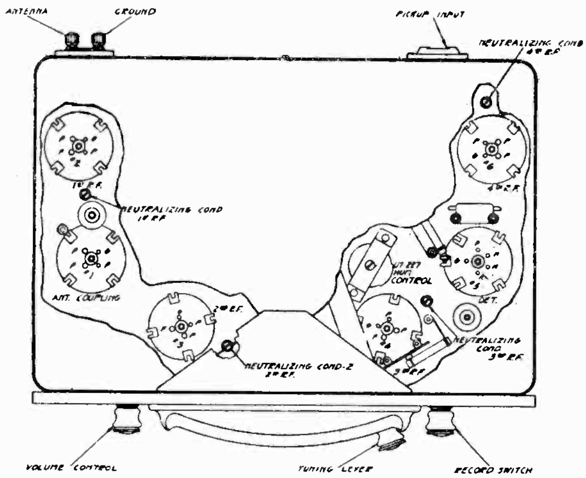


Fig. 5—Top View of Radio, Showing Radiotron Sockets

It may be desirable in some cases, however, to change the adjustment because of unusual room characteristics, a customer's preference for stronger bass, or to reduce record scratch and static. The control arm can be turned with a small screw driver as desired.

GENERAL TESTS

1. EXCESSIVE HUM—This condition can be caused by:
   - a. Improperly adjusted or faulty hum controls. See subject 4, under Installation.
   - b. Defective UX-280 or UY-227.
   - c. Wire or terminal grounded to the frame, or open circuit in any of the various ground connections.
   - d. Shorted condenser, 10, Fig. 1, across UX-226 filament supply.
   - e. Open or shorted center tap resistor, 43, Fig. 1, across UX-226 filament supply.
   - f. Shorted condenser, 64, Fig. 3, across power line in power-amplifier unit.
   - g. Shorted condenser in condenser bank, 56, Fig. 2, of power-amplifier unit.

2. HOWL—Microphonic howl can be traced to:
   - a. Defective Radiotron, particularly in the detector or audio stages.
   - b. Improper neutralization. See subject 1 under Special Adjustments below.
   - c. Speaker not felt insulated from baffle. Remove speaker and arrange felt properly.
   - d. Open condenser, 15, Fig. 1.
   - e. Loose metal parts such as shielding, screws, etc., or improperly centered cone may set up a howl or mechanical rattle. See subject 2 under Special Adjustments for method of centering cone.

3. DISTORTED REPRODUCTION—Distortion may be caused by any of the following:
   - a. Low emission Radiotron, particularly in the detector or in the power supply unit. For best reproduction the plate currents of the two UX-245 should balance within 2 milliamperes.
   - b. Operation with volume control advanced too far on powerful local stations, causing overloading of the detector.
   - c. Incorrect setting of the tone control in the base of the power-amplifier. See subject 5, under Installation.
   - d. Improper neutralization. See subject 1, under Special Adjustments.
   - e. Cone in speaker unit improperly centered. See subject 2 under Special Adjustments.

4. NOISY REPRODUCTION—Station carrier noise, static, and power line disturbances should not be confused with noise which is set up within the receiver. This latter condition may be caused by any one of the following:
   - a. *Volume Control.* Dirt or corrosion on the resistance wire or contact arms of the volume control will produce noise when the control is operated. This condition can usually be corrected by rubbing the parts lightly with very fine sandpaper and then cleaning with gasoline.
   - b. *Shorted Tuning Condenser.* If the plates of one or more of the tuning condensers are shorted, noise will be produced when the tuning lever is operated. If such a condition is found, the faulty condenser should be replaced.

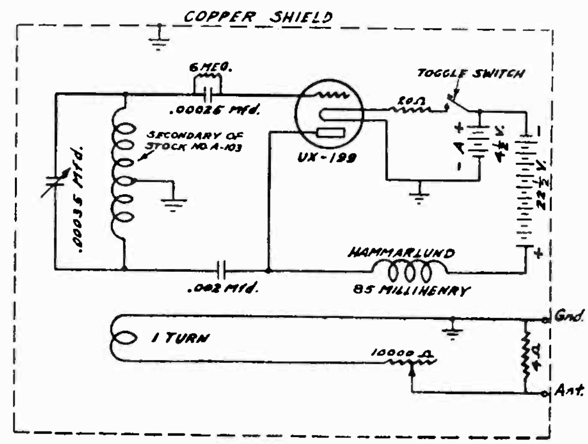


Fig. 6—Schematic Wiring Diagram, Modulated Oscillator

   - c. *Intermittent short or open circuit* in any of the various soldered connections or in power switch.
   - d. *High resistance grid leak.* Any of the grid leaks which have developed an excessive high resistance will produce a "frying noise."
   - e. *Faulty power or audio transformer* will also produce this same type noise.

5. WEAK RECEPTION—This condition can be caused by:
   - a. Faulty antenna, characterized by weak reception, intermittent reception, or grating noise. Examine the antenna for poor contact at the lead-in connection to the radio set, poor soldered connections, grounded or partially grounded lightning arrester, or contact with surrounding objects. See subject 1, under Installation for further details of antenna.

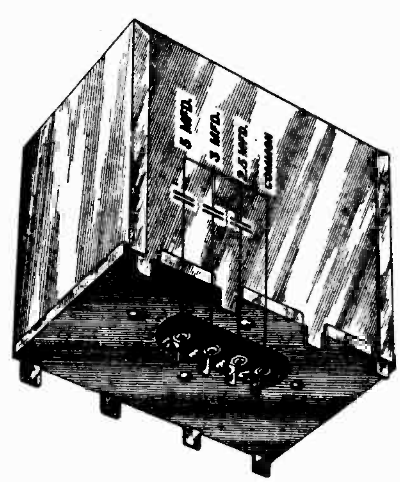


Fig. 7—Internal Connections of Filter Condenser Bank

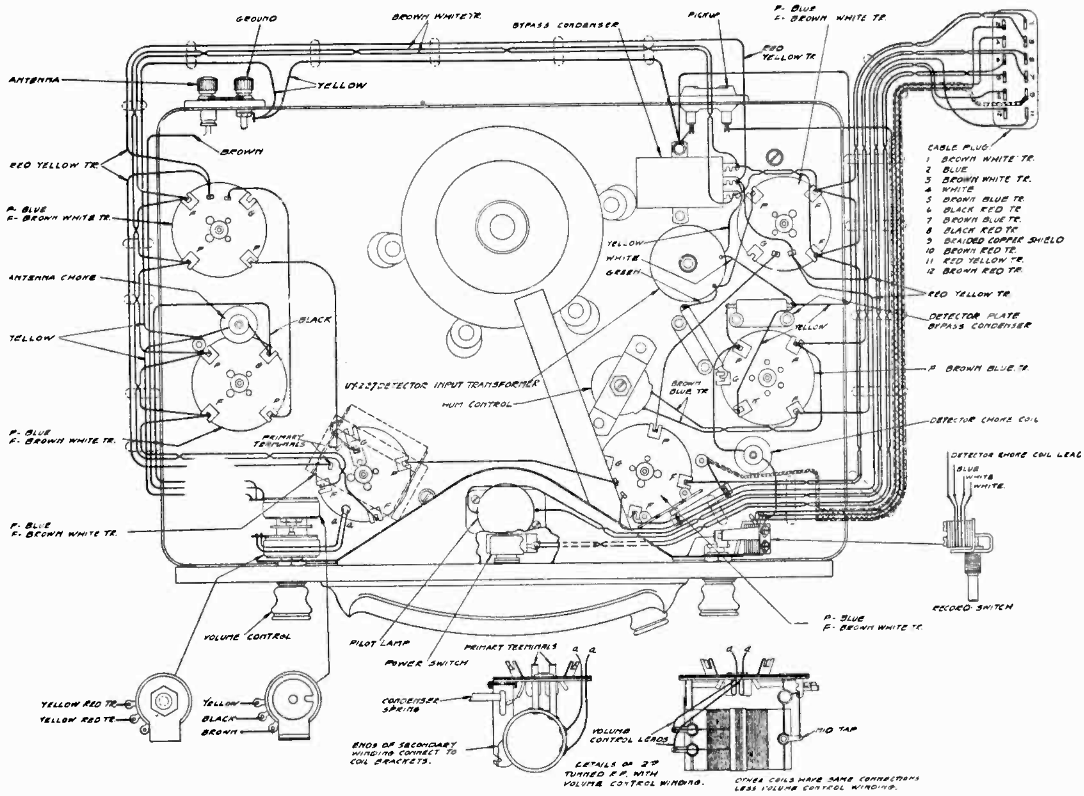


Fig. 9—Top View of Radio, Showing Wiring Between Terminals

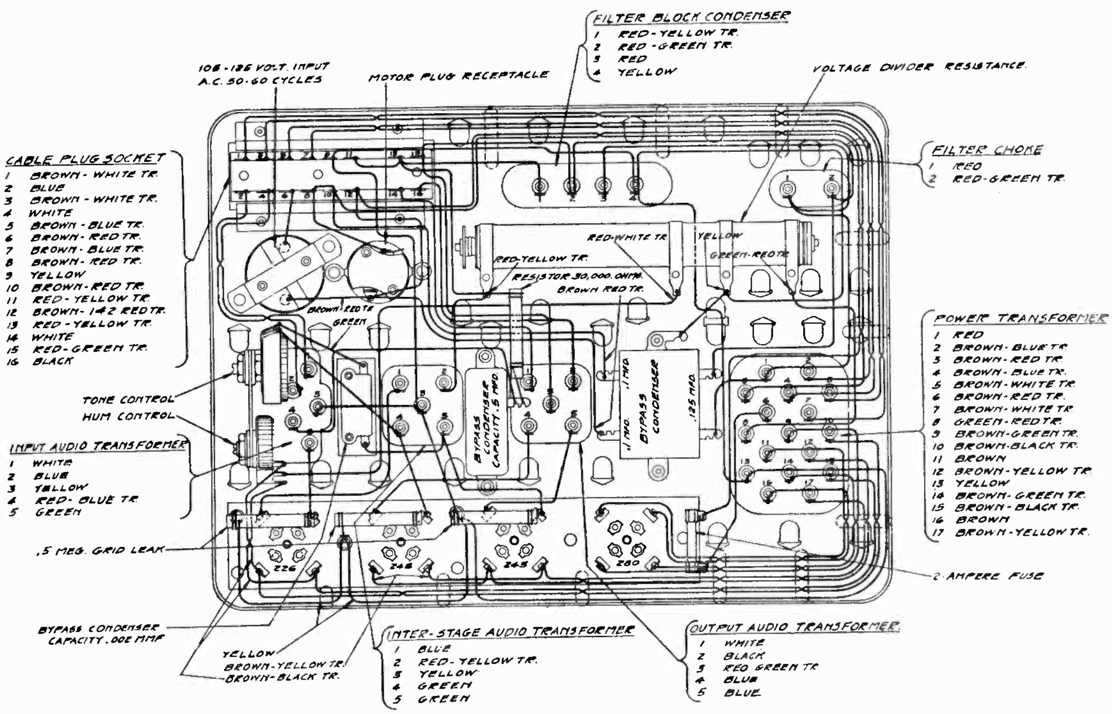


Fig. 11—Bottom View of Amplifier, Showing Wiring Between Terminals

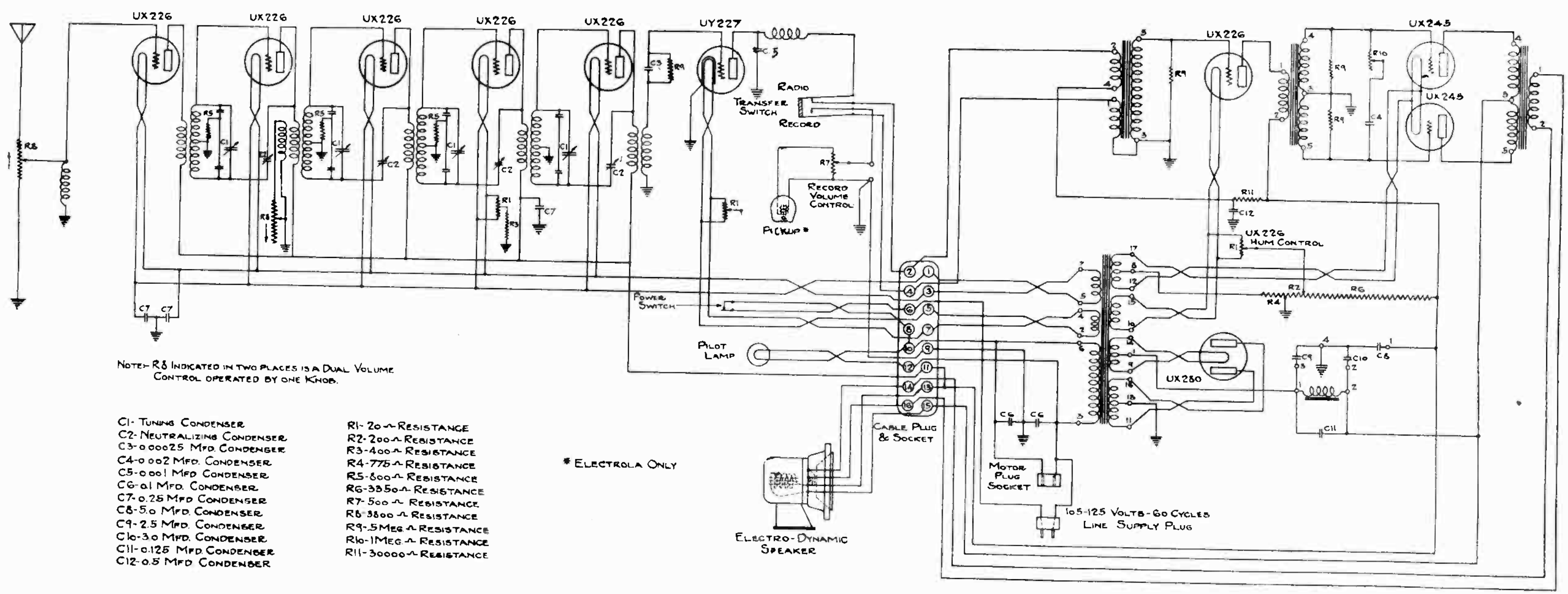


Fig. 10—Schematic Wiring Diagram Victor Radio and Victor Radio with Electrola

Model R-32, R-52, RE-45, RE-75

b. Faulty ground, characterized by weak reception, intermittent reception, grating noise, or oscillation. Examine the ground wire for poor contact at the ground binding post connection the the radio set, poor soldered connections, corroded connection at ground clamp.
c. Low power line voltage. Test power outlet with A. C. voltmeter. Voltage should be between 105 and 125 volts, for radio instruments and between 105 and 120 volts for instruments with Electrola.
d. Defective Radiotron in any of the various sockets.
e. Defect in radio set or power amplifier. See subjects 5, 6 and 8 below for method of isolating trouble.

