

# RCA Radiola 47

SERVICE NOTES



*RCA Radiola 47*

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**RADIO-VICTOR CORPORATION OF AMERICA**  
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# PREFACE

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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.

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# CONTENTS

	Page
Preface .....	2
Electrical Specifications .....	5
Physical Specifications .....	5
Introduction .....	6

## PART I—SERVICE DATA ON RECEIVER

	Page		Page
Voltage Readings .....	7	RCA Radiola 47 Continuity Tests.....	8

## PART II—ASSEMBLY REMOVALS

To Remove Motor.....	16	To Remove Tone Arm and Pick-up.....	16
To Remove Receiver Assembly.....	16	To Remove Electro Dynamic Loudspeaker	
To Remove S.P.U.....	16	Unit .....	16

## PART III—SERVICE DATA ON MAGNETIC PICK-UP

Adjustment of Armature.....	17	Replacing Pick-up Coil .....	20
Magnetic Pick-up Service Data Chart.....	18	Replacing Pick-up Armature.....	20
Replacing Rubber Pivot Supports and Damp- ing Block .....	19		

## PART IV—SERVICE DATA ON PHONOGRAPH MOTOR AND AUTOMATIC STOP

Theory of Operation of RCA Phonograph Motor .....	20	Heating .....	24
Speed Regulation .....	21	Continuity of Motor Circuits.....	24
Governor .....	21	Replacing the Motor Coils.....	24
Lubrication of Motor.....	21	Replacing the Motor Governor Parts.....	24
Service Data on Phonograph Motor.....	21	Replacing the Motor Spindle, Disc or Governor Driving Gear .....	25
Phonograph Motor Service Data Chart.....	22	Replacing the Motor Spindle Ball Bearing....	26
Noisy Operation .....	23		

## PART V—SERVICE DATA ON AUTOMATIC STOP

Automatic Stop Service Data Chart.....	27	Switch Failure .....	28
Brake Failure .....	28		

## ILLUSTRATIONS

RCA Radiola 47.....	1	Armature Spacing Tool .....	19
Rear Interior Cabinet View.....	4	Phonograph Motor .....	20
Schematic Circuit of Receiver.....	6	Phonograph Motor Coil Connections.....	20
Schematic Circuit of S.P.U.....	6	25-Cycle Condenser Connections .....	21
Top View of Receiver Chassis.....	7	Internal Connections of the Condenser Bank..	21
Complete Layout and Cable Connections.....	10	Top Cabinet View of Phonograph Compart- ment .....	25
Receiver Wiring Diagram.....	12	Automatic Stop Mechanism .....	26
S.P.U. Wiring Diagram .....	14		
Phonograph Pick-up .....	17		

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# CONTENTS

	Page
Preface .....	2
Electrical Specifications .....	5
Physical Specifications .....	5
Introduction .....	6

## PART I—SERVICE DATA ON RECEIVER

	Page		Page
Voltage Readings .....	7	RCA Radiola 47 Continuity Tests.....	8

## PART II—ASSEMBLY REMOVALS

To Remove Motor.....	16	To Remove Tone Arm and Pick-up.....	16
To Remove Receiver Assembly.....	16	To Remove Electro Dynamic Loudspeaker	
To Remove S.P.U.....	16	Unit .....	16

## PART III—SERVICE DATA ON MAGNETIC PICK-UP

Adjustment of Armature.....	17	Replacing Pick-up Coil .....	20
Magnetic Pick-up Service Data Chart.....	18	Replacing Pick-up Armature.....	20
Replacing Rubber Pivot Supports and Damp- ing Block .....	19		

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Theory of Operation of RCA Phonograph Motor .....	20	Heating .....	24
Speed Regulation .....	21	Continuity of Motor Circuits.....	24
Governor .....	21	Replacing the Motor Coils.....	24
Lubrication of Motor.....	21	Replacing the Motor Governor Parts.....	24
Service Data on Phonograph Motor.....	21	Replacing the Motor Spindle, Disc or Governor Driving Gear .....	25
Phonograph Motor Service Data Chart.....	22	Replacing the Motor Spindle Ball Bearing....	26
Noisy Operation .....	23		

## PART V—SERVICE DATA ON AUTOMATIC STOP

Automatic Stop Service Data Chart.....	27	Switch Failure .....	28
Brake Failure .....	28		

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Rear Interior Cabinet View.....	4	Phonograph Motor .....	20
Schematic Circuit of Receiver.....	6	Phonograph Motor Coil Connections.....	20
Schematic Circuit of S.P.U.....	7	25-Cycle Condenser Connections .....	21
Top View of Receiver Chassis.....	7	Internal Connections of the Condenser Bank..	21
Complete Layout and Cable Connections.....	10	Top Cabinet View of Phonograph Compart- ment .....	25
Receiver Wiring Diagram.....	12	Automatic Stop Mechanism .....	26
S.P.U. Wiring Diagram .....	14		
Phonograph Pick-up .....	17		

