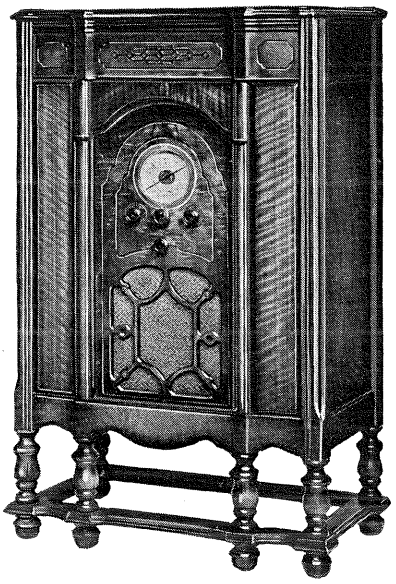
RCA Victor "All-Wave Duo"

Models 340 and 340-E

Eight-Tube Superheterodyne, Radio-Phonograph Combinations

(External I. F. Transformers)

INSTRUCTIONS



RCA Victor Company, Inc.

CAMDEN, N. J., U. S. A.

INTRODUCTION

This combination "all-wave" radio receiver and electrical phonograph embodies the widely recognized superheterodyne circuit and is capable of operation through a continuous tuning range of from 540 to 18,000 kilocycles (555 to 16.7 meters). Certain models intended primarily for European destinations are operable through an additional range of from 150 to 410 kilocycles (2000 to 732 meters) for long-wave services. All facilities provided in this instrument for reception beyond the limits of the standardized broadcast band (540 to 1500 kilocycles) are built into the radio chassis—not simply connected to an existing chassis as a short-wave adaptor—resulting in distinctly superior performance.

To facilitate tuning as far as possible, the complete main tuning range is divided into four overlapping steps, each spread over the full span of the dial. These steps, or frequency bands, together with the long-wave range provided in some models, are quickly interchangeable by means of a switch located on the front of the cabinet. Also contributing to tuning ease and accuracy are the clock-type "full-vision" illuminated dial, which is calibrated throughout in frequency, and the associated vernier (double-reduction ball-bearing) tuning drive.

The technically-informed user of this instrument naturally will be interested in its many advanced engineering features. Of chief importance is the use of *tuned-radio-frequency amplification* preceding the heterodyne circuit to minimize extraneous signal interference (image-frequency response, etc.) and to improve the "signal-noise" ratio. Two t-r-f stages are included, one being common to all bands and the second used only in conjunction with the highest-frequency band to compensate for the inherently greater circuit losses obtained in that range. Additional features of note are: (1) Its efficient automatic volume control operating uniformly at all carrier frequencies and (2) its high-powered (Class B) audio-output system utilizing the new "twin-amplifier" Radiotron RCA-53. In general, all of the best practices observed heretofore in modern, high-grade receivers of the standard broadcast type are incorporated in this "all-wave" instrument, thus insuring excellent performance over the entire tuning range.

Facilities for the electrical reproduction of either standard-speed (78 revolutions per minute) or long-playing (33⅓ R. P. M.) records of 12 inches diameter or less are accessible beneath the hinged lid of the cabinet. All parts of the electrical phonograph are assembled on a metallic motorboard which is supported upon springs to insure proper acoustical performance. The lid of the cabinet when lowered rests upon a "sound-proofing" cushion, thus confining within the phonograph compartment extraneous noise incident to record playing—a feature distinctly advantageous to reproduction quality.

INSTALLATION

Location—The instrument should be placed convenient to the antenna and ground connections and near an electrical outlet.

Set-up—After removing the instrument from its shipping container, detach the unfinished wooden cleat fastened across the rear of the chassis. Then remove the vertical wooden prop which supports the motor and the two "red" hex-head bolts from the motorboard mounting rails. The two wooden blocks which brace the motorboard in shipment finally must be removed so that the board will float freely upon its spring suspension.