Improper neutralization. This condition is characterized by a tendency of the set to oscillate. See subject 1 under Special Adjustments for method of neutralizing.

g. Improper alignment of tuning condensers. This adjustment requires special attention and IT IS RECOMMENDED THAT YOU CONSULT YOUR DISTRIBUTOR BEFORE MAKING ANY CHANGES IN THE CONDENSER ALIGNMENT.

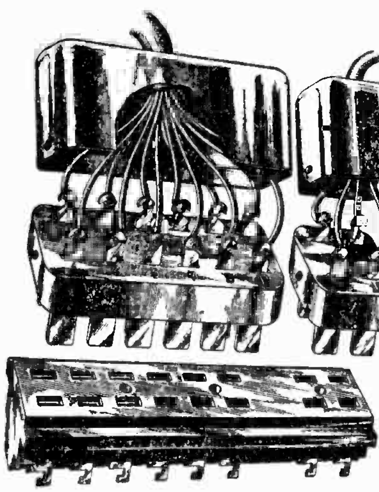


Fig. 8—Multi-Plug Terminals

1. Brown-white tracer—UX-226 Filament
2. Blue—Transfer Switch
3. Brown-white tracer—UX-226 Filament
4. White—Transfer Switch
5. Brown-blue tracer—UY-227 Filament
6. Black-red tracer—Power Switch
7. Brown-blue tracer—UY-227 Filament
8. Black-red tracer—Power Switch
9. Braided Copper Shield—Ground
10. Brown-red tracer—Pilot Lamp
11. Red-yellow tracer—B UX-226
12. Brown-red tracer—Pilot Lamp
13. Red-yellow tracer—Field
14. White—Voice Coil
15. Red-green tracer—Field
16. Black—Voice Coil

6. LACK OF REPRODUCTION—PRELIMINARY TESTS—After it has been definitely determined that the trouble is not due to a faulty tube, antenna or ground, place the instrument in operation with the transfer switch in the "record" position. Note that all tubes are lighted, and that all cables are connected. In the combination models, play a record in the usual manner with the volume control advanced to maximum. On the radio models without Electrola, connect two wires to the terminals of a dry cell or to the 1½ volt terminals of a "C" battery. Touch these wires across the two pin jack terminals marked "Phono," and note any click in the reproducer when this is done. If the record reproduction is correct, or if there is a noticeable click when the pickup pin jack terminals are tested in this manner, the trouble must lie in the radio set, and reference should be made to subject 7 below. If there is no record reproduction, reference should be made to subjects 8 and 9 below. It is recommended that a tube voltmeter, such as shown in Fig. 4 and a Weston or Jewell test box be used for isolating trouble in the radio set.

SOCKET NO.	READING NO SIGNAL	READING WITH SIGNAL
1	.45 Milliamperes	.45 Milliamperes
2	.45 Milliamperes	.50 Milliamperes
3	.45 Milliamperes	.65 Milliamperes
4	.45 Milliamperes	1.80 Milliamperes
5	.45 Milliamperes	4.50 Milliamperes

7. LACK OF REPRODUCTION—RADIO—After definitely determining that the trouble lies in the radio set, make the following tests with the tube voltmeter and test box:

a. Place the transfer switch in the "radio" position.
b. Remove the UY-227 detector tube, and insert the UY adapter in this socket.
c. Remove the tube in socket No. 1, Fig. 5, (coupling stage), place the UX adapter in this socket with the UY-227 in the socket of the adapter. Note the meter reading when all connections are made in accordance with Fig. 4 and no station is being received.
d. Place the UX adapter in socket No. 2, Fig. 5, (1st R. F.), and note a slight increased meter reading when a powerful local station is tuned in. Note: If such a broadcast signal is not available, a modulated oscillator, such as shown in Fig. 6, can be used.
e. Take readings in this same manner for sockets 3, 4, and 5. An additional increase, corresponding to an increase in signal strength, should be noted as readings are taken progressively, from one socket to another. In the first R. F. socket which does not show any further increase in meter reading from that of the preceding socket will be found the source of trouble. These readings are entirely arbitrary and are intended to indicate gain per stage only. They will vary with different stations and with different milliameters. The following is a typical set of readings obtained in this test.

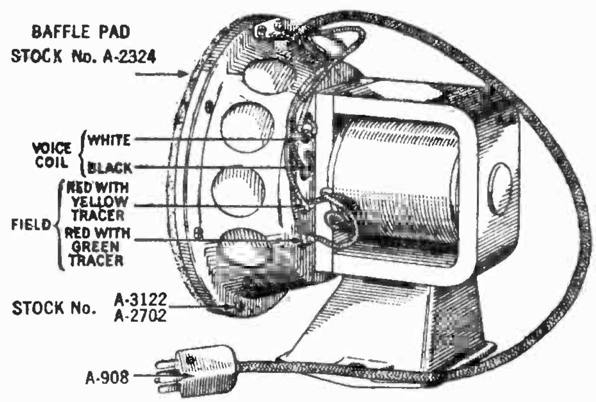


Fig. 12—Terminal Strip and Parts of Electro Dynamic Reproducer

f. After locating the particular stage in which the trouble exists, test with the Weston or Jewell test box to determine the exact location of the faulty part or connection. The "Radio Voltage Tests" table lists the approximate voltage readings which should be obtained in each of the sockets at 110 volts power input and the possible location of the fault if these readings are not obtained.

If the above tests do not locate the trouble the fault must then be caused by improper neutralization, defective volume control, or improper alignment or shorted plates of tuning condensers.

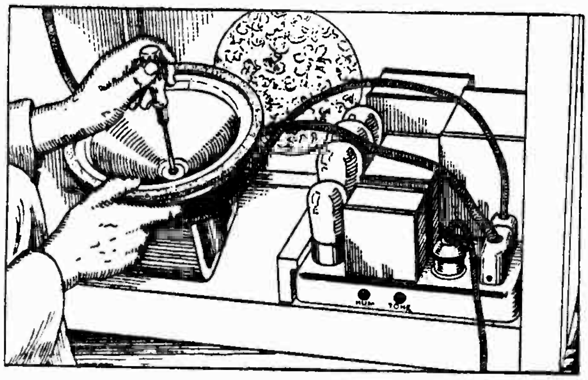


Fig. 13—Centering Cone in Electro Dynamic Reproducer

8. LACK OF REPRODUCTION—SPEAKER—If there is no reproduction on either radio or record, the trouble may be in the field or voice coil or in the cable leads of the speaker. Turn off the power switch, remove the speaker cable plug from the

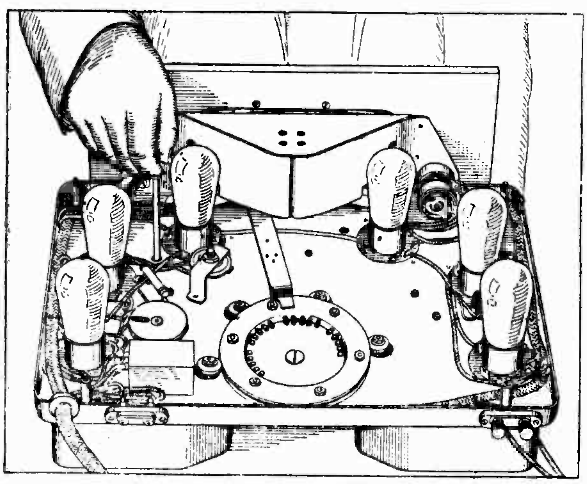


Fig. 14—Method of Neutralizing Victor Radio

POWER AMPLIFIER CONTINUITY TESTS
(Transfer switch in "Radio" position)

TEST BETWEEN TERMINALS	LACK OF VOLTAGE INDICATES
4 and 9	Open record primary of input transformer, 59, Fig. 2.
10 and 12	Open primary of power transformer, 62, Fig. 2.
14 and 16	Open secondary of output transformer, 58, Fig. 2.

amplifier, test for voice coil continuity between terminals 14 and 16 (black and white), and for field continuity between terminals 13 and 15 (red with green tracer and red with yellow tracer).

9. LACK OF REPRODUCTION—POWER AMPLIFIER UNIT—If the speaker has been found correct, the trouble must then lie in the power amplifier unit, which should be tested in the following manner:

a. Make the power-amplifier socket voltage tests with the Weston or Jewell test box. The "Power-Amplifier Voltage Tests" table lists the approximate voltage readings which should be obtained in each of the sockets at 110 volts power input, and the possible location of the fault if these readings are not obtained.

b. If the trouble is not yet located, remove the screws in the metal cap over the terminal connections in the multi-plug, and make the Cable Terminal Voltage Tests with the plug in its socket of the amplifier, and the radio set in operation.

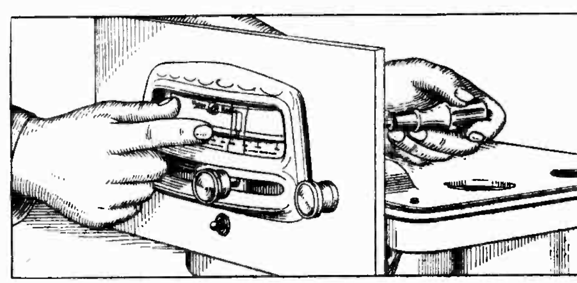
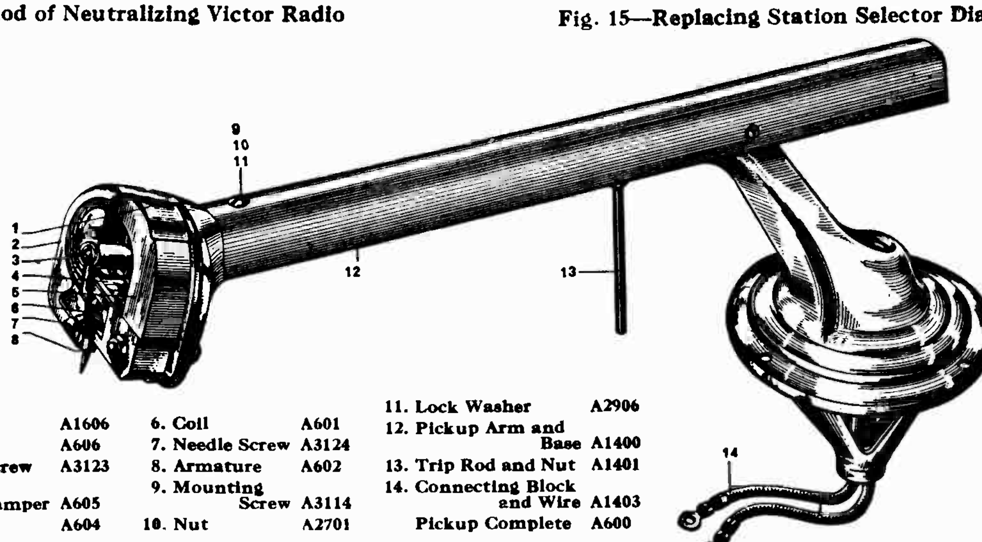


Fig. 15—Replacing Station Selector Dial



1. Spring	A1606	6. Coil	A601	11. Lock Washer	A2906
2. Cover	A606	7. Needle Screw	A3124	12. Pickup Arm and Base	A1400
3. Cover Screw	A3123	8. Armature	A602	13. Trip Rod and Nut	A1401
4. Rubber Damper	A605	9. Mounting Screw	A3114	14. Connecting Block and Wire	A1403
5. Magnet	A604	10. Nut	A2701	Pickup Complete	A600

Fig. 16—Electric Pickup, Pickup Arm, and Base

c. Connect a 4½ volt "C" battery in series with the voltmeter binding posts of the test box, and with the cable plugs disconnected from the amplifier, test between the following multi-plug socket terminals for continuity.

SPECIAL ADJUSTMENTS

1. NEUTRALIZING—Improper neutralization is characterized by oscillation and lack of sensitivity. First be sure that the instrument has a good ground connection, since a poor ground will also cause oscillation. If oscillation still persists, the set should be neutralized in the following manner, using a dummy tube, made by cutting off one of the filament prongs of a UX-226, and a neutralizing screw driver such as Stock No. A6000.

a. Remove the four hex nuts which hold the plate.

b. Tune in a powerful local station, preferably near the high frequency end of the scale. If such a signal is not available, a modulated oscillator, such as shown in Fig. 6, can be used to supply the signal. If the oscillator is used, it should be placed near the radio set and approximately three feet of wire used as an antenna on the set.

c. Remove the UX-226 from the first tuned R. F. stage (socket No. 2, Fig. 5), replace with the dummy UX-226, and adjust the corresponding neutralizing condenser to give minimum signal in the loudspeaker. The volume control may be set to obtain a signal loud enough for accurate neutralization, but not so loud as to cause the minimum to be blurred.

d. Replace the UX-226 in socket No. 2, and repeat the procedure for sockets 3, 4 and 5, adjusting the corresponding neutralizing condenser in each case. After completing the neutralization in this manner, turn back the neutralizing condenser for socket No. 5 approximately ⅛ turn counter-clockwise.

Note:—The first UX-226, antenna coupling stage, is not neutralized.

If the instrument continues to oscillate, it is probable that the condensers are out of alignment. This adjustment requires special attention, and it is recommended that you consult your distributor before making any changes in the setting.

2. CENTERING CONE IN ELECTRO DYNAMIC REPRODUCER—Improper centering of the fabric cone in the speaker is characterized by a noticeable rattle or buzz when the volume control is advanced. Such a rattle can sometimes be traced to faulty tubes in the detector or audio stages; this possibility should first be eliminated before attempting to center the cone. If the voice coil is improperly centered,

a. Remove the two large mounting screws in the base of the speaker and pull the unit away from the front of the cabinet.

b. Place the instrument in operation with the transfer switch in the "record" position.

c. Turn the UX-226 hum control all the way to the right or left to produce a loud 60 cycle hum.

d. Loosen the center screw as shown in Fig. 13, and then re-tighten the screw.

e. Ordinarily, the cone should now be properly centered, which condition can be determined by the sound of the 60 cycle vibration. When the cone is improperly centered, a 60 cycle mechanical buzz will be heard as contrasted with a 60 cycle musical note when the coil is free and properly centered. In some cases it may be necessary to press the outer edge slightly while tightening the center screw in order to obtain proper voice coil clearance.

f. Replace the speaker and re-adjust the UX-226 hum control.