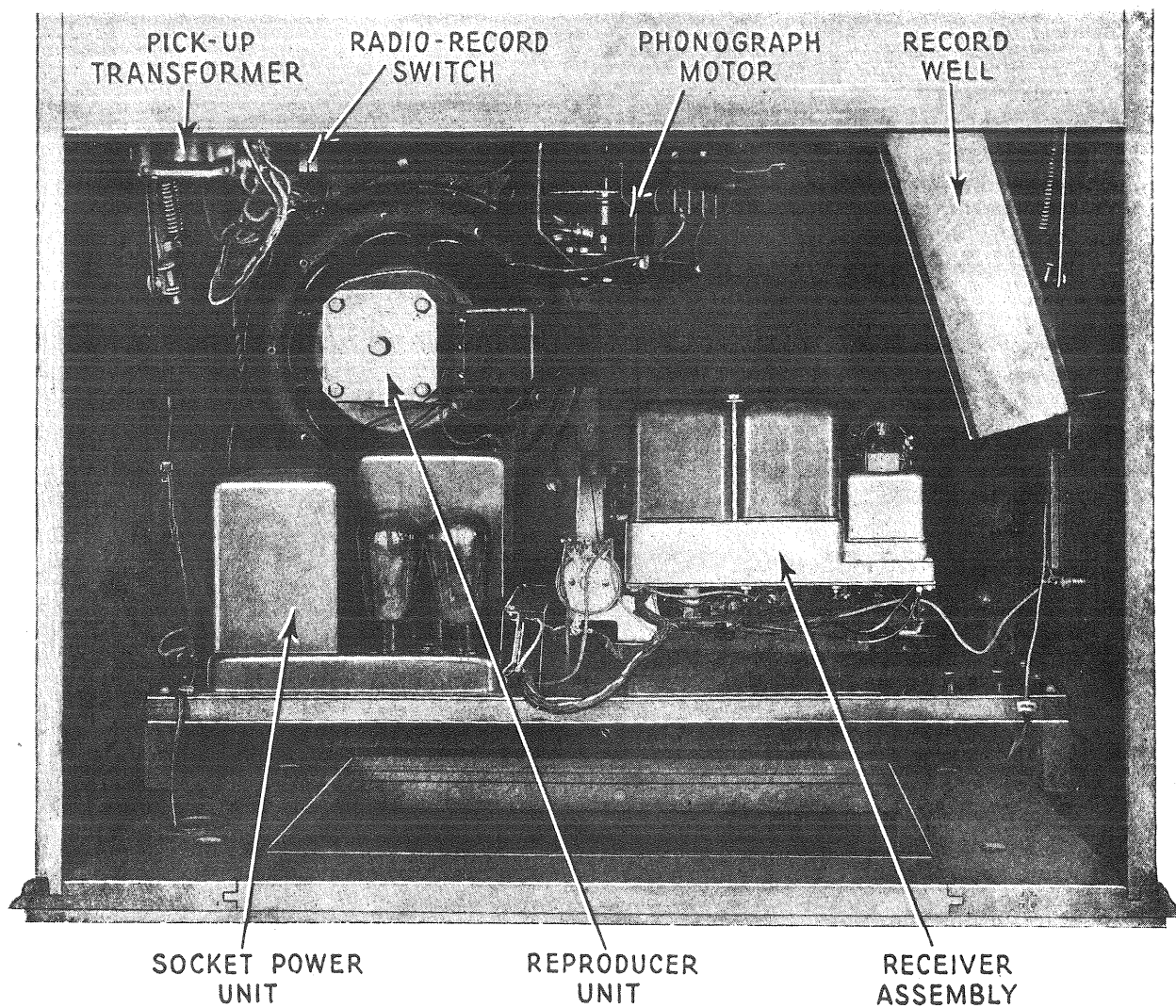


Figure 1—Rear interior cabinet view showing main assemblies

### 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	. . . . .	29 $\frac{3}{4}$ inches
Depth	. . . . .	18 $\frac{1}{2}$ inches
Weight, Net	. . . . .	125 lbs.
Weight, Packed in Standard Packing Case	. . . . .	200 lbs.
Packing Case Dimensions	. . . . .	22 $\frac{1}{2}$ x35x49 inches