Now raise the cabinet lid and withdraw all packing material from the playing compartment. Insert the used-needle cup (packed in outfit package) in the hole provided. With the speed-shifter (lever projecting toward front left-hand corner of motorboard) set in its 78 R. P. M. (outward) position, mount the turntable (also in outfit package) on the motor spindle. Make certain that the spindle drive key engages the slot in the turntable hub.

Tubes—The instrument is equipped and tested at the factory with RCA Radiotrons and is shipped with these tubes installed. Before making the required external connections, however, it will be advisable to examine the tube installation, as one or more of the tubes, shields or dome terminal clips may have been jarred loose in shipment. Refer to the tube location diagram printed on the instrument label inside the cabinet and ***make certain:***

(1) That all tubes are in the proper sockets and pressed down firmly.

(2) That all shields are rigidly in place over the tubes represented by double circles on the diagram.

(3) That the spring connectors of the short flexible (grid) leads, shown on the diagram, are securely attached to the dome terminals of the proper tubes.

NOTE—The grid lead for the RCA-2B7 Radiotron must be enclosed by the cylindrical tube shield. A slot is provided at the bottom of this shield for entrance of the lead.

Antenna and Ground—The efficiency of any antenna varies greatly with the frequency of incoming radio waves, a given length being excellent at certain frequencies and comparatively poor at others. For uniform results throughout a wide tuning range such as found in this instrument, therefore, an antenna of adjustable length would be desirable theoretically. From a practical standpoint, however, very good results will be obtained using two antennas of different length, one 24–29 feet for short-wave reception and the other 50–100 feet for reception in the long-wave, standard broadcast and police bands, the lead-in considered as part of the total length in each case.

The shorter antenna may be used alone if preferred, but probably will not be satisfactory for receiving distant or low-powered stations in the

standard broadcast band. Further, no advantage will be gained by its use on the shorter wave-lengths unless it can be installed so that the majority of its length is unshielded (not contained in a building of metallic construction) and sufficiently remote from sources of man-made interference (such as housewiring, power lines, street-railways and passing automobiles) to prevent excessive noise. If these conditions cannot be fulfilled, it will be preferable to erect a single antenna of compromise length (100–105 feet overall) which, in addition to providing excellent results in the standard broadcast band, will also favor reception in the short-wave broadcast bands located at 49, 31, 25 and 19 meters.

Best performance of this receiver on the shorter wave-lengths can be insured by installation of the recently-introduced "World-Wide" antenna system, available from your dealer as a convenient accessory kit. The advantages of this system are two-fold, its use providing: (1) A great improvement in efficiency, as evidenced by increased signal strength—often several times that obtainable with the conventional single-wire type, and (2) a considerable decrease in local electrical interference (man-made static) which is apt to be objectionably severe at the higher frequencies. For densely-populated districts, therefore, this system is virtually a necessity.

Good reception in many installations will be obtained without connecting the instrument to an external ground, since the power line characteristics often render a separate radio ground unnecessary. In any case, however, best results will be insured by grounding the set in the conventional manner to a water-pipe or radiator or to a metallic pipe or stake driven from five to eight feet into the soil. The ground lead when used should be short, preferably not more than 15 feet in length, and connected to a clean portion of the pipe or stake surface by means of an approved ground clamp.

A terminal board is provided at the rear of the receiver chassis for connection to the antenna and ground. Attach the antenna wire or lead-in to the left-hand terminal (marked "ANT") and the ground wire to the right-hand terminal (marked "GND"). Tighten both terminals with a screw-driver to insure permanent electrical connections.

Power Supply—Connect the power cord of the instrument to an electrical outlet supplying alternating current at the correct voltage and frequency (cycles)—see instrument-label rating which corresponds to rating symbol on chassis. As shipped from the factory, models rated 105–125 volts are connected correctly for operation at 115–125 (230–250 for 200–250 volt models) *unless otherwise indicated by a tag attached to the power cord.* Hence, if the local voltage does not lie within the present range of the instrument, the alternative form of connection must be substituted. Consult your power company if you are in doubt as to the specific voltage or frequency of the supply. Reconnections when required should be performed by your dealer, to whom complete technical information is available in a separate booklet known as the Service Notes.