3. REPLACING CLOTH CONE—Should it become necessary to replace the cloth cone because of an open voice coil or other defect, the following procedure should be used:

a. Unsolder the voice coil leads (black and white) from the terminals on the side of the frame.

b. Carefully pull the felt insulating material away from the frame flange.

c. Remove the eight screws which hold the retaining ring against the cone, and also remove the center screw and washer.

d. Remove the retaining ring, and lift the old cone from the unit.

e. Replace with the new cone and assemble in the reverse order from that given above, using Victor turntable cement to fasten the felt to the metal flange.

f. Center the cone as described in subject 2 above.

4. REPLACING AND RE-ADJUSTING SELECTOR SCALE—The following procedure should be used when replacing or shifting the selector scale.

a. Disconnect the cable and wires to the radio set, and remove the set from the cabinet.

b. Insert a screw driver through the holes in the back of the pilot lamp compartment as shown in Fig. 16, and loosen the clamps on the old scale.

c. Remove the old scale, and place the new one in position with the ends under the metal clamps.

d. Before tightening the clamps, tune in a station of known broadcast frequency, and slide the scale slightly to the right or left until the number corresponding to the known frequency of the station is in line with the center mark of the celluloid indicator.

e. Check this position on one or two other stations of known broadcast frequency.

f. Holding the scale in the proper position, re-tighten the screws as shown in Fig. 16.

5. ADJUSTING ELECTRIC PICKUP—Faulty record reproduction with noticeable blasting, particularly on the bass notes, may be caused by worn records, needles, or by improper centering of the pickup armature. If such a condition is traced to improper adjustment of the pickup, the armature should be centered in the following manner:

1. Remove the cover by taking out the needle screw and the cover screw, taking care that the magnet is not pulled away from the assembly.
2. Loosen both round head screws in the armature adjusting plate with a small screw driver.
3. Move the plate until the armature is properly centered between the pole pieces.
4. Hold the plate securely in its centered position, and re-tighten the screws.
5. When certain that the armature is properly centered, replace all parts of the pickup assembly.
6. While making adjustments to the pickup, the lubrication between the pickup arm and base should be checked. Victor Motor Grease should be placed on the bearing surface to insure free motion of the arm.

RADIO VOLTAGE TESTS

NOTE:—The following tests are to be made after determining that the trouble lies in the radio receiver and not the power amplifier unit as described in subject 6 above.

TEST	SOCKET NO.	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
Filament	1	1.40 Volts A. C.	Poor socket contact, broken connection, shorted condenser, 10, Fig. 1.
	2	1.40 Volts A. C.	
	3	1.40 Volts A. C.	
	4	1.45 Volts A. C.	
	5	2.1 Volts A. C.	
	6	1.50 Volts A. C.	
Plate	1	105 Volts D. C.	Poor socket contact; broken connection; open 20 ohm resistor, 43, Fig. 1; open grid bias resistor, 44, Fig. 1; shorted condenser, 10, Fig. 1; open primary R. F. transformer; shorted neut. condenser open R. F. choke, 22, Fig. 1; faulty transfer switch; shorted .001 mfd. condenser, 15, Fig. 1.
	2	105 Volts D. C.	
	3	105 Volts D. C.	
	4	105 Volts D. C.	
	5	40 Volts D. C.	
	6	105 Volts D. C.	
Grid	1	9 Volts D. C.	Poor socket contact; broken connection; open 20 ohm resistor, 43, Fig. 1, across filament UX-226; open grid bias resistor, 44, Fig. 1; shorted condenser, 10, Fig. 1; open secondary R. F. transformer; shorted neut. condenser; faulty volume control and R. F. choke, 42 and 46, Fig. 1.
	2	9 Volts D. C.	
	3	9 Volts D. C.	
	4	9 Volts D. C.	
	5	0 Volts D. C.	
	6	9 Volts D. C.	

POWER AMPLIFIER VOLTAGE TESTS

TEST	SOCKET	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
Filament	UX-226	1.40 Volts A. C.	Poor socket contact; broken connection; defective UX-226 (ampl.) filament winding of power transformer, 57, Fig. 2.
	UX-245	2.2 Volts A. C.	Poor socket contact; broken connection; defective UX-245 filament winding of power transformer, 57, Fig. 2.
	UX-280	4.6 Volts A. C.	Poor socket contact; broken connection; defective UX-280 filament winding in power transformer, 57, Fig. 2.
Plate	UX-226	100 Volts D. C.	Low emission UX-280; poor socket contact; broken connection, open primary, interstage transformer, 58; defective voltage divider resistor, 60; shorted condenser in condenser bank, 56; open filter choke, 55; open or poor connection in UX-226 hum control 68, Figs. 2 and 3.
	UX-245	230 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open primary, output transformer, 58; open filter choke, 55; shorted condenser in condenser bank, 56; defective voltage divider resistor, 60, Figs. 2 and 3.
Grid	UX-226	6 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open secondary, input transformer, 59; defective voltage divider resistor, 60; poor or open contact in UX-226 hum control, 681 shorted condenser in condenser bank, 56, Figs. 2 and 3.
	UX-245	40 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open secondary, interstage transformer, 58; defective voltage divider resistor, 60; shorted condenser in condenser bank, 56, Figs. 2 and 3.

CABLE TERMINAL VOLTAGE TESTS

TEST BETWEEN TERMINALS	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
1 and 3	1.70 Volts A. C.	Broken connection; defective UX-226 (radio) secondary winding of power power transformer, 57, Fig. 3.
5 and 7	2.35 Volts A. C.	Broken connection; defective UY-227 secondary winding of power transformer, 57, Fig. 3.
2 and 9	39 Volts D. C.	Defective UX-280; broken connection; open radio primary, input transformer, 59, open filter choke; 61, defective voltage divider resistor, 60, shorted condenser, 56, Figs. 2 and 3.
9 and 11	105 Volts D. C.	Defective UX-280; broken connection; defective voltage divider resistor; open choke 61; shorted condenser, 56, Figs. 2 and 3.
13 and 15	185 Volts D. C.	Low emission UX-280; poor socket contact broken connection; open choke, 61, defective voltage divider, 60; shorted condenser in condenser bank, 56, Figs. 1 and 2.

VICTOR MICRO-SYNCHRONOUS RADIO
R-35, R-39, RE-57

The new Victor Micro-Synchronous Radio is a screen grid five circuit tuned radio frequency receiver of the antenna type. It employs three stages of tuned radio frequency amplification and a power detector, all of which are screen grid Radiotrons UY-224. A UY-227 Radiotron is used as a first stage audio amplifier, resistance coupled; two UX-245's are used in the push-pull power amplifier stage, and a UX-280 as rectifier.

Through the use of the screen grid Radiotrons, which produce an extremely high degree of amplification, and the five circuits, tuned with the micro-synchronous principle, extremely high sensitivity and selectivity are obtained without sacrifice of tone quality.

Both the radio and the combination instruments contain two standard interchangeable units. The radio chassis contains the r. f. amplifiers, the power detector, and the first audio amplifier. The amplifier-speaker unit contains the push-pull stage of audio amplification, the rectifier-power supply, and the new Victor electro-dynamic speaker.

The Victor Micro-Synchronous Radio is designed for operation on 105 to 125 volts, 50 to 60 cycles, alternating current. Special instruments are also available for 25 to 30 cycle operation.

Models R-35 and R-39 consume a maximum power of 120 watts, and the RE-57 a maximum of 170 watts when operating the Electrola.

RADIO CHASSIS PARTS

Radio Chassis Complete

Name of Part

1. Cam wheel cover plate
2. Cam wheel cover plate screw
3. Filter coil and condenser shield
4. Filter coil shield eyelet screw
   Filter coil shield eyelet screw rivet*
5. Filter coil shield nut
   Filter coil shield lockwasher*
6. Condenser shield (4 used)
7. Escutcheon panel (less dial)*
   Escutcheon panel bracket (R.H.)*
   Escutcheon panel bracket (L.H.)*
   Escutcheon panel bracket rivet*
8. Pilot lamp shield
9. Condenser shield (1 used)
10. 1st R.F. Coil
11. Coil shield base rivet
12. Coil shield base (4 used)
13. Antenna coupling coil
14. Twin binding post (ant. & grd.)
15. Coil mounting screw
    Coil mounting lockwasher*
    Coil mounting nut*
16. Cam roller shaft
    Cam roller shaft "C" washer*
17. Cam wheel (complete)
    Cam wheel indicator bracket rivet*
    Cam wheel and clamp indicator*
18. Cam wheel adjusting screw
19. Cam wheel plate
20. Cam wheel plate screw
21. Pilot lamp socket
    Pilot lamp*
22. Link coil
23. UY-224 tube socket (4 used)
24. UY-224 tube socket clip rivet
25. UY-224 grid connector
26. Filter coil and condensers
    Filter coil condenser (2 used)*
    Filter coil mounting screw*
    Filter coil mounting nut*
    Filter coil mounting lockwasher*
27. 5 contact terminal strip
28. 5 contact terminal strip rivet
    5 contact terminal strip link*
    (2 used on straight radio models)
    5 contact terminal strip screw*
29. 3rd R.F. Coil
30. Tube shield base (4 used)
31. Tube socket clip (4 used)
32. Tube shield body (4 used)
33. Coil shield body (4 used)
34. Tube shield cap (4 used)
35. Coil shield cap (4 used)
36. Escutcheon panel screw
    Escutcheon panel nut*
    Escutcheon panel lockwasher*

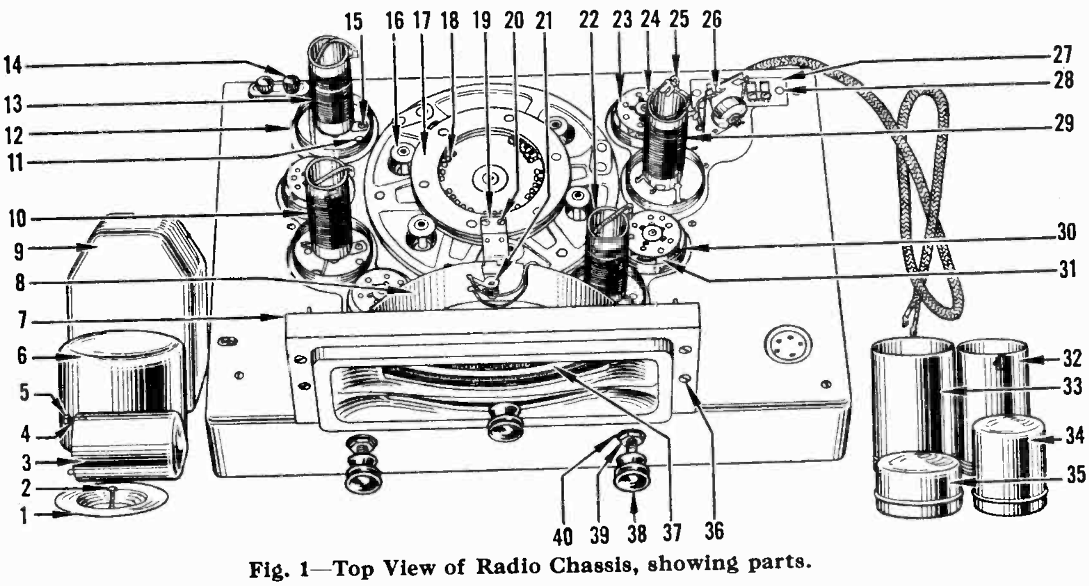


Fig. 1—Top View of Radio Chassis, showing parts.

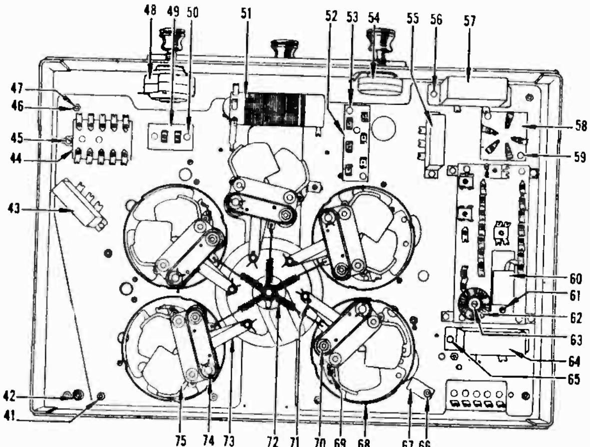


Fig. 2—Bottom View of Radio Chassis, showing parts.