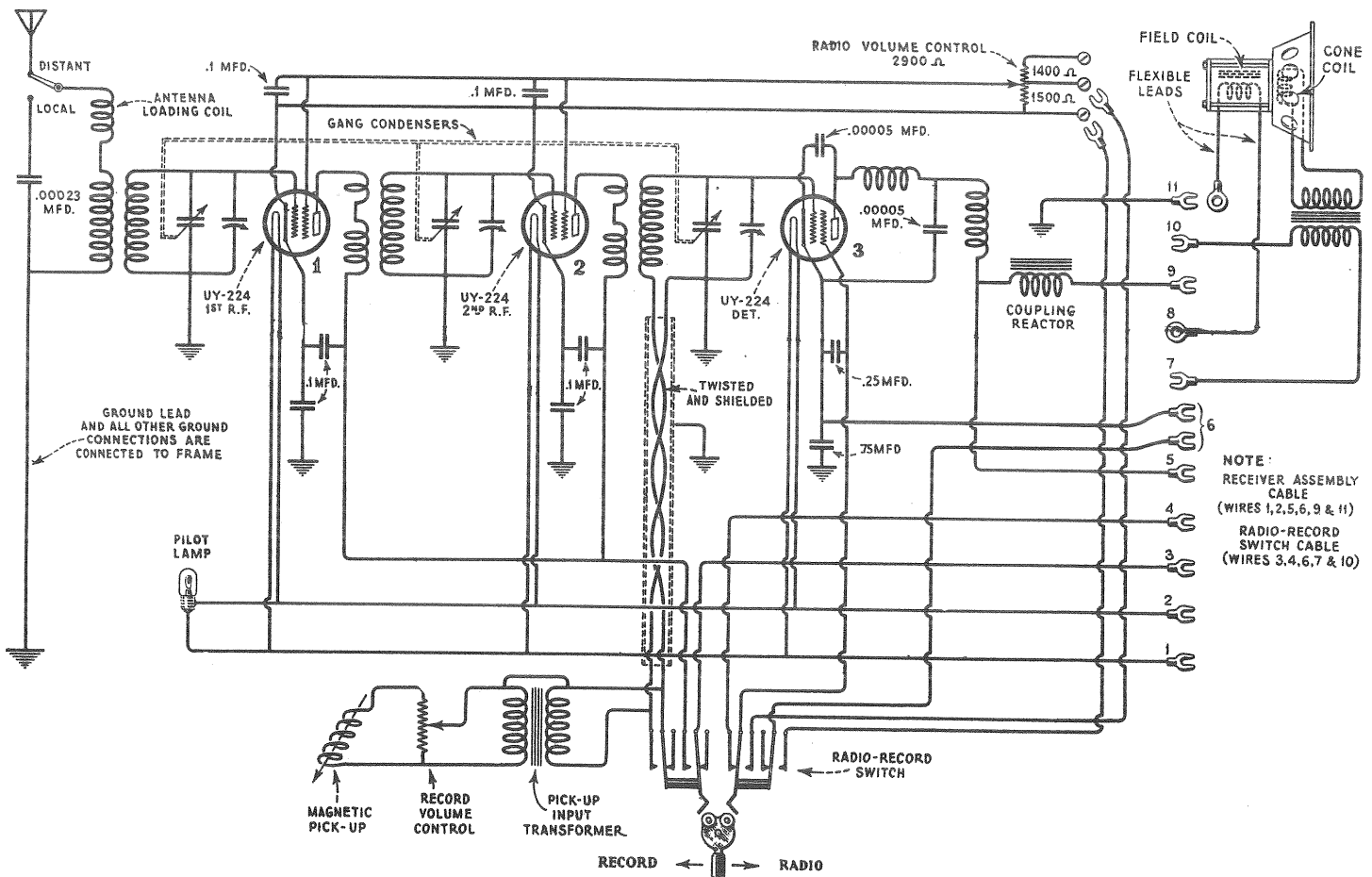


Figure 2—Schematic circuit diagram of receiver, phonograph pick-up and reproducer