OPERATION

Controls

The four control knobs on the front panel of the cabinet serve the following purposes:

(1) ***Range Switch*** (Left-hand Knob)—This switch converts the receiver for operation within any of the tuning ranges provided. As indicated on the selector dial, the letters on the switch escutcheon signify:

X—*Long-Wave Range*—150 to 410 kilocycles (2000 to 732 meters). This range is included only in certain models of the instrument (see "Introduction").

A—*Standard Broadcast Band*—540 to 1500 kilocycles (555 to 200 meters).

B—*Police Band*—1500 to 3900 kilocycles (200 to 77 meters). Services available within this band include police calls at 1574, 1712 and 2450 kilocycles, amateur radio "phone" communications between 1800 and 2000 kilocycles, and aviation communications (phone) between 2500 and 3500 kilocycles.

C—*Short-Wave Range*—3900 to 10,000 kilocycles (77 to 30 meters). Within the limits of this range are included two of the internationally-assigned short-wave broadcast bands. These are known as the 49 and 31 meter bands. (The portion of this range from 8000 to 10,000 kilocycles, which includes the latter band, is preferably received on range D.)

D—*Short-Wave Range* — 8,000 to 18,000 kilocycles (37.5 to 16.7 meters). This range embraces four of the standardized short-wave broadcast bands located at 31, 25, 19 and 16 meters, respectively.

(2) ***Station Selector*** (Upper Middle Knob with Crank)—Scale X (when included) and scales A and B on the illuminated dial are calibrated in kilocycles and traversed by the lower end of the moving pointer. The upper end of the pointer traverses scales C and D, which are calibrated in megacycles (affix three ciphers to convert to kilocycles). The scale portions covered by the police bands on scale B and by the standardized short-wave broadcast bands on scales C and D are bracketed and clearly identified; each police band is designated by the letter "P" and each broadcast band by numerals corresponding to the wave-length followed by the letter "M" (meters), such as "49M."

(3) ***Power Switch and Tone Control*** (Lower Middle Knob)—The power switch operates at the counter-clockwise end of the control range. A slight clockwise rotation actuates the switch, causing illumination of the dial—indicative of normal operation. Treble response increases gradually to a maximum with continued clockwise rotation.

(4) ***Radio Volume Control*** (Right-hand Knob)—Sound level (volume) increases with rotation of this control in a clockwise direction.

A fifth knob is located in the phonograph playing compartment at the left rear corner of the motor-board. This control serves two functions as follows:

(5) ***Transfer Switch and Record Volume Control)***—The transfer switch operates at the counter-clockwise end of the control range. With the knob turned fully counter-clockwise, the switch is set for radio operation. Clockwise rotation first transfers the circuits for phonograph operation and then increases the sound level (volume) obtained from records.

Radio Procedure

The actual operation is simple and not unlike that of more conventional instruments designed for the reception of standard broadcast programs alone. However, the full possibilities of any short-wave receiver cannot be attained unless the user has a practical knowledge of short-wave transmission behavior and operating schedules. It is therefore recommended that the appended Notes on Short-Wave Reception and the inserted Short-Wave Broadcasting Station List and Program Schedule be studied carefully.

A brief outline of the recommended operating procedure should suffice. See the foregoing description of the controls and proceed as follows:

1. Set the Transfer Switch counter-clockwise (for radio operation) and the Range Switch for the frequency range within which the desired station is included.

2. Turn the Power Switch "on" and the Tone Control fully clockwise—*for full-range reproduction.* Wait a few seconds in order that the tubes may attain the proper temperature before attempting further operation.

3. Advance the Radio Volume Control to a position near the middle of its range and rotate the Station Selector until the dial indicator assumes a position coincident with the listed frequency of the desired station (on that scale which is designated by the letter corresponding to the range switch setting). Then turn the selector *very slowly* over a narrow range on each side of that setting, advancing the volume control further in a clockwise direction and repeating the tuning process, if necessary, until the signal is heard.