RADIO CHASSIS PARTS—Continued

Name of Part

37. Dial scale
 Dial clamp*
 Dial clamp wood screw*
 Dial clamp washer*
38. Wood knob (all except receiver tuning)
 Wood knob (receiver tuning)*
39. Tone and volume control nut
40. Tone and volume control washer
 Tone and volume control locking plate*
 Tone control washer*
41. Twin binding post lockwasher
42. Twin binding post nut
43. By-pass condenser, three units of .1 mfd. each with common ground
 By-pass condenser rivet*
44. Stabilizing inductor (complete)
 Resistor (9000 ohms) (brown & blue)*
 Resistor (130 ohms) (blue & gray)*
45. Stabilizing inductor mounting screw
 Stabilizing inductor mounting lockwasher*
 Stabilizing inductor mounting nut*
46. Mounting plate nut
47. Mounting plate screw
 Mounting plate lockwasher*
48. Volume control (complete less knob)
49. 2 contact terminal strip
50. 2 contact terminal strip rivet
51. 2nd R.F. Coil
 10 mmf. Condenser
52. 6 contact terminal strip
53. 6 contact terminal strip rivet
54. Tone control (complete less knob)
55. By-pass condenser (3 units of .1 mfd. each with common ground)
 By-pass condenser rivet*
56. By-pass condenser rivet
57. 1.0 and .1 mfd. by-pass condenser
58. 1st A.F.[tube socket (complete)
59. 1st A.F. tube socket rivet
60. .01 mfd. resistor board condenser
61. .01 mfd. resistor board condenser rivet
62. Resistor board coil
63. Resistor board coil rivet
 Resistor board condenser "AC" 100 MMF*
 Resistor board condenser "AD" 1200 MMF*
 Resistor board rivet*
 1½ Meg resistor (red & white)* under res. bd.
 1 Meg resistor (green & white)* under res. bd.
 ½ Meg resistor (blue & green)* under res. bd.
 2800 ohm resistor (blue & white)* under res. bd.
 28000 ohm resistor (buff & brown)* under res. bd.
64. .25 and .75 mfd. by-pass condenser
65. .25 and .75 mfd. by-pass condenser rivet
66. Cable clamp nut
 Cable clamp screw*
 Cable clamp lockwasher*
67. Cable clamp
68. Condenser shield base
69. Condenser shield base rivet
70. Cam roller shaft nut
 Cam roller shaft washer*
 Cam roller shaft lockwasher*

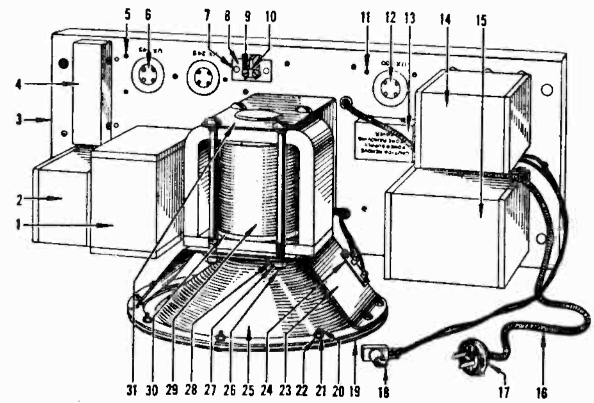


Fig. 3—Top View of Amplifier-Speaker Unit, showing parts.

RADIO CHASSIS PARTS—Continued

Name of Part

71. Cotter pin
 Washer (between condenser links)*
 Washer (on top of condenser links)*
 Condenser spacer washer*
72. Condenser spring (spiral)
73. Condenser link (one piece) Bakelite
 Condenser link rivet*
 Condenser link bushing*
74. Condenser washer
 Condenser cotter pin
75. Tuning condenser (one complete)

AMPLIFIER-SPEAKER PARTS

Name of Part

 Victor Amplifier with Speaker (60 cycle)
 Victor Amplifier with Speaker (25 cycle)
 Victor Electro Dynamic Speaker (only)
1. Condenser Bank
 Extra condenser for 25 cycle only*
2. Interstage & Output Transformer
3. Amplifier Base
4. Terminal strip cover
5. UX-245 Tube socket rivet
6. UX-245 tube socket (2 sockets complete)
7. Two contact terminal strip rivet
8. Two contact terminal strip (complete)
9. Terminal strip screw (2 used)
10. Terminal strip link
11. UX-280 tube socket rivet
12. UX-280 tube socket (complete with terminal board)
13. Fuse Cover
 Fuse Cover insulation*
 Fuse cover bushing*
 1½ amp. fuse*
14. Reactor
15. Power transformer (60 cycle, 120 volt)
 Power transformer (25 cycle, 120 volt)
16. Amplifier power cord (with male connector)
17. Power cord male connector
18. Toggle switch (complete with nuts)
19. Speaker cone retaining ring
20. Speaker cone retaining ring screw
21. Speaker cone retaining ring nut
22. Speaker cone retaining ring lock washer
23. Speaker cone housing
24. Cone housing terminal strip
25. Speaker cone
26. Speaker bolt
27. Speaker nut
28. Speaker lock washer
29. Speaker field coil
30. Speaker felt spacing ring
31. Speaker base
32. Resistor 730 ohms (UX-245 grid bias)
33. Resistor rivet
 Resistor wood spacer*
34. Resistor (UX-245 filament center tap) 55 ohms
35. Eight contact terminal strip
36. Eight contact terminal strip rivet
37. Resistor (8000 ohms) (gray & brown)
38. Wood End

*Not illustrated

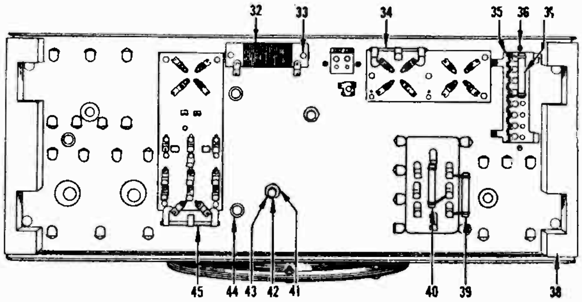


Fig. 4—Bottom View of Amplifier-Speaker Unit, showing parts.

AMPLIFIER-SPEAKER PARTS—Continued

Name of Part

Wood end wood screw*
39. Resistor (8000 ohms) (gray & brown)
40. Resistor (70,000 ohms) (red & green)
41. Speaker mounting nut
42. Speaker mounting screw
43. Speaker mounting lock washer
44. Insulation bushing
45. Resistor (UY-224 filament center tap) 55 ohms
Speaker cone center screw*
Speaker cone center washer*
Amplifier mounting screw*
Amplifier mounting nut*
Amplifier mounting lock washer*
Amplifier mounting plate*

*Not Illustrated

INSTALLATION

1. ANTENNA AND GROUND—A good antenna and ground installation is most essential to the correct performance of the instrument. The antenna should be from 30 to 100 feet long, depending upon the proximity to nearby powerful stations. It should be as high above ground or the roof as possible, and should be held at both ends with good quality glass or porcelain insulators. The ground wire should be connected to a well scraped section of a water pipe. If such a connection is not available, a hot water or steam radiator pipe will be satisfactory.

A good ground connection is essential and must be used at all times.

If the instrument is being connected to an antenna and ground installation which was used with a previous set, make a careful inspection of all lead-in and ground wires and connections to see that they are properly insulated and free from broken or corroded joints. Check the lightning arrestor, making sure that it is not grounding the antenna. This can best be accomplished by using a "C" battery in series with a low range voltmeter (see Fig. 11). With the antenna and lead-in wires disconnected from the arrestor, there should be no continuity between the antenna and ground terminals of the lightning arrestor.

2. POWER LINE VOLTAGE—The power line voltage should be measured with an A.C. voltmeter at the time of installation. If the voltage is consistently below 115 volts, turn off the power, pull out the power plug, remove the metal cover over the fuse in the amplifier unit (see 13, Fig. 3), and change the fuse position to the 110 volt side. If the voltage is 115 volts or above, the fuse should be left in the 120 volt position. If the voltage is above 125 volts, a good grade self adjusting voltage regulator, such as the Amperite 9-V-10, or a tapped resistor such as stock No. A310, should be connected in one side of the power line. If the voltage fluctuates badly, it is essential that the self adjusting voltage regulator be employed.

3. LOCATION IN ROOM—When installing the instrument, it should be so located in the room that it will face the length of the room rather than the width. The back of the cabinet should be at least four inches away from the wall. Best acoustic results will be obtained if these suggestions are followed.

GENERAL TESTS

1. EXCESSIVE HUM—This condition can be caused by—

a. Faulty UY-224 in detector socket. (See Fig. 5 for location of various sockets.) At least one UY-224 out of the four will usually be found which will produce a minimum hum in the detector socket.
b. Faulty UX-280 or UY-227.
c. Unbalance in plate currents of two UX-245 Radiotrons. Try a new UX-245 first in one socket and then the other.
d. Wire or terminal grounded to chassis, or open circuit in any of the various ground connections to chassis.
e. Open or shorted center tap resistor in amplifier unit. (Shown at 34 and 45, Fig. 4.)
f. Short or partial short in one of the resistors, mounted on the under side of the resistor board. (See Fig. 18 for proper resistance values.)
g. Shorted or open condenser in condenser bank or faulty connection to condenser bank 1, Fig. 3 and Fig. 15.
h. Defective UX-280 socket—one plate not making contact.
i. Faulty connection to tapped section of filter reactor, 14, Fig. 3.

2. HOWL—Microphonic howl may be caused by—

a. Defective Radiotron, particularly in the detector or first audio sockets.
b. Speaker not properly felt insulated from baffle on front of cabinet. Raise the amplifier—speaker unit to obtain access to the felt and readjust the felt properly, making sure that the rim of the speaker is tight against the felt.

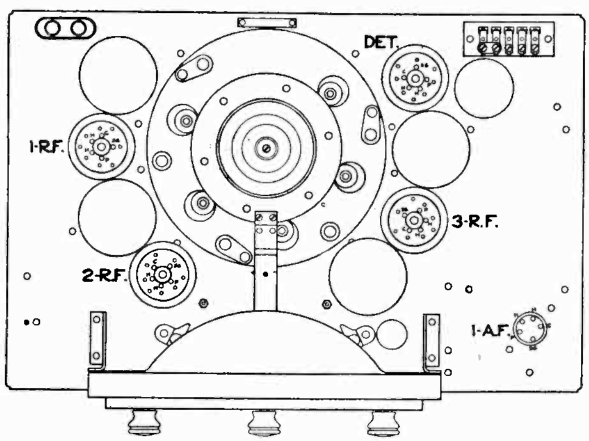


Fig. 5—Location of Radiotron Sockets in Radio Chassis.

c. Loose metal parts such as shields, screws, etc., or an improperly centered cône may set up a howl or mechanical rattle, depending upon the nature of the fault. See subject 2 under Special Adjustments for the proper method of centering cone.
d. On home recording, an open in either of the resistors of the microphone reactor, Fig. 19, may cause a howl.

3. DISTORTION—Distortion may be caused by—

a. Tone control knob turned too far to the left.
b. Radio volume control advanced too far to the right on local stations, causing overloading of the detector. The customer should be thoroughly instructed on this point, as well as on the importance of tuning exactly to the station.
c. Faulty Radiotron, particularly in the audio amplifier sockets. For best quality reproduction, the plate currents of the two UX-245's should balance within 5 milliamperes. This test can be made with a Weston Test Box or similar radio set analyzer.
d. Cone in speaker unit improperly centered. See subject 2 under SPECIAL ADJUSTMENTS, page 31.

4. EXCESSIVE NOISE—Excessive Noise may be caused by some external source, or it may be within the set. If the noise stops or is reduced when the antenna is disconnected, it will be known that the source is external, being caused by defective electrical or power equipment of some kind. If there is no apparent change when the antenna is disconnected, the cause may be:

a. Intermittent short or high resistance contact in any of the soldered joints or in the power switch connections.
b. Loose or defective pilot lamp or pilot lamp socket.
c. Shorted plates in one or more of the tuning condensers. This will be most noticeable when the tuning lever is operated, and should be corrected by replacing the faulty condenser.
d. Faulty power or audio transformer.
e. Intermittent short on filter or by-pass condensers.

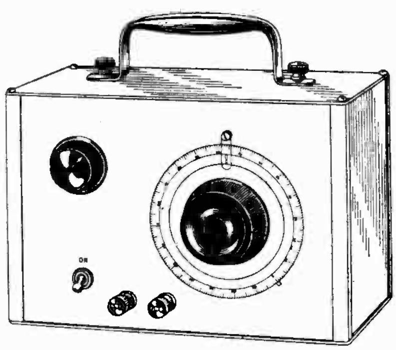


Fig. 6—Victor Oscillator.

5. OSCILLATION—Oscillation in the radio set, characterized by a generally unstable condition while tuning, may be caused by—

a. Ungrounded or poorly grounded chassis. A good ground connection as described on page 8 is essential even for local reception.
b. Removal of shielding from any of the condensers, coils or tubes.
c. Too much unshielded exposure of green lead between control grid of UY-224 and coil. The unshielded portion of this wire should be as short as possible.
d. Open circuit in any of the .1 Mfd. by-pass condensers 43 and 55 Fig. 2, or poor ground (loose rivet) in any of these condensers.
e. Ungrounded shield on shielded lead of radio chassis.

6. WEAK RECEPTION—This condition may be traced to—

a. Faulty antenna characterized by weak reception, intermittent reception, or a grating noise. Examine the antenna for poor connections, poor contacts, grounded lightning arrestor or antenna contact with surrounding objects.
b. Faulty ground connection, characterized by weak reception, intermittent reception, grating noise, or oscillation. Examine the ground wire for poor contact at the ground binding post connection, poor soldered connections, corroded connections at ground clamp.
c. Low power line voltage. Test the line voltage at the power outlet by means of an A.C. voltmeter of the proper range. The voltage should be within the range of 105 to 125 volts with the instrument in operation. The position of the fuse is important in this respect. For 105 to 115 volts, the fuse should be placed in the 110 volt position) between 115 and 125 volts, in the 120 volt position.
d. Low emission Radiotron in any of the various sockets.

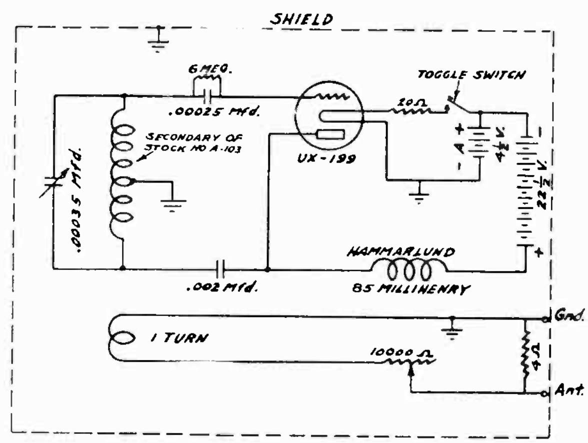


Fig. 7—Wiring Diagram of Victor Oscillator.

e. Defect in radio chassis or in amplifier-speaker unit. See subjects 7 and 8 below for method of isolating trouble.
f. Improper alignment of tuning condensers. This adjustment requires special attention and equipment. See subject 1, page 29, under SPECIAL ADJUSTMENTS for the proper method of re-aligning.

7. FAILURE IN RADIO OPERATION—PRELIMINARY TESTS—The most probable causes for failure in operation are—

a. No power from power supply line. See that the power plug is plugged into the wall socket, and that it is making proper contact. See that the instrument power switch is making proper contact.
b. Open fuse in amplifier-speaker unit. Pull out wall plug, turn off switch, remove fuse cover, and examine fuse: if necessary make a continuity test with a D. C. voltmeter and a 4½ volt "C" battery in series as shown in Fig. 11.