## 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:



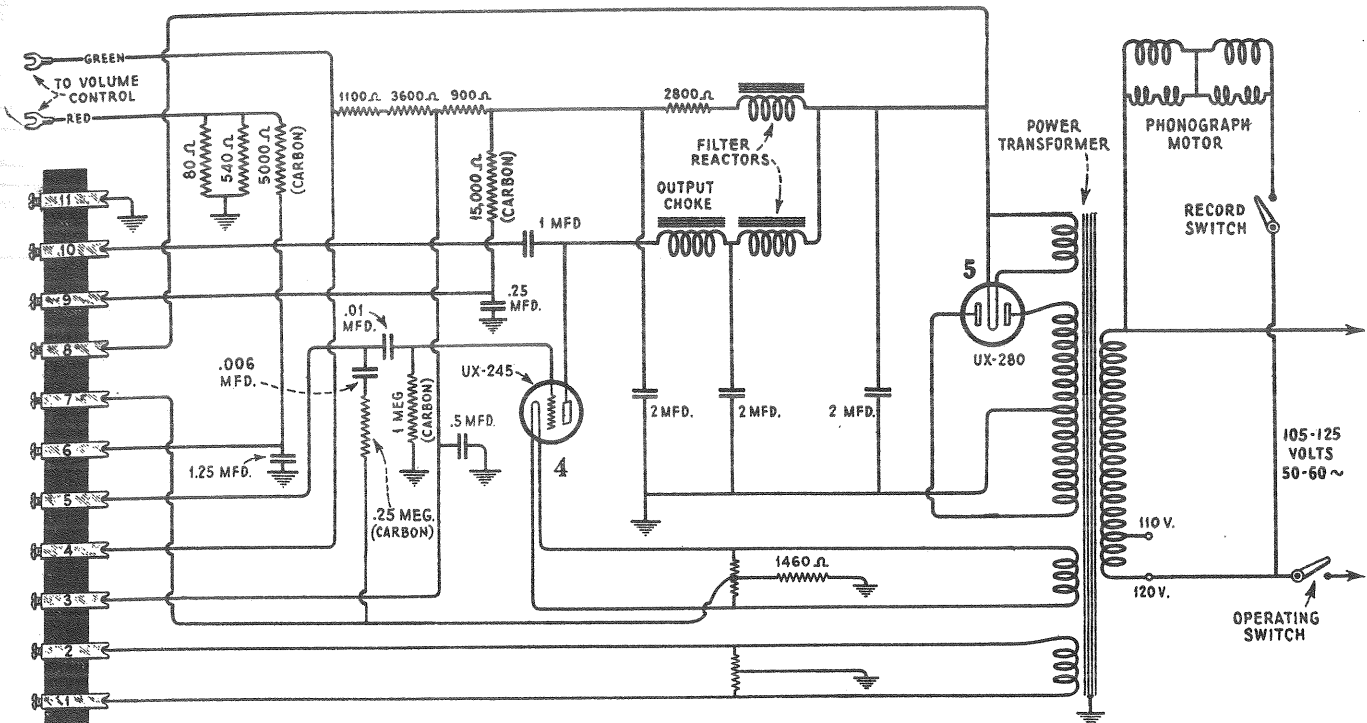


Figure 3—Schematic circuit diagram of socket power unit

### 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.

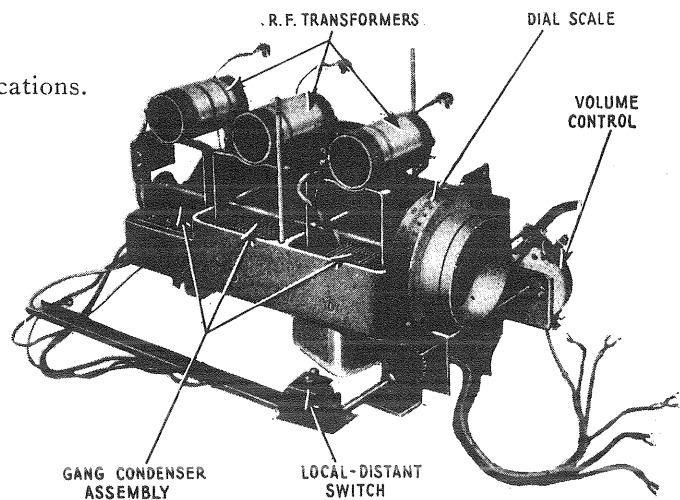


Figure 4—Top view of receiver assembly showing parts

## (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 satis-

factory 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 Plate voltage of Radiotrons Nos. 1 and 2
3 to red V. C. lead	185 D.C.	170 D.C.	
4 to 6	70 D.C.	65 D.C.	Screen grid voltage of Radiotron No. 3 Plate voltage of Radiotron No. 3
6 to 9	195 D.C.	180 D.C.	
6 to 11	5.0 D.C.	5 D.C.*	Control grid voltage of Radiotron No. 3 Total D. C. output from rectifier
8 to 11	320 D.C.	320 D.C.	
Red V.C. lead to 11	2.1 D.C.	2.1 D.C.	Control grid voltage of Radiotrons Nos. 1 and 2 Screen grid voltage of Radiotrons Nos. 1 and 2
Arm of V.C. to red V. C. lead	0	70 D.C.	

\*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

<i>Circuit</i>	<i>Test Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect</i>	
			<i>Indication</i>	<i>Caused by</i>
<b>Radio-Record Switch at Radio Position</b>				
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
<b>Radio-Record Switch in Center Position</b>				
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