NOTE—This procedure is important—especially so for short-wave reception. Because of the wide band of frequencies covered by the short-wave ranges, tuning is critical (sharp). A station of suitable strength often will be imperceptible if passed through rapidly or in a haphazard manner.

4. After receiving the signal, turn the Radio Volume Control counter-clockwise until the volume is reduced to a low level. Then readjust the Station Selector accurately to the position mid-way between the points where the quality becomes poor or the signal disappears. *This setting minimizes the proportion of background noise (static) and provides the fine quality of reproduction possible with this instrument.*

5. Adjust the Radio Volume Control to the desired volume level.

NOTE—*The automatic volume control* built into this instrument maintains the volume level substantially constant irrespective of normal fluctuations of signal strength (fading). Also, other stations with good signal strength will be received at approximately the same level without manual readjustment of the volume.

6. If less treble response is preferred, rotate the Tone Control counter-clockwise to obtain the most pleasing quality of reproduction; static interference, when excessive, also may be reduced in this manner.

7. When through operating, turn the Tone Control fully counter-clockwise, thus switching "off" the power.

Phonograph Procedure

To operate the electrical phonograph, refer to the section on "Controls" and proceed as follows:

1. Turn the Transfer Switch and Record Volume Control Knob clockwise, for phonograph operation.

2. Apply power by turning the Tone Control clockwise from the "off" position. Set this control in the extreme clockwise position for *full-range* reproduction. A few seconds are required for the tubes to heat before operation is possible.

3. Place the desired record on the turntable. Insert a *new* needle in the pickup as far as it will go and tighten the needle screw. For long-playing (33⅓ R. P. M.) records, use *only* the *orange Chromium* needle. For standard (78 R. P. M.) records, use the latter needle or, if preferred, either the *green Chromium* or the full volume *Tungstone* needle. Ordinary steel needles (full volume) can be used with standard (78 R. P. M.) records, provided a new needle is inserted for each selection.

NOTE—With care, the orange Chromium needle should play 75, the green Chromium 100, and the Tungstone 100 to 150 records. *Never re-insert in the pickup a Chromium needle which has been used (however slightly), as damage to the record grooves would result.* Do not use *Tungstone* needles with thin, flexible records or with transparent-faced (illustrated) records.

4. Pull the starting lever (right-hand side of turntable) forward to start the motor. Set the speed shifter (left-hand side of turntable) for the speed—78 or 33⅓ R. P. M.—corresponding to the record on the turntable. Then place the needle on the smooth outer surface of the record and slide it into the first groove.

NOTE—The speed shifter should not be moved inward (from the 78 to the 33⅓ R. P. M. position) while the turntable is at rest.

5. Adjust the Record Volume Control to obtain the desired volume.

6. For most faithful reproduction, the Tone Control should be left in the fully clockwise position while using the phonograph. Turning this control counter-clockwise decreases the treble response and reduces the needle scratch noise (particularly noticeable with old records) reproduced by the loudspeaker.

7. Close the lid while playing. As the lid rests on a sound-proof cushion, needle scratch and other noises incident to record playing are thus rendered far less prominent.

8. At the completion of the record, lift the pickup arm and move it toward the right to stop the motor (motor stops automatically at the end of a record having the *eccentric* final groove). Lower the pickup outside the turntable—never allow it to rest on the record (or turntable) when not operating the phonograph.

9. When through operating, close the lid and turn "off" the power switch.

Lubrication—The motor should be lubricated with light oil once every six months. Two oil holes on top of the motor are accessible through openings in the motorboard when the turntable is removed. The ball-bearing mechanism under the turntable should be lubricated once a year by prying off the cover and packing with vaseline or light motor grease, being careful to prevent any dirt particles from entering with the grease. Make sure that the speed shifter is in the outward (78 R. P. M.) position before replacing the turntable on the spindle.

NOTES ON SHORT-WAVE RECEPTION

While the design of this instrument is such that no previous experience or special skill is required for proper operation, its full possibilities can be realized only by those familiar with the general characteristics of transmission on the shorter wave-lengths. The following notes are a summary of extensive data compiled mainly by experimentation and should be found both interesting and helpful, especially to beginners in the field of short-wave reception.