IMPORTANT:—The insertion by mistake of a UX-245 in the UX-280 socket, or of the UX-280 in a UX-245 socket will cause the fuse to burn out.

c. Faulty antenna or lead-in connection. See the discussion of this subject under INSTALLATION, page 8.
d. Defective Radiotron. Examine all Radiotrons, noting that they light properly. If visual examination does not reveal the faulty Radiotron, replace each one successively with a new tube of the proper type until operation is restored.
e. Poor contact in Radiotron socket or in grid cap connections. Move each Radiotron in and out of its socket in order to locate any loose socket contacts. In some cases it may be necessary to remove the Radiotrons and clean the contact pins. See that the control grid clip attached to a green wire is making proper contact to the cap on top of each UY-224 Radiotron. Also see that the wire is properly connected from the clip to the associated coil.

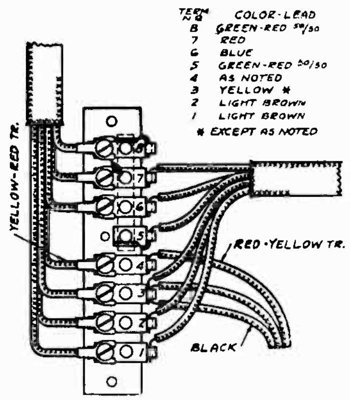


Fig. 8—Top View of Amplifier Terminal Strip.

CAUTION:—When replacing coil or tube shield caps, always be sure that the slots are aligned with the green wire before the cap is forced into position. To avoid damage to the wire or coil, never turn the cap once it is in place.

Before attempting to locate the trouble in the chassis or the amplifier, make sure that the difficulty is not traceable to any of the points listed above.

8. LOCATING TROUBLE—Trouble in the radio chassis or the amplifier-speaker unit can be isolated in the following manner:—

a. ***Terminal Strip Tests.*** **Test the voltages at the terminal strip, Fig. 8, with all tubes in place and compare the readings with those listed in chart No. 1 on page 15. This will tell in a general way if the proper voltages are being delivered to the chassis from the amplifier.**

Touch a wire across terminals 4 and 6 of the amplifier terminal strip as shown in Fig. 8. If there is a noticeable click in the speaker as this is done, it will be known that the audio amplifier and speaker system is functioning properly.

If the terminal voltages obtained are not in accordance with those listed in chart No. 1, disconnect all terminals from the terminal strip and make the terminal strip voltage tests in accordance with chart No. 2. If the voltages obtained are in approximate agreement with those listed in chart No. 2 and the click test described in the previous paragraph indicates

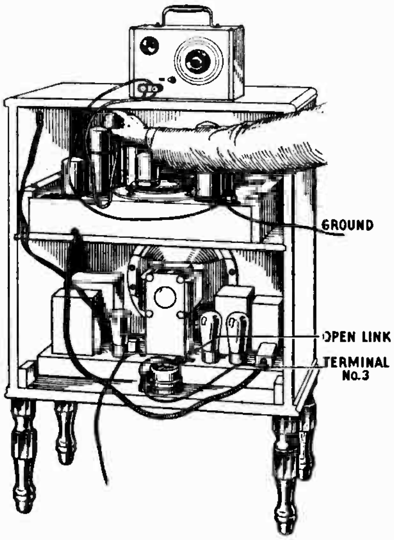


Fig. 9—Using Exploring Coil for Circuit Tests.

that the amplifier and speaker are operating correctly, it will be known that the trouble lies within the radio chassis. If the voltages do not agree with chart No. 2, the trouble must then be in the amplifier unit.

b. ***Radio Chassis Tests with Test Box.*** **If the fault is in the radio chassis, replace the terminal strip connections and check the voltages in the various sockets by means of a test box such as the Weston 547 or equivalent. Average voltage readings and possible causes of improper readings are listed in chart No. 3 page 16.**

c. ***Radio Chassis Tests with Exploring Coil and Oscillator.*** **If an oscillator such as shown in Fig. 6 and a 0-4 volt A. C. voltmeter (in Weston 547) are available, a quick and simple test can be made to locate any defect in the R. F. circuit between the detector and the antenna binding post. An exploring coil is used, consisting of several turns of No. 18 insulated solid copper wire fitted into a UY-227 tube shield, stock No. A2319. The shield is equipped with a set of antenna and ground binding posts as shown in wiring diagram, Fig. 10. One end of the coil is connected to the "ANT." post and the other end is left disconnected. The "GND." post is grounded to the shield. The meter is connected to terminal 3 of the amplifier terminal strip, Fig. 8, and to the link terminal on the amplifier base, nearer the UX-245 Radiotron. The link is left disconnected.**

With the power turned on, if the shield cap is removed from any of the R. F. tubes and the exploring coil brought over the tube and the set then tuned to the frequency of the oscillator, the oscillator signal will be induced into the grid of that tube and will be indicated on the voltmeter, providing all tubes and circuits, including and beyond the particular stage under test, are functioning properly.

(1) Set the oscillator and radio volume controls at maximum, remove the shield cap from the third R. F. tube (see Fig. 9) and place the exploring coil over this tube. If a readable signal is indicated on the A.C. voltmeter, it will be known that the third R. F. and the detector tubes are O. K., that the grid circuits of the two are correct, and the plate circuit of the third R. F. is correct. If no readable signal is obtained, however, it will be known that a defect such as an open or short circuit or a faulty tube exists at some point in the circuits or tubes just mentioned. Such defects can be isolated by replacing the tubes in question and then by making the voltage tests as described in b. above.

(2) If the third R. F. tests O.K., replace the shield cover over this tube and then make a similar test on the second R. F. An increased meter reading will be obtained, as indicated in the tabulation below, if this circuit is O.K. If no meter reading is obtained, however, it will be known that the second R. F. tube, the plate or grid circuit of this tube, or the link circuit is not functioning correctly. Again the defect can be isolated by replacing the tube in question and by testing the voltages in the tube sockets.

0-4 SCALE

Det.	0.0
3rd R. F.	1.1
2nd R. F.	2.0
1st R. F.	2.6
Ant. Binding Post	2.6

(3) A lack of reading when the exploring coil is placed over the first r. f. tube will indicate a poor r. f. tube or faulty connection either in the secondary of the antenna coupling coil, or in the plate circuit of the first r. f. tube. To test the circuit between the antenna binding post and the primary of the antenna coupling coil, it will be necessary to disconnect the oscillator leads from the exploring coil, and connect them direct to the antenna and ground binding posts.

(4) After a number of such readings have been taken on good sets, a knowledge of the approximate gain per stage with the particular oscillator being employed will be obtained. A lower gain in any particular stage than that which should be expected will indicate a low emission tube or improper alignment of the tuning condensers, which latter adjustment is described in Subject 1 under SPECIAL ADJUSTMENTS, page 29.

d. ***Amplifier Speaker Test.*** **If it is found in "a" above that the source of trouble is in the amplifier unit, make the socket voltage tests of the UX-245 and UX-280 sockets by means of the test box. The average voltages and possible causes of trouble for incorrect voltages are listed in chart No. 4.**

If the socket voltages are correct, shut off the power switch, disconnect amplifier-speaker unit, remove it from the cabinet and make the continuity tests with a D.C. voltmeter and a 4½ volt "C" battery in accordance with chart No. 5. A more accurate test can be made with the Weston No. 547 test box by changing the voltmeter readings to ohms resistance in accordance with the conversion chart accompanying the test box.

Explanation of Charts:—All tests made with Weston No. 547 Radio Set Tester. Power line voltage 110 volts, 60 cycle, A.C. volume control at maximum in all cases.

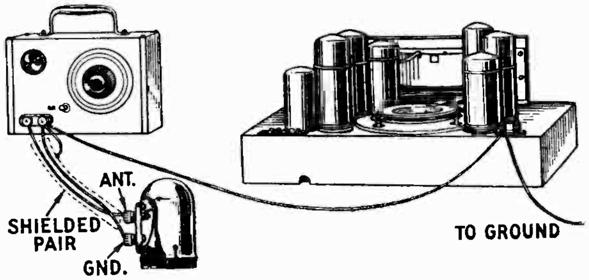


Fig. 10—Wiring for Exploring Coil Tests.

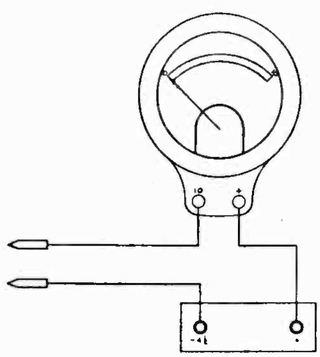


Fig. 11—Wiring Diagram Simple Continuity Test Circuit.

CHART No. 1

Amplifier Terminal Strip

(CAUTION—High Voltage)

TEST ACROSS AMPLIFIER TERMINALS	VOLTAGE SUPPLY	NORMAL VOLTAGE
1 and 2	UY-224 and UY-227 Filament	2.4 Volts A.C.
3 and 7	UY-224 Plate	170 Volts D.C.
3 and 6	UY-227 Plate	65 Volts D.C.
3 and 8	Screen Grid	89 Volts D. C.

CHART No. 2

Amplifier Terminal Strip with Radio Chassis Disconnected

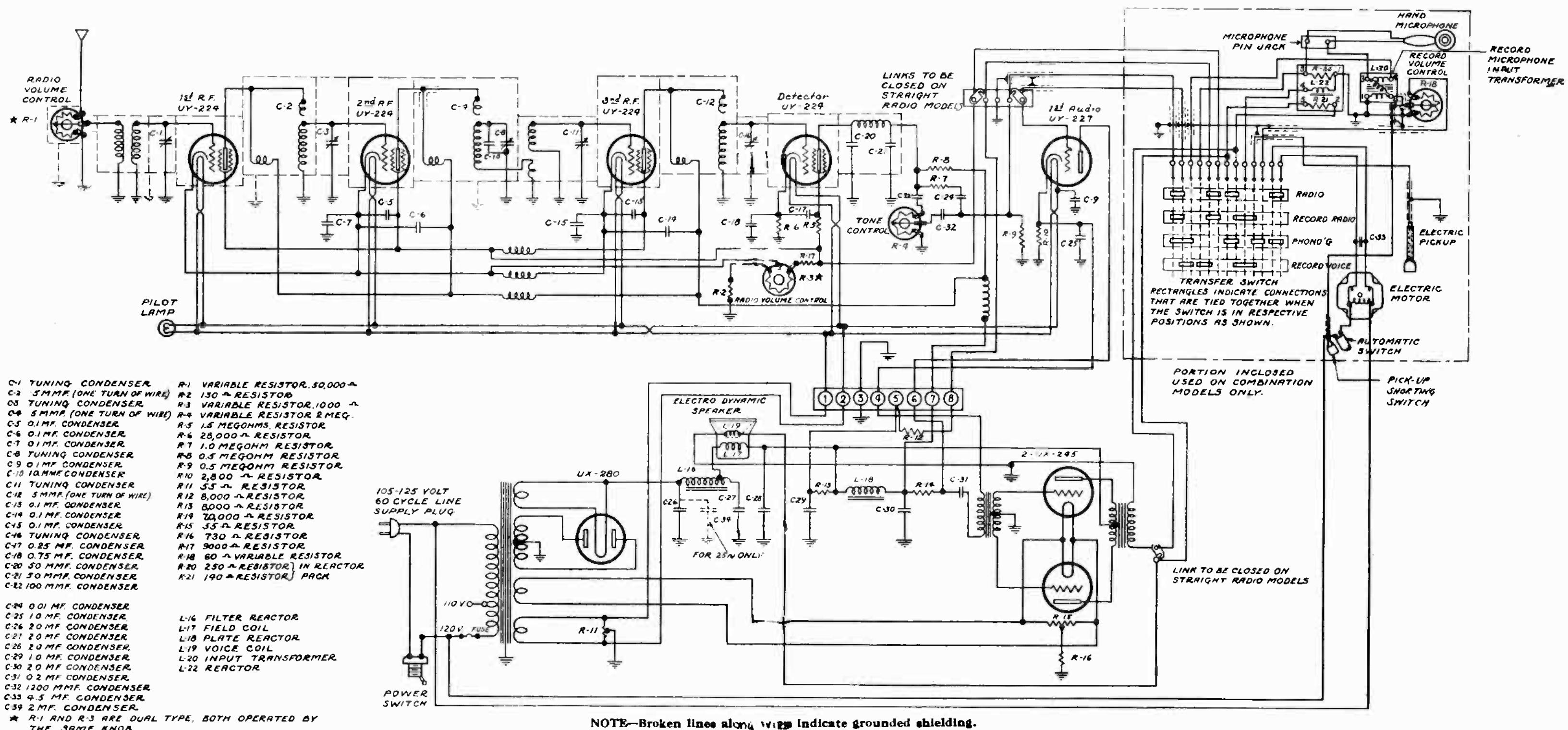
(CAUTION—High Voltage)

TEST ACROSS AMPLIFIER TERMINALS	VOLTAGE SUPPLY	NORMAL VOLTAGE
1 and 2	UY-224 and UY-227 Filament	2.6 Volts A.C.
3 and 7	UY-224 Plate	300 Volts D.C.
3 and 6	UY-227 Plate	275 Volts D.C.
3 and 8	Screen Grid	295 Volts D.C.

CHART No. 3
Radio Chassis Tube Socket Tests

TEST	SOCKET NUMBER	TUBE	NORMAL VOLTAGE	NORMAL CURRENT	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
Filament "A"	1 2 3 4 5	UY-224—1st R. F. UY-224—2nd R. F. UY-224—3rd R. F. UY-224—Detector UY-227—1st Audio	2.1 2.1 2.1 2.0 2.1		Open or shorted wire or contact in filament supply.
Plate "B"	1 2 3 4 5	Same as above	173 173 173 50* 67	3.1 3.1 3.1 .3 1.5	Open or grounded wire or contact in plate supply. Open plate coil 44, Fig. 2) short in any of the by-pass condensers 43, 55, 57, 60, 64, Fig. 2. Open or shorted resistor board (see Fig. 18). Open in plate winding of any of the R. F. coils. Short between plate and grid section of R. F. coils. On detector, open or shorted plate filter 26, Fig. 1) open choke 62, Fig. 2) open .5 meg. resistor, Fig. 18.
Control Grid "C"	1 2 3 4 5	Same as above	3.1 3.1 3.1 1.5 .2		Open or shorted wire or contact in grid voltage supply. Open or ungrounded R. F. coil, Fig. 1. Open or shorted resistor on resistor board (see Fig. 18). Open in control grid section of volume control. Any defect listed above which would cause an abnormal plate voltage would also cause an abnormal grid voltage. On UY-227 an open link in radio terminal strip (radio only) or open in wiring or poor contact in control switch (combination).
Screen Grid	1 2 3 4	Same as above	89 89 89 3.4		Open or shorted wire or contact in screen grid voltage supply. Open link in radio terminal strip (radio only) or open in wiring or poor contact in control switch (combination). Open in coil 44, Fig. 2. Any defect listed above which affects plate and control grid voltages will also affect the screen grid voltages.