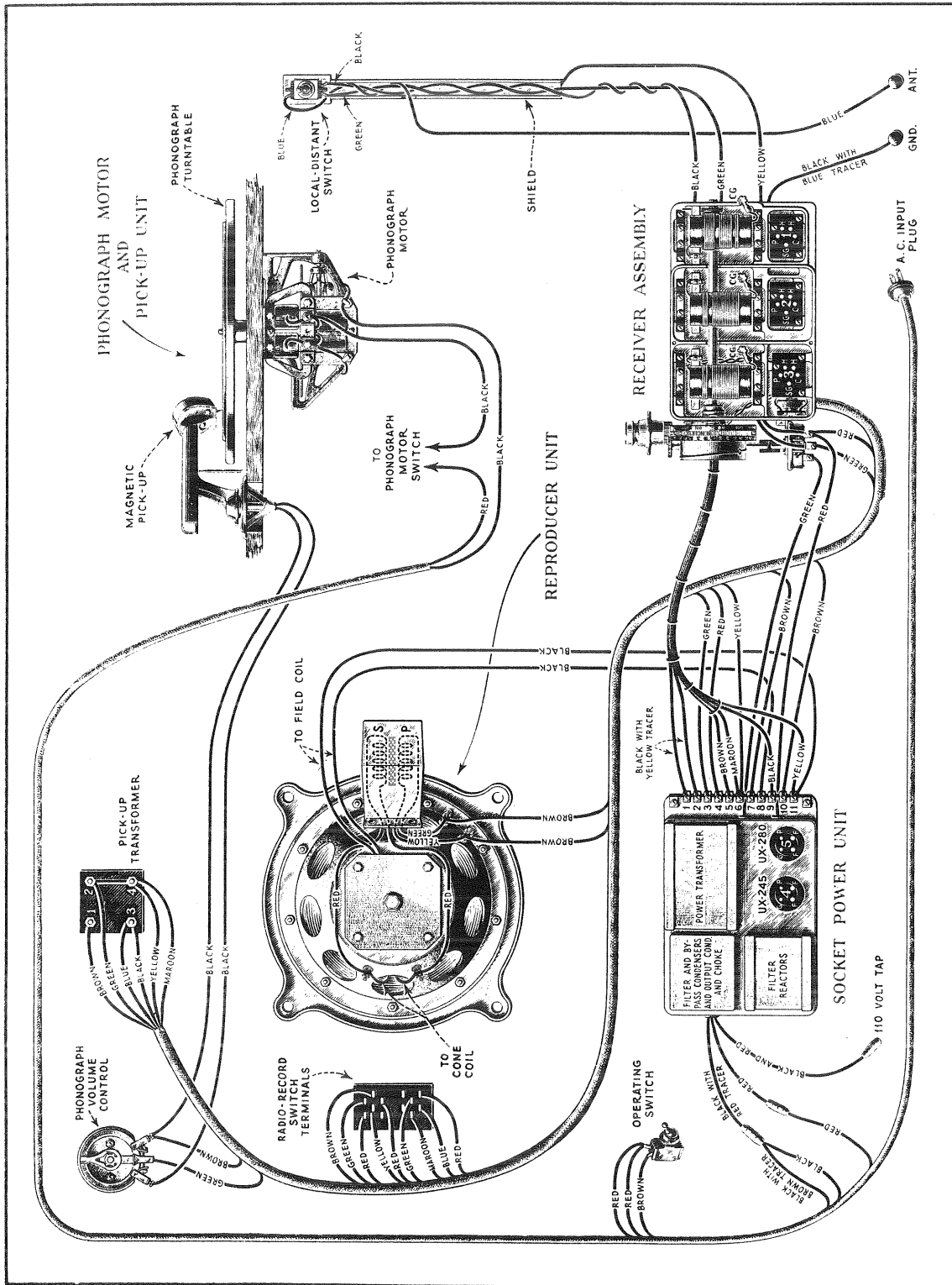


Figure 5—Complete layout of main assemblies showing cable connections

## 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  Closed (200 Ohms)	Open R.F. filter coils  Both 0.00005 mfd. condensers shorted
<b>Unscrew Pilot Lamp From Socket</b>				
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	