Broadcast transmission at 49 meters is most reliable when received from a distance of 300 miles (500 kilometers) or more, although good reception at distances greater than 1500 miles (2400 kilometers) can be expected only when a large portion of the signal path lies in darkness.

Thirty-one (31) meter stations afford greatest reliability of service to receivers situated at a distance exceeding 800 miles (1300 kilometers). Good reception from distant stations in this band is possible both day and night.

Reception from stations operating in the 25 meter band is most common when a span of 1000 miles (1600 kilometers) or more separates the receiver and transmitter. Such transmission over distances of less than 2000 miles (3200 kilometers), will be received best during daylight hours. The more distant stations, however, can still be heard well after nightfall under favorable conditions.

In the 19 meter band, stations situated at a distance of 1500 miles (2400 kilometers) or greater will be found most satisfactory. Signals in this band will generally be heard during daylight hours—rarely after nightfall or when any appreciable portion of the transmission path is in darkness. Wave-lengths below 19 meters are useful only when transmitted entirely through daylight and over long distances (2000 miles or more); ordinarily they cannot be received after sunset.

Transmitted signals of any wave-length are known to divide into two components—the "ground" wave and the "sky" wave. The former remains close to the earth's surface, providing reliable service only over short distances from the broadcasting station. The sky wave, however, travels into the higher layers of the atmosphere and is reflected back to the earth's surface at an appreciable distance from the station. With short-wave signals, the sky wave usually does not return within the radius covered by the ground wave, resulting in a so-called dead-spot region within which reception is impossible or extremely unsatisfactory. The length of the region wherein such conditions are effective is known as the skip distance, varying greatly from day to night and from summer to winter approximately as shown in Table I.

When attempting to receive distant or foreign stations, the time standards observed at various longitudes throughout the world must be considered. At 8:00 P. M. in New York or 7:00 P. M. in Chicago, it is of the next day—1:00 A. M. in London, 2:00 A. M. in most of Europe and 11:00 A. M. in Australia. On the American continents, therefore, regular evening broadcasts from Europe will be received in the late afternoon and from Australia in the early morning. Special programs, however, are frequently transmitted from European stations at times chosen for evening reception in America.

Although reception on the short wave-lengths is less affected by atmospherics or static and good results may be had in midsummer even during a thunder storm, the reverse is true of man-made interference. Electrical machinery such as trolleys, dial telephones, motors, electric fans, automobiles, airplanes, electrical appliances, flashing signs and oil burners create far more interference to the shorter waves than to frequencies in the standard broadcast band (200 to 555 meters).

While the foregoing statements are valid, many other factors may so influence the transmission of short waves that exceptions are probable in certain locations. Experience in the operation of short-wave receivers in a given location is the best guide as to what to expect in reception at various times.

Table I—Effect of Time of Day and Season of Year on Short-Wave Transmission*

Wave-length (Meters)	Ground Wave Range		Sky Wave (Mid-Summer) Approximate Range				Sky Wave (Mid-Winter) Approximate Range			
			Noon		Midnight		Noon		Midnight	
	Miles	Kilom.	Miles	Kilom.	Miles	Kilom.	Miles	Kilom.	Miles	Kilom.
100	90	145	—90	—145	90—600	145—960	90—100	145—160	90—2500	145—4000
49	75	120	100—200	160—320	250—5000	400—8000	200—600	320—960	400—∞	640—∞
31	60	97	200—700	320—1125	1000—∞	1600—∞	500—2000	800—3200	1500—∞	2400—∞
25	50	80	300—1000	480—1600	1500—∞	2400—∞	600—3000	960—4800	2000—∞	3200—∞
19	35	56	400—2000	640—3200	2500—∞	4000—∞	900—4000	1450—6400	X	X
15	15	24	700—4000	1125—6400	X	X	1500—∞	2400—∞	X	X

∞—Unlimited distance. X—Ordinarily cannot be heard.