*250 V Scale



NOTE—Broken lines along wires indicate grounded shielding.

Fig. 12—Schematic Wiring Diagram Victor Mico-Synchronous Radio, Models R-35, R-39, and RE-57.

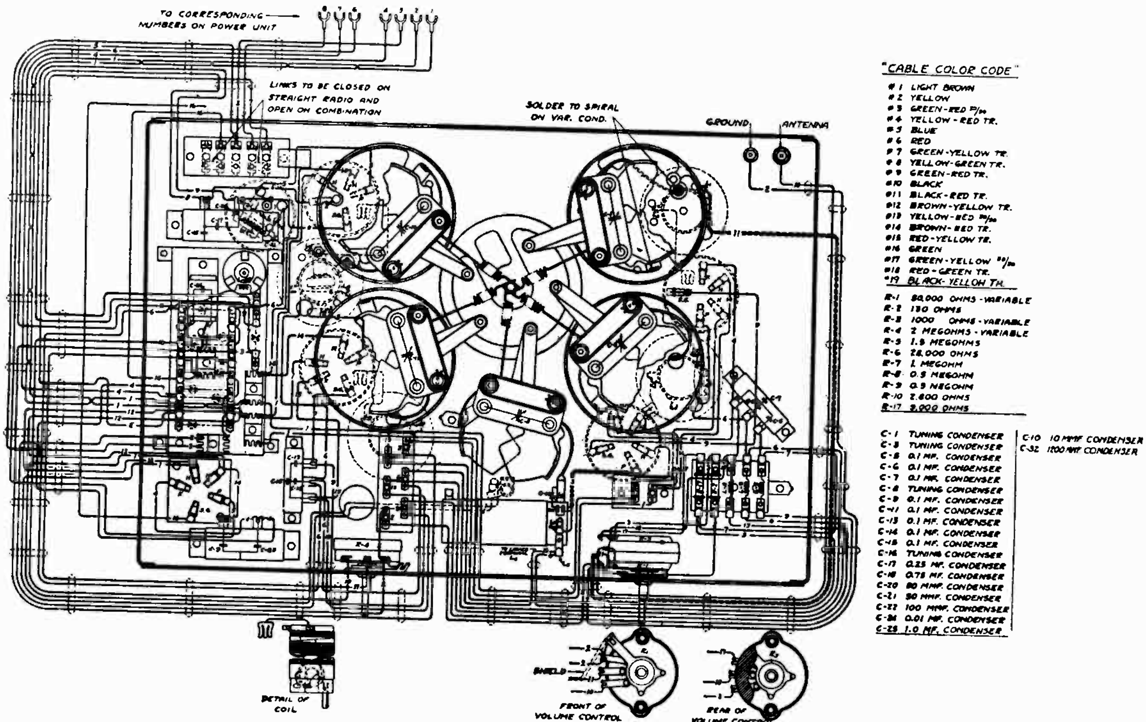
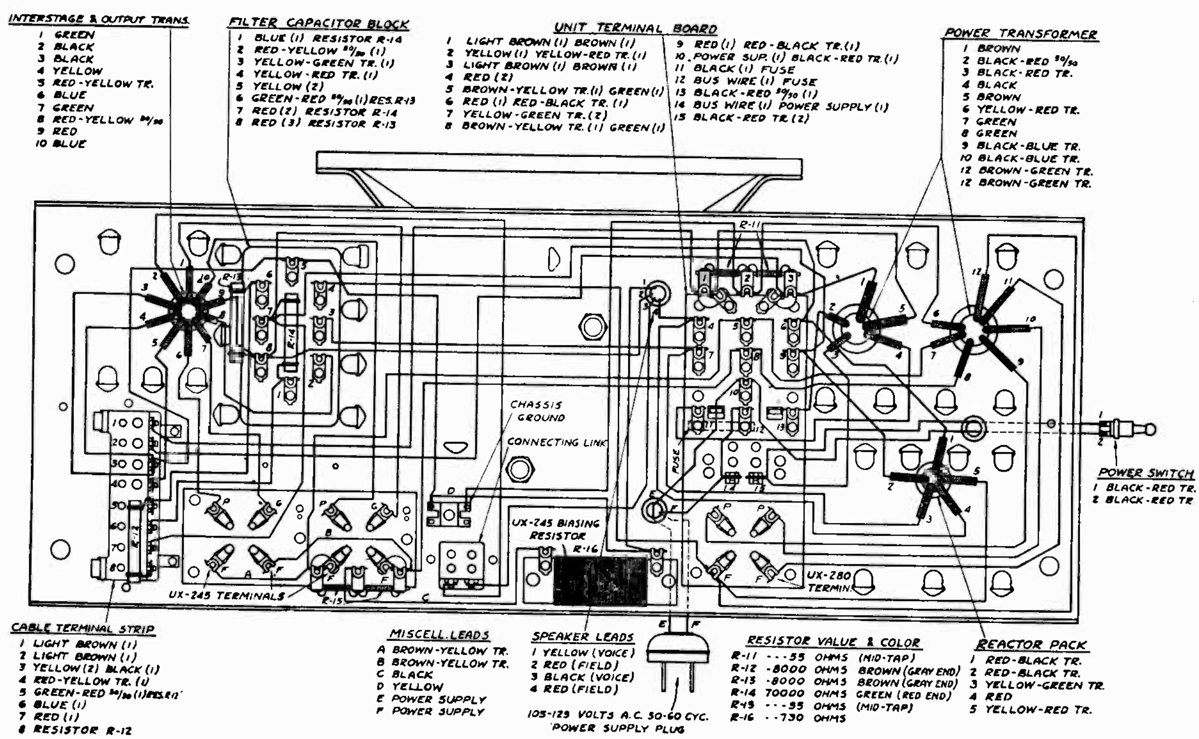


Fig. 13—Bottom View of Radio Chassis, Showing Wiring Between Terminals.

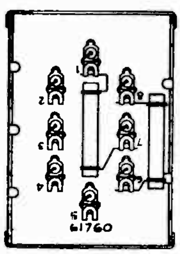


NOTE:—Filter Condenser Bank and Cable Terminal Strip are the only parts having numbers. All other numbers are given for reference only.

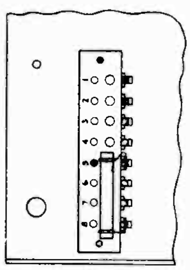
Fig. 14—Bottom View of Amplifier-Speaker Unit, showing Wiring between Terminals.

CHART No. 4
Amplifier Tube Socket Tests

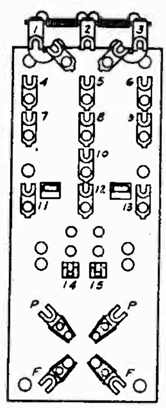
TEST	SOCKET	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
Filament	UX-245 UX-245	2.25 2.25	Open or shorted wire or secondary winding in filament supply.
	UX-280	4.9	
Plate	UX-245 UX-245	222 222	Open or shorted wire in plate supply; open primary of output transformer 2, Fig. 3; open or shorted field or reactor coil; shorted condenser in condenser bank 1, Fig. 4.
	UX-280	40 M. A.	Open or shorted wire in plate circuit. Open high voltage secondary of power transformer; any items listed above which affect UX-245 plate supply; any items listed in Chart No. 3 which affect UY-224 plate supply.
Grid	UX-245 UX-245	37 37	Open or shorted wire in grid circuit; open secondary of interstage transformer; open or shorted grid bias resistor 32, Fig. 4; faulty ground in center tap of secondary interstage transformer 2, Fig. 3, or faulty ground in grid bias resistor 32, Fig. 4.



Condenser Bank Terminals



Under Side of Terminal Strip



Terminal Board

CHART No. 5
Continuity Test of Amplifier-Speaker Unit
IMPORTANT NOTES

Meter used, 10 volt scale of Weston test box 547. Open circuit voltage on continuity test 9.0 volts when reading on 10 V scale. Readings will vary with different meters and batteries, but relative proportions will be the same as those listed in chart below. Approximate resistance values are given, corresponding to the direct reading ohmeter conversion chart for the Weston 547 test box. Terminals on terminal board are not numbered) numbers in the illustration to the left are for convenience in reference to this chart only. Lack of voltage, or voltage readings which vary considerably from those listed below will indicate open circuits or other irregularities in the parts under test.

TEST BETWEEN TERMINALS	PART	APPROXIMATE VOLTAGE (10 V SCALE)	APPROXIMATE RESISTANCE (OHMETER)
F and 7 of Terminal Board	Tapped Choke	8.4 Volts	300 Ohms
4 and 6 of Terminal Board	Speaker Field	7.2 Volts	1,500 Ohms
Brown-Grey Resistor	8000 Ohm Resistor	3.4 Volts	8,000 Ohms
Brown-Grey Resistor	8000 Ohm Resistor	3.4 Volts	8,000 Ohms
Green-Red Resistor	70,000 Ohm Resistor	.5 Volts	70,000 Ohms
7 and 8 of Condenser Bank	Plate Choke	4.0 Volts	6,000 Ohms
2 of Condenser Bank and 4 of Terminal Strip	Primary Interstage Transformer	6.4 Volts	2,000 Ohms
UX-245 Grids	Secondary Interstage Transformer	2.4 Volts	14,000 Ohms
UX-245 Grids to Chassis	One-half Secondary Interstage Transformer	4.4 Volts 3.6 Volts	5,500 Ohms 7,500 Ohms
UX-245 Plates	Primary Output Transformer	8.4 Volts	330 Ohms
UX-245 Plates and No. 3 of Condenser Bank	One-half Primary Output Transformer	8.8 Volts	165 Ohms
Voice Coil	Speaker Voice Coil	9.0 Volts	0 Ohms
14 and 15 of Terminal Board	Primary Power Transformer	9.0 Volts	0 Ohms
P and P	High Voltage Secondary Output Transformer	8.4 Volts	340 Ohms
F and F	UX-280 Filament Secondary Output Transformer	9.0 Volts	0 Ohms
UX-245 Grid Bias Resistor 32, Fig. 4	UX-245 Grid Bias Resistor	8.0 Volts	700 Ohms

Note:—To test continuity of UY-224 and UX-245 filament windings of power transformer and the respective center tap resistors, it will first be necessary to unsolder the transformer leads from the resistors, and then test each part separately. Readings in all cases will correspond to a 9.0 volt reading under the test conditions listed above.

CHART No. 6

Voltmeter Continuity Test of Electrola Parts

TEST	TERMINALS	APPROXIMATE Voltage (10 V. Scale)
Electric Pickup	On P. U. Connector Block	9.0 Volts
Record Volume Control	Two Ends	8.6 Volts
Input Transformer	*1* and *2*	9.0 Volts
	1 and *3*	8.5 Volts
	1 and *4*	4.4 Volts

CHART No. 7

Voltmeter Continuity Test of Recording Parts

TEST	TERMINALS	APPROXIMATE Voltage (10 V. Scale
Microphone	Cord Tips	8.4 Volts
150 Ohm Resistor	Term. 245 Two Ends	8.5 Volts
Input Transformer	*1* and *3*	8.5 Volts
	1 and *4*	4.4 Volts
Coil	*4* and *1* on Ter. Board, Fig. 19	9.0 Volts
250 Ohm Resistor	Two Ends *1* and *3* on Ter. Board	8.4 Volts

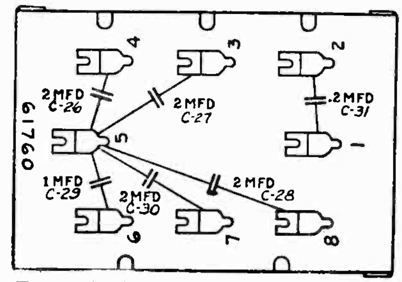


Fig. 15—Internal Connections of Filter Condenser Bank.

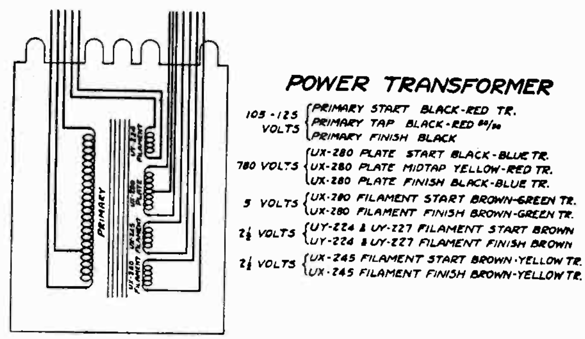


Fig. 16—Internal Connections of Power Transformer.

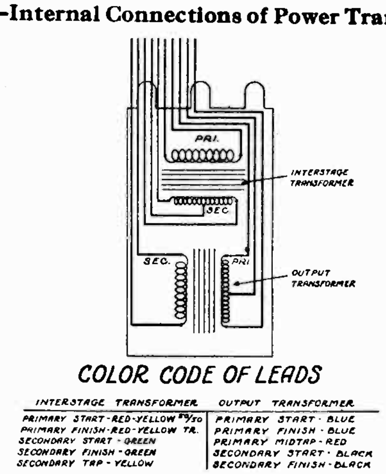
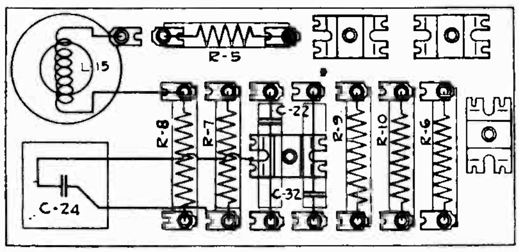


Fig. 17—Internal Connections of Interstage and Output Transformer.

9. FAILURE IN ELECTROLA OPERATION—Failure in operation of the Electrola may be traceable to any of the following defects. See chart No. 6 for continuity tests on Electrola parts:—

a. Broken wire or connection. Examine all leads carefully and if necessary use the continuity test meter and battery as shown in Fig. 11.