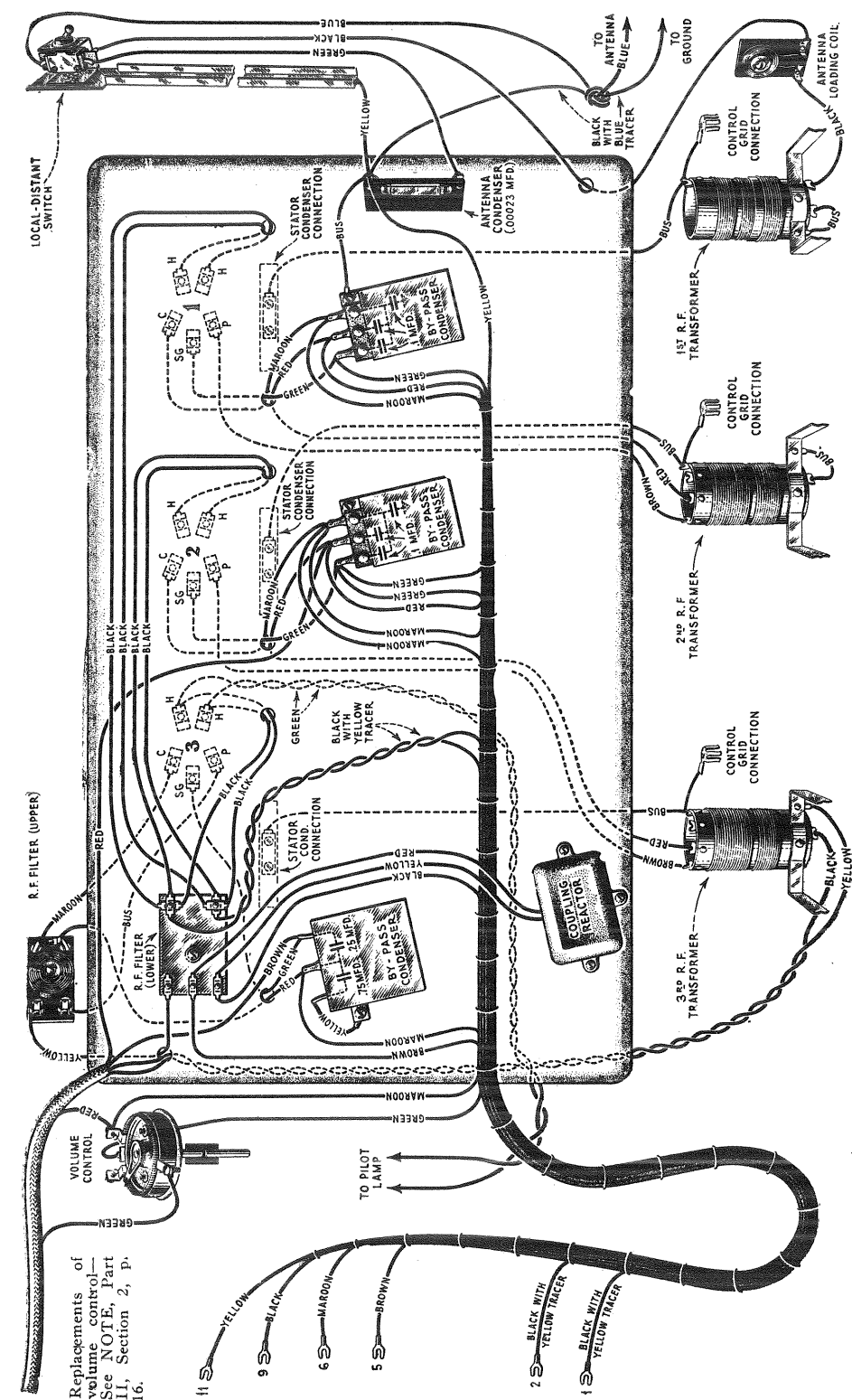


Figure 6—Receiver wiring diagram

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	Caused by
<b>Insulate Movable Arm on Volume Control With Bit of Paper</b>				
Miscellaneous	C1 to SG1	Open	Closed	Shorted .1 mfd. condenser
	C2 to SG2	Open	Closed	Shorted .1 mfd. condenser
<b>Radio-Record Switch at Record Position</b>				
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

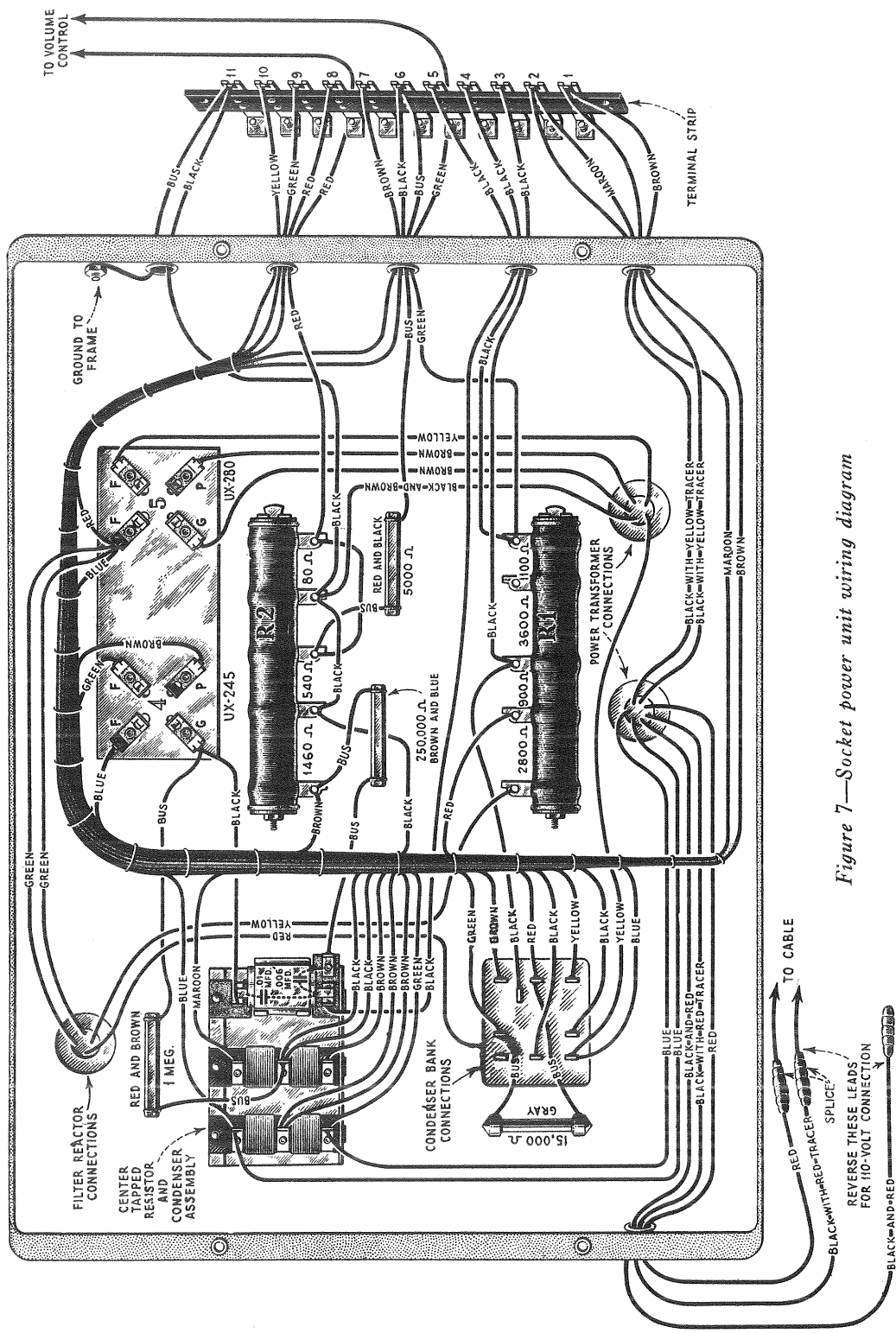


Figure 7—Socket power unit wiring diagram



# CONTINUITY TESTS

## Radiola 47 S. P. U.

Circuit	Test Terminals	Correct Effect	Incorrect Effect	
			Indication	Caused by
Miscellaneous	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
	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.