* Time and season apply to transmitting station. Distances specified are based on relatively high-power transmission and favorable conditions of reception.

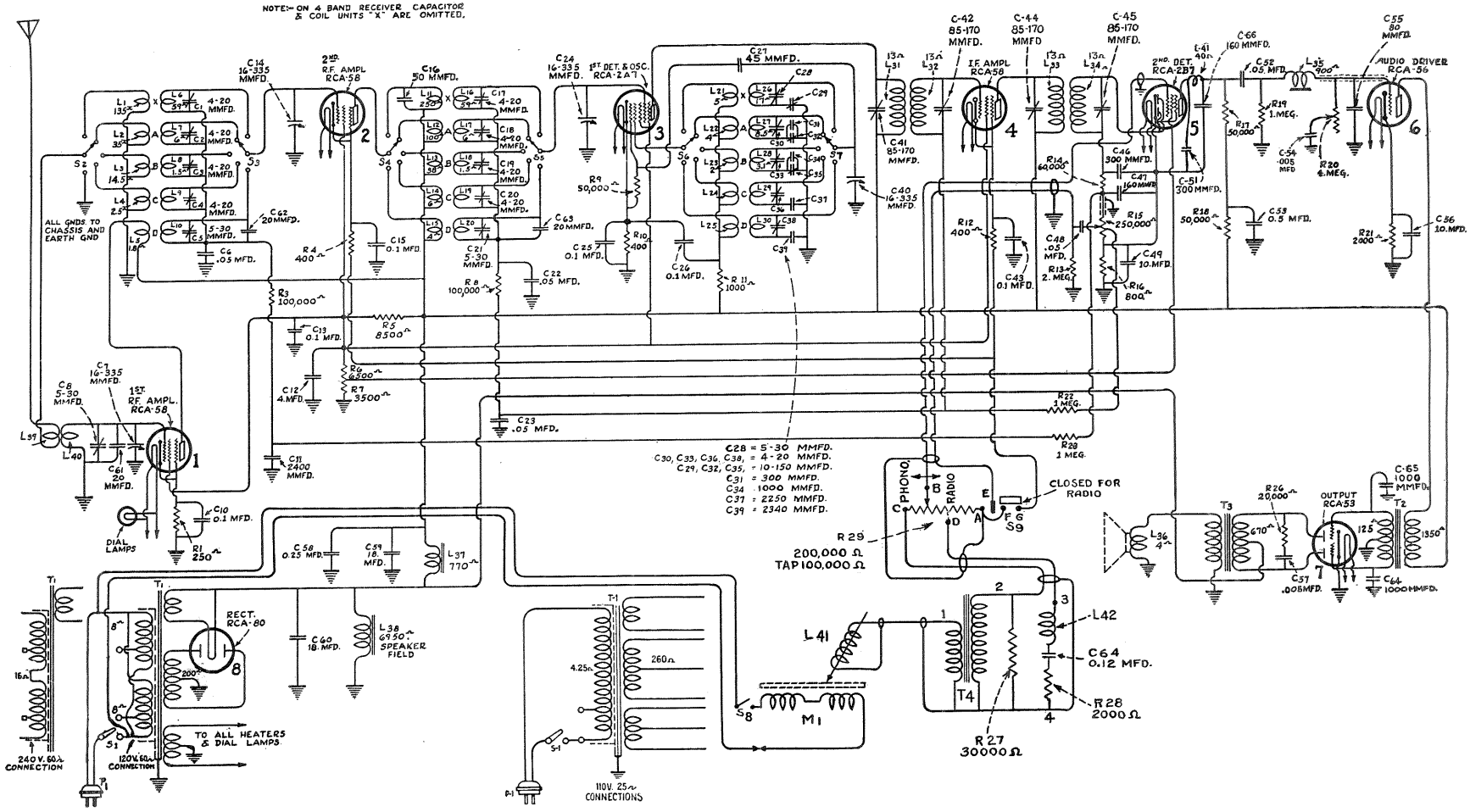


Figure A—Schematic Circuit Diagram