CAPACITORS

C-22	100 MMF.	
C-24	0.01 MF.	
C-32	1200 MMF.	

RESISTOR COLOR CHART

R-5	1500 000 OHMS	WHITE (WITH RED END)
R-6	28 000 OHMS	BUFF (WITH BROWN END)
R-7	1000 000 OHMS	GREEN (WITH WHITE END)
R-8	500 000 OHMS	BLUE (WITH GREEN END)
R-9	500 000 OHMS	BLUE (WITH GREEN END)
R-10	2800 OHMS	BLUE (WITH WHITE END)

Fig. 18—Resistor Board on Radio Chassis

b. Open or short circuit in electric pickup. Remove the pickup from the pickup arm by taking out the screw 11, Fig. 29, and pulling the connector block from the pickup terminals. Test for continuity by means of the meter and battery shown in Fig. 11. If no reading is obtained, pickup is open.

c. Faulty contact in control switch. Remove the switch from the motor board, by taking off the knob and the mounting nut. Remove the cover from the switch and examine all contacts carefully.

d. Open or short circuit in record volume control. Remove the lead on terminal No. 2 of the input transformer. Test for continuity through each of the side connections with the pickup removed.

e. Open or short circuit in the input transformer. With the wire still removed from terminal No. 2 of the input transformer, test for continuity between terminals No. 1 and No. 2 and between No. 1 and No. 4. See Fig. 21 for Electrola connections.

Distortion in the Electrola may be caused by the armature of the electric pickup being improperly centered (see subject No. 7 under SPECIAL ADJUSTMENTS) or by an open grid resistor, R-9, mounted on the resistor board, Fig. 18.

10. FAILURE OF HOME RECORDING—Failure of the home recording feature can be traced to any of the following. (See chart No. 6 Page 22 for continuity tests on home recording parts.)

a. Poor contacts in microphone pin jack terminals.
b. Loose or broken wire or connection.
c. Open or short circuit in microphone.
d. Short in either of the resistors on reactor unit Fig. 19.
e. Shorted or open record-microphone input transformer on motor board.
f. Faulty contact in control switch.
g. Open reactor coil on reactor unit, Fig. 19.
h. Weak magnet in electric pickup. See note under b, subject 7, page 35.
I. Reversed leads on two contact terminal strip 8, Fig. 3. Black with red tracer lead should connect to the terminal nearer the two UX-245 Radiotrons.

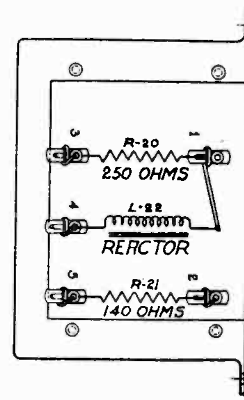


Fig. 19—
Microphone Reactor Terminals and Connections

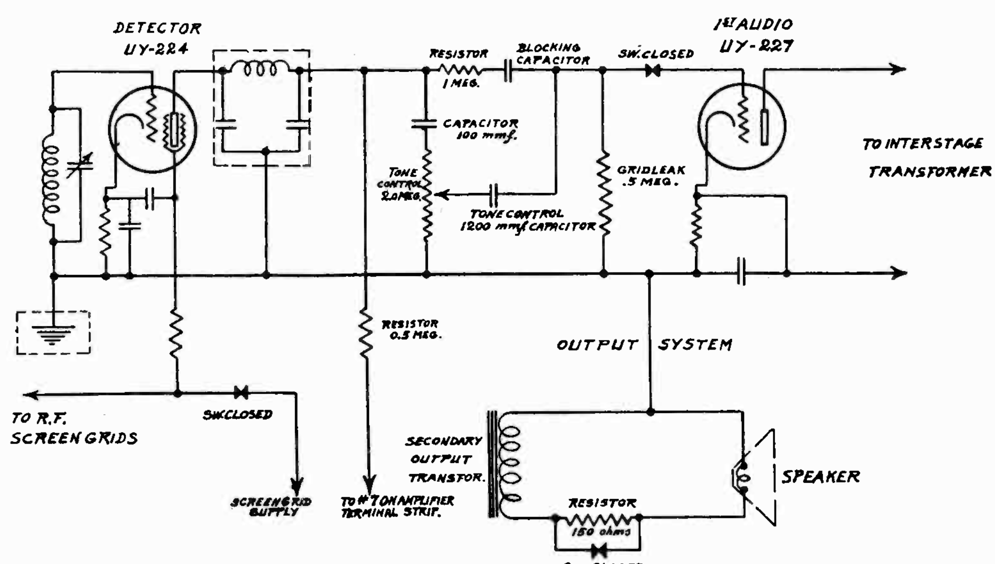


Fig. 20—Schematic Connections Between Detector and First Audio Tubes with Transfer Switch in "Radio" Position.

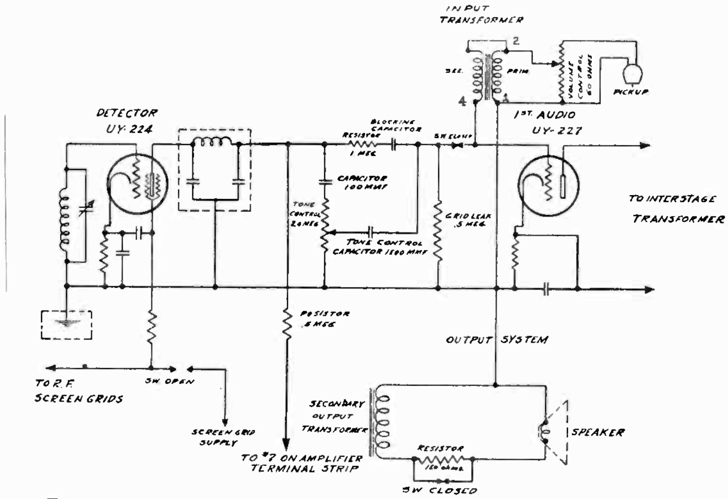


Fig. 21—Schematic Connections Between Detector and First Audio Tubes with Transfer Switch in "Record Reproduction" position

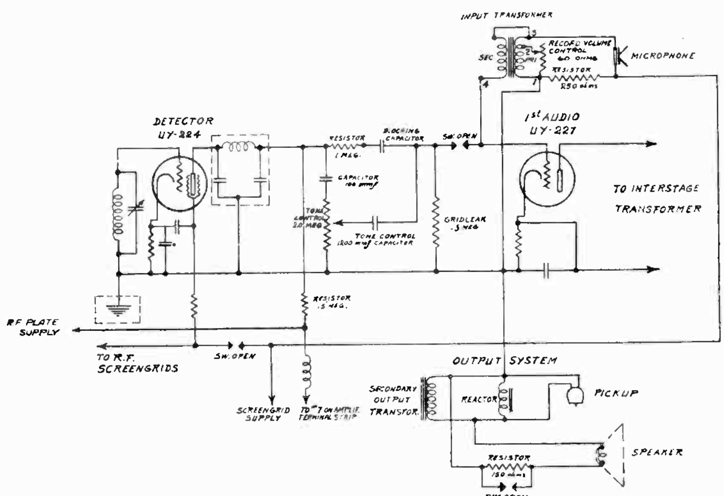


Fig. 22—Schematic Connections Between Detector and First Audio Tubes with Transfer Switch in "Home Recording" position.

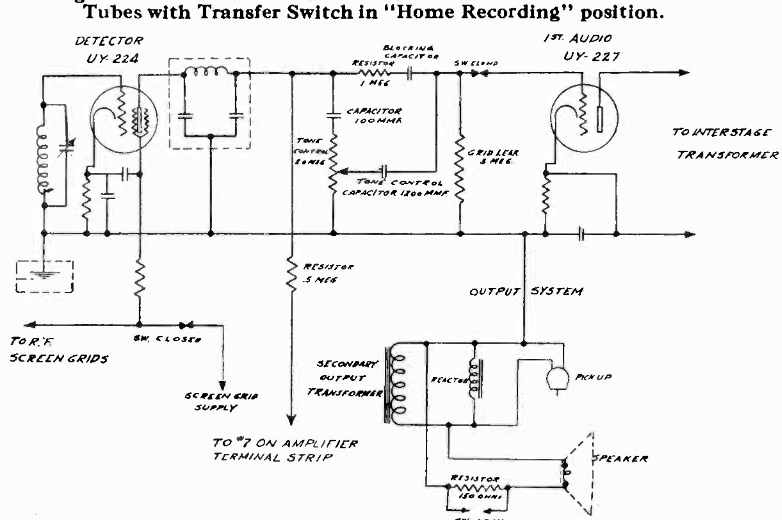


Fig. 23—Schematic Connections Between Detector and First Audio Tubes with Transfer Switch in "Radio Recording" position.

SPECIAL ADJUSTMENTS

1. RE-ALIGNING TUNING CONDENSERS—Under normal conditions, the occasion will seldom arise when it will be necessary to re-align the tuning condensers. Low sensitivity and selectivity and improper dial settings over certain sections of the dial for stations of known broadcast frequencies are indications that the tuning condensers are out of line. Before assuming that the instrument requires re-alignment, investigate such possible causes of weak reception as outlined under the subject of GENERAL TESTS, beginning on page 9.

NOTE:—Improper dial settings should not be confused with improper location of selector scale, the adjustment for which is described in Subject 5 below.

The parts required for re-aligning consist of a modulated oscillator, such as stock No. A-6004; a special aligning wrench, stock No. A-6085; and a 0-8 volt a.c. voltmeter. All of these parts are shown in Fig. 24. The meter which is available in the Weston test box can be used if desired.

The Victor oscillator is accurately calibrated at 550, 710, 1000, 1300 and 1500 kilocycles. These aligning frequencies, which are the correct values used in the factory, must be employed in all cases. If it is desired to build an oscillator in accordance with the diagram Fig. 7, it should be constructed of the best grade materials available in order to hold its calibration properly, and should be calibrated at the frequencies listed above. If a standard wavemeter is not available for calibrating, the signals from a number of reliable broadcasting stations, operating on known frequencies from 550 to 1500 KC can be used by plotting a curve of oscillator dial settings against frequencies.

Proceed to re-align the tuning condensers in the following manner:

a. Disconnect the link (on straight radio models) across the two terminals on the base of the amplifier (see Fig. 24), and connect one side of the 0-8 volt a.c. voltmeter to the terminal nearer the UX-245 Radiotrons. Connect the other side of the a.c. voltmeter to No. 3 terminal (ground) on the amplifier terminal strip or clip to any clean metallic part of the amplifier base. The meter is thus connected in the speaker output circuit but the voice coil is out of the circuit. Silent aligning can thus be accomplished.

b. Connect the shielded leads from the oscillator terminals to the antenna and ground terminals of the radio set, making sure that the ground wire is still connected to the radio chassis.

c. Remove the small metal plate in the center of the cam wheel by taking out the retaining screw.

d. Place the radio set in operation with the volume control turned to maximum.

e. Set the tuning lever at 550. Place the oscillator in operation and set the dial at this same frequency. Adjust the oscillator output volume control to the lowest setting possible to obtain a reading on the A. C. voltmeter.

f. It will be noted on the inside of the cam wheel that there are five groups of five screws each, and that the first screw of each group is opposite a cam roller. Using the special socket wrench, stock No. A-6085, adjust each of the first screws until the reading on the A.C. voltmeter is a maximum. As the condensers are brought into alignment, it may be necessary to decrease the setting of the oscillator volume control in order to prevent the voltmeter from going off scale.

g. Move the tuning lever of the Victor Radio to 710 KC and set the oscillator dial at this same frequency. Now adjust the second screw of each group until a maximum reading is obtained on the voltmeter.

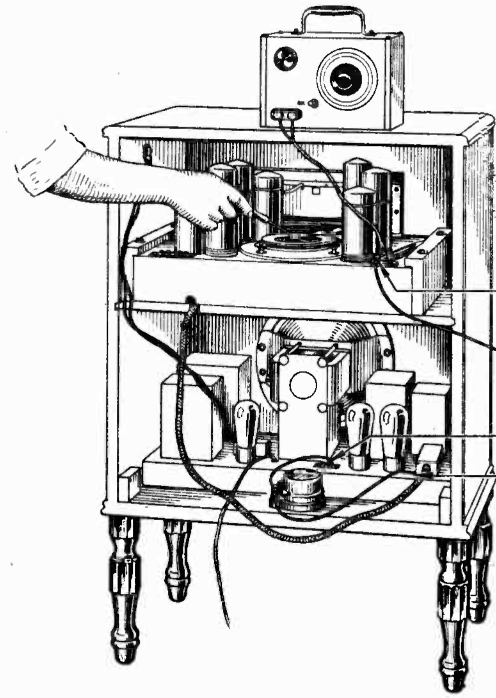


Fig. 24—Re-aligning the Tuning Condensers

h. Repeat this procedure for 1000 KC, 1300 KC, and 1500 KC. The alignment is now complete. The flexible cam strip around the outer edge of the cam wheel assures perfect alignment between the aligning frequencies mentioned.

i. Remove all oscillator and meter connections, and reconnect the link (or wire in the case of combination models).

It will be desirable to check the oscillator calibrations from time to time with signals from reliable broadcasting stations. Dial settings may otherwise be incorrect because of rough handling of the oscillator or capacity changes in the UX-199 Radiotron.

2. CENTERING CONE OF SPEAKER—Improper centering of the cone in the electro dynamic speaker is characterized by a noticeable rattle or buzz, particularly when the volume control is advanced. Such a rattle can sometimes be traced to faulty tubes in the detector or audio stages or to loose metal parts. This possibility should first be eliminated before attempting to center the cone. If the voice coil is improperly centered:

a. Remove the mounting screws which hold the amplifier-speaker unit to the base of the cabinet, and turn the unit on its side as shown in Fig. 25.

b. Remove one of the R. F. tubes from its socket and place a short piece of wire in the cathode and one of the filament terminals of a UY-224 socket to produce a 60 cycle hum. See Fig. 5 for location of these terminals.