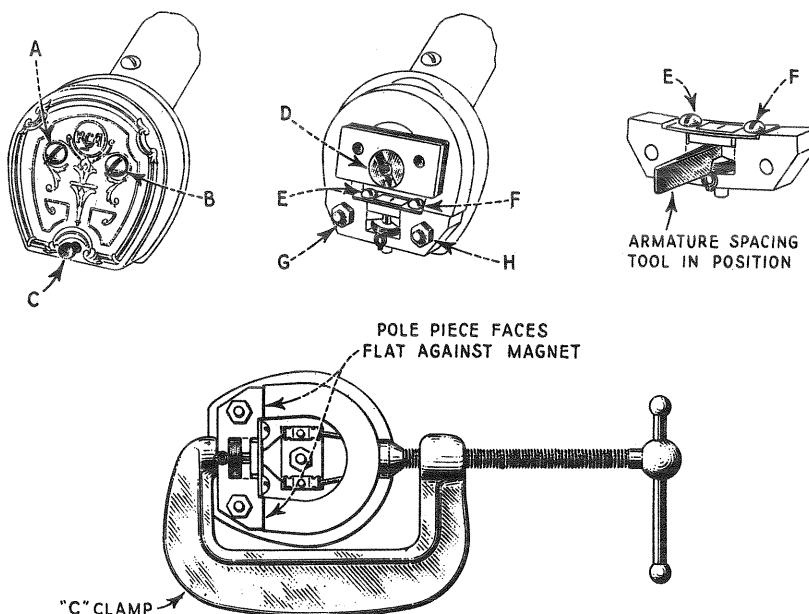


Figure 8—Phonograph pick-up showing various adjustments

#### (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.

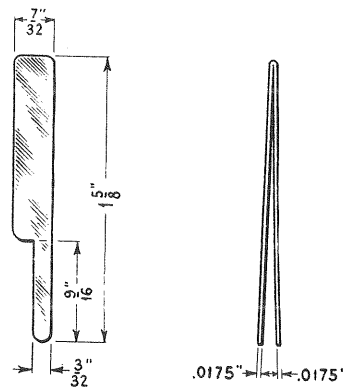


Figure 9—Magnetic pick-up armature spacing tool

- (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.

## (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.

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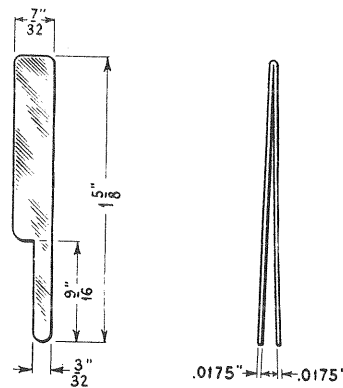


Figure 9—Magnetic pick-up armature spacing tool

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

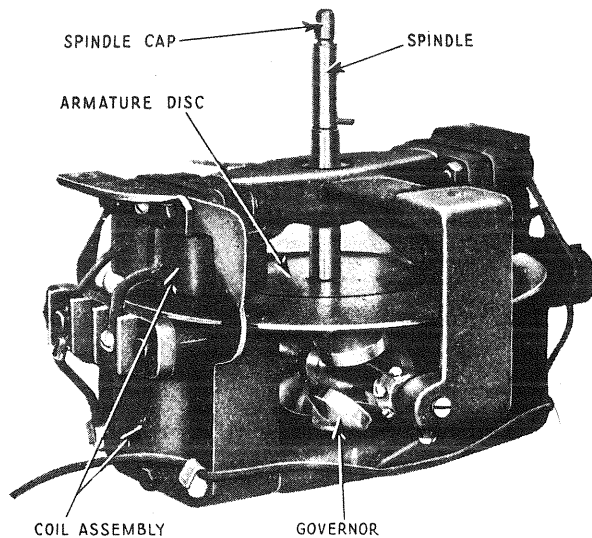


Figure 10—Phonograph motor mechanism

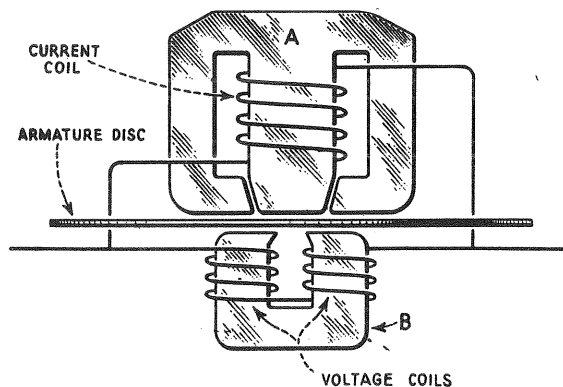


Figure 11—Phonograph motor coil connections

## 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.

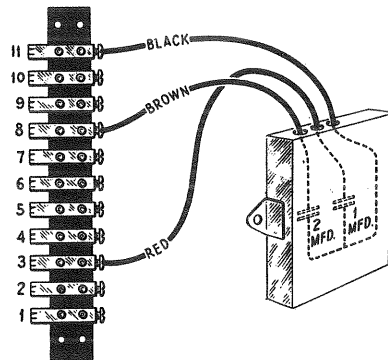


Figure 12—25-cycle condenser connections. This condenser is an additional part in all 25-cycle models.

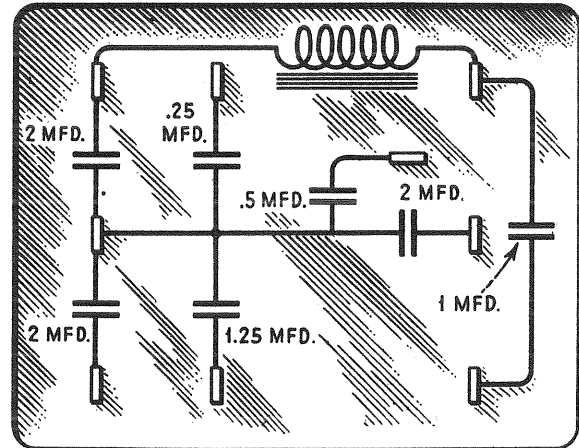


Figure 13—Internal connections of the condenser bank

## (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 0-150-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 0-150 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 screw 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.

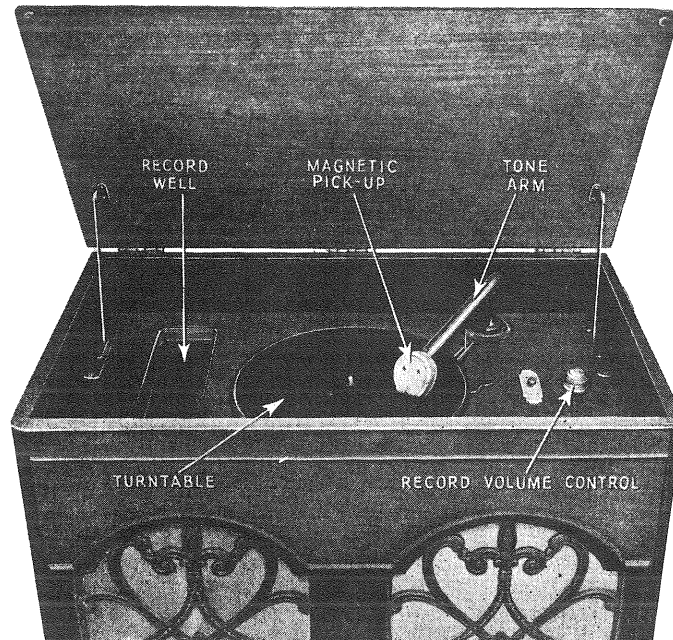


Figure 14—Top cabinet view showing phonograph parts

- (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.

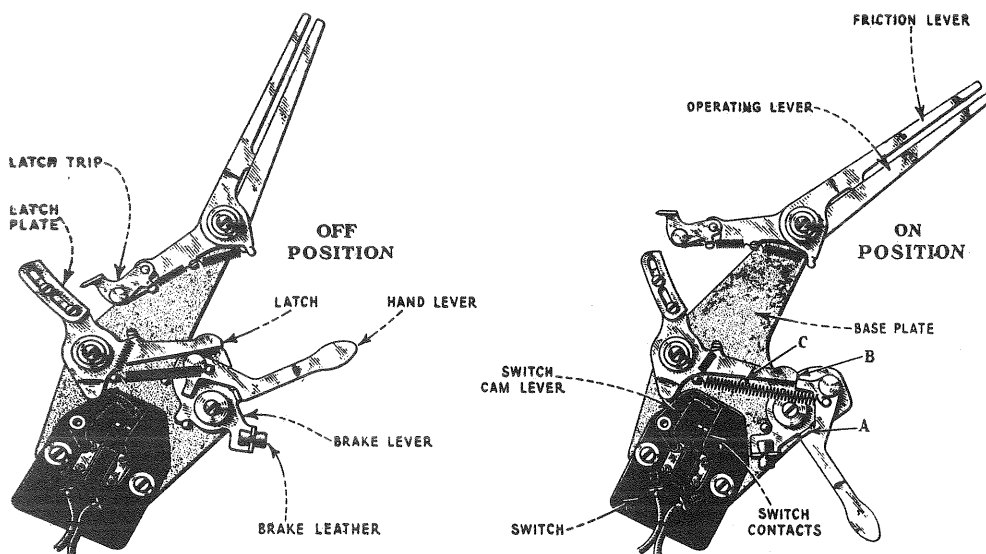


Figure 15—Automatic stop mechanism

- (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  $\frac{3}{8}$  in. length of  $\frac{1}{4}$  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 over-size 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  $\frac{1}{32}$  in. between the switch cam lever and the latch cam and about  $\frac{1}{16}$  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.