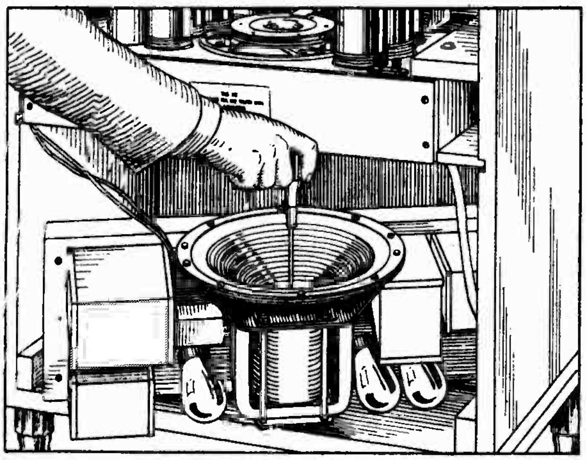


Fig. 25—Centering Speaker Cone.

CAUTION—Great care should be exercised not to touch any of the high voltage terminals on the under side of the amplifier.

c. Place the instrument in operation in the usual manner.

d. Loosen the center screw in th speaker cone and then re-tighten the screw.

e. Ordinarily the cone should now be properly centered, which condition can be determined by the sound of the A.C. hum. When the cone is improperly centered, an A.C. mechanical buzz will be heard as contrasted with a clear low frequency musical note when the coil is free and properly centered. In some cases it may be necessary to remove the retaining ring, loosen the outer edge of the cone, replace the ring without tightening the screws, center as described above, and then retighten the ten retaining screws.

Remove the wire across the cathode and filament of the R. F. tube and then replace the amplifier-speaker unit in the cabinet.

3. REPLACING CONE OF SPEAKER—Should it become necessary to replace the speaker cone because of an open voice coil or other defect, the following procedure should be used:

a. Unsolder the voice coil leads (black and yellow) and the two fine black wires attached to the cone, from the terminals on the side of the speaker frame.

b. Using a No. 4 Spintite socket wrench, remove the ten screws which hold the retaining ring against the cone and also remove the center screw and washer.

c. Remove the retaining ring and lift the old cone from the unit.

d. Replace with the new cone, but before complete assembly is made, center the cone as described in 2, above.

4. ADJUSTING TUNING LEVER TENSION—Should the tuning lever fail to operate freely, or should the vernier roller fail to track when turned, adjust the tension of the lever on its track by means of the adjusting nut which will be found on the lever midway between the cam wheel and the dial. To assure free movement of the lever, a small amount of grease should be placed on both the top and bottom of the roller track.

5. READJUSTING AND REPLACING SELECTOR SCALE—Should it be necessary to shift the selector scale so as to obtain correct dial readings, or to replace a damaged scale, proceed in the following manner:

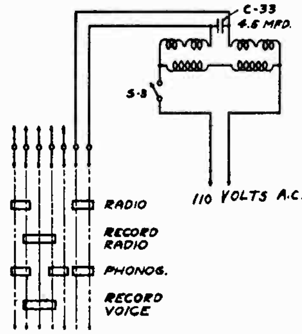


Fig. 26—Electric Motor Connections for 60 cycles.

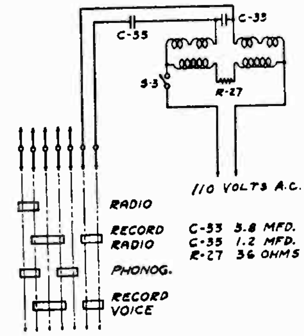


Fig. 26A—Electric Motor Connections for 25 Cycles.

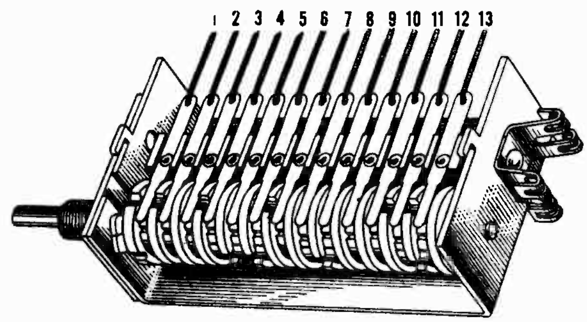


Fig. 27—Control Switch

COLOR CODE

1. Black
2. Black
3. Black—Yellow Tracer
4. Pickup Lead
5. Yellow—Black Tracer
6. Black and Red—50-50
7. Black—Red Tracer
8. Green—Yellow Tracer
9. Green and Red—50-50
10. Black and Yellow—50-50
11. Green and Yellow—50-50
12. Green
13. Green—Red Tracer

Connection to Switch Case—Yellow

a. Reach in from the back of the cabinet, insert a screw driver through the holes in the back of the pilot light compartment, and loosen the clamps at each end of the scale.

b. Remove the old scale if a replacement is being made, and place the new one in position with the ends under the clamps.

c. Before tightening the clamps, tune in a station of known broadcast frequency and slide the scale to the right or left until the number corresponding to the known frequency of the station is in line with the station indicator.

d. Check this position on two or three other stations of known broadcast frequency at different sections of the scale.

e. Holding the scale in position, re-tighten the screws in the scale clamps.

6. ADJUSTING PILOT LAMP—If the pilot lamp is mounted off center, the dial readings at certain sections of the scale, particularly at the extreme ends, will be incorrect. The lamp is clamped on the back of the pilot lamp compartment in a position which will be obvious upon exam-

ination. Always be sure that the lamp is exactly in the rear of the center of the dial and that the hair line station indicator is vertical at the center and the extreme ends of the dial.

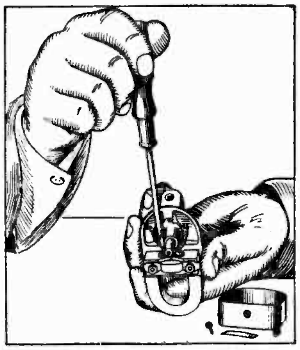


Fig. 28—Adjusting Electric Pickup.

7. ADJUSTING ELECTRIC PICKUP—Faulty record reproduction with noticeable blasting, particularly on the bass notes, may be caused by worn records or needles, or by improper centering of the pickup armature. If such a condition is traced to the pickup, center the armature in the following manner:

a. Remove the pickup from the pickup arm by taking out the retaining screw and nut, 11, Fig. 29. Pull the pickup away from the connector block.

b. Remove the cover by taking out the needle screw and the cover screw, taking care not to lose the phosphor bronze clamp which holds the magnet in place.

NOTE—IT IS HIGHLY IMPORTANT that the magnet be in contact with the pole pieces or with a small iron or steel keeper at all times. Even a momentary break in the magnetic path of the pickup magnet will produce a noticeable loss of magnetism which is reflected in decreased efficiency of the pickup, *particularly in home recording*.

c. Place a steel keeper 1¼" x ½" x ¼' across the two ends of the magnet, and carefully slide the magnet from the pole pieces onto the keeper.

d. Slide the magnet back onto the under side of the pole pieces as shown in Fig. 28.

e. Loosen both round head screws in the armature adjusting plate with a small screw driver as shown in Fig. 28.

f. Insert the pickup gauge, stock No. A-6074, between the armature and the pole pieces and re-tighten the round head screws in the adjusting plate.

g. When the armature is properly centered, replace all parts of the pickup assembly.

h. While making adjustments to the pickup, it will be well to place a small amount of Victor Motor Grease on the bearing surface between the pickup arm and the base at the rear of the arm to insure free motion of the arm.

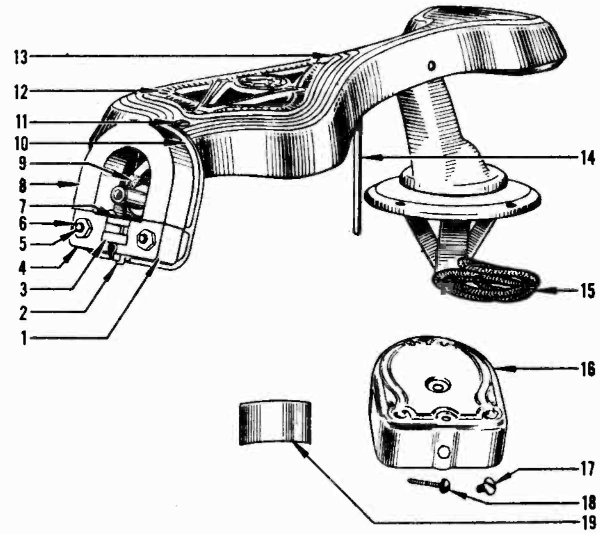


Fig. 29—Parts of Electric Pickup.

ELECTRIC PICKUP PARTS

	Name of Part
	Pick-up unit (complete)
	Pick-up arm and base (less unit)
1.	Pick-up pole piece (R.H.)
2.	Pick-up armature
	Pick-up armature rubber pivot*
3.	Pick-up coil (low impedance)
4.	Pick-up pole piece (L.H.)
5.	Pick-up pole piece screw
6.	Pick-up pole piece nut
	Pick-up pole piece lock washer*
7.	Pick-up damper and plate
	Pick-up damper (rubber)*
	Pick-up damper screw*
8.	Pick-up magnet
9.	Pick-up insulating sleevc
10.	Pick-up unit back
11.	Pick-up mounting screw
	Pick-up mounting nut*
	Pick-up mounting lock washer*
12.	Pick-up arm escutcheon
13.	Pick-up arm escutcheon rivet
14.	Pick-up arm trip rod and nut
	Pick-up arm trip rod nut*
15.	Pick-up connector block and wire
16.	Pick-up unit cover
17.	Pick-up unit cover screw
18.	Pick-up needle screw
19.	Pick-up spring (flat)
	Pick-up arm mounting screw*

*Not Illustrated.

VICTOR RADIO WITH ELECTROLA RE-17

The Victor Radio with Electrola RE-17 is a combination of the four circuit radio equipment in the R-15, with the Electrola equipment, less home recording, of the RE-57. A transfer switch controls the change-over from radio to record operation. When the switch is in the "Electrola" position, the power detector Radiotron becomes a first stage audio amplifier, transformer coupled, by a change in the grid bias of this tube when a 600 ohm resistor is connected into the grid bias circuit. The screen grid voltage supply to the R. F. tubes is opened during record reproduction to prevent the possibility of obtaining both radio and record reproduction simultaneously.

The RE-17 operates on 105 to 125 volts, 50 to 60 cycles, alternating current. Special instruments are also available for 25 to 30 cycle operation. The maximum power consumption of the instrument is 170 watts.

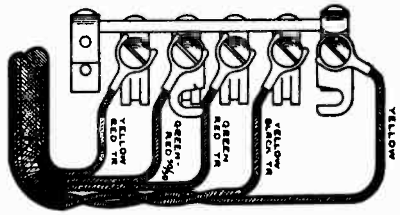


Fig. 3—Electrola Terminal Strip

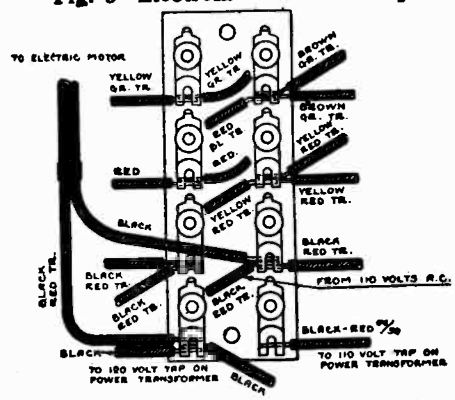


Fig 4.—Radio Chassis Terminal Board, showing Additional Connections for Motor

Voltmeter Continuity Test of Electrola Parts

Using 10 volt scale of Weston 547 Test Box and 4½ volt "C" battery.

TEST	TERMINALS	APPROX. VOLTAGE (10 Volt Scale)
Electric Pickup	On P. U. Connector Block	9.0 Volts
Record Volume Control	Two End Terminals	8.6 Volts
Input Transformer	1 and 2 3 and 4	9.0 Volts 7.2 Volts

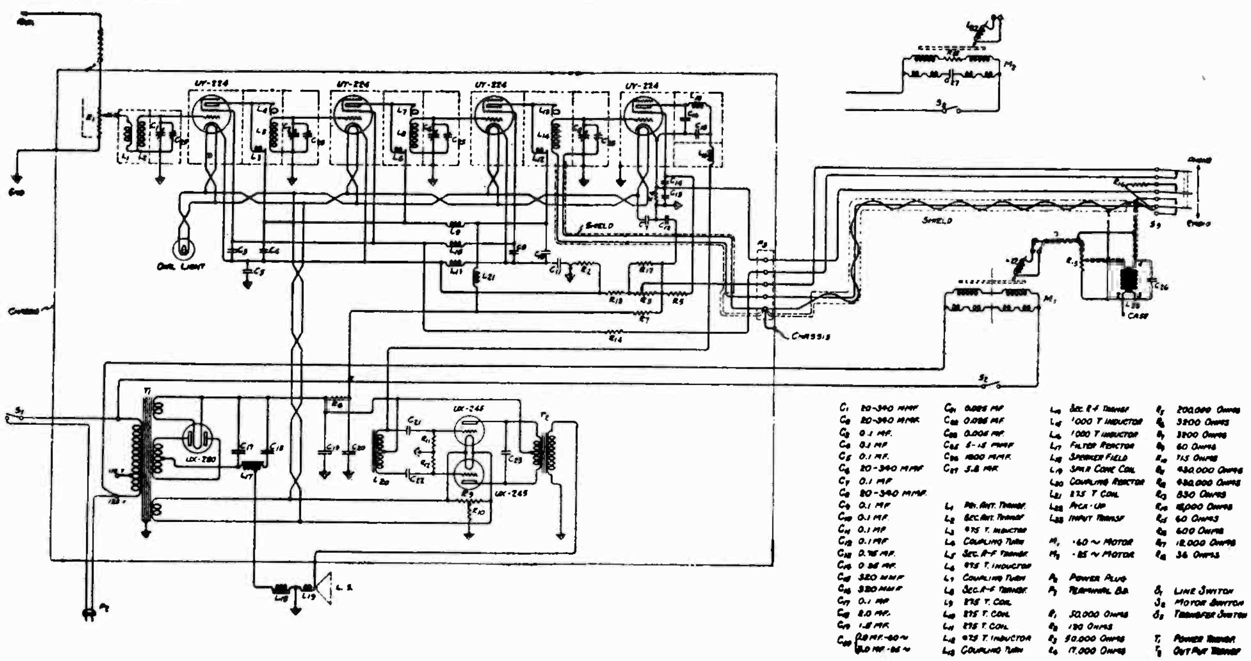


Fig. 5—Schematic Wiring Diagram Victor Radio with Electrola RE-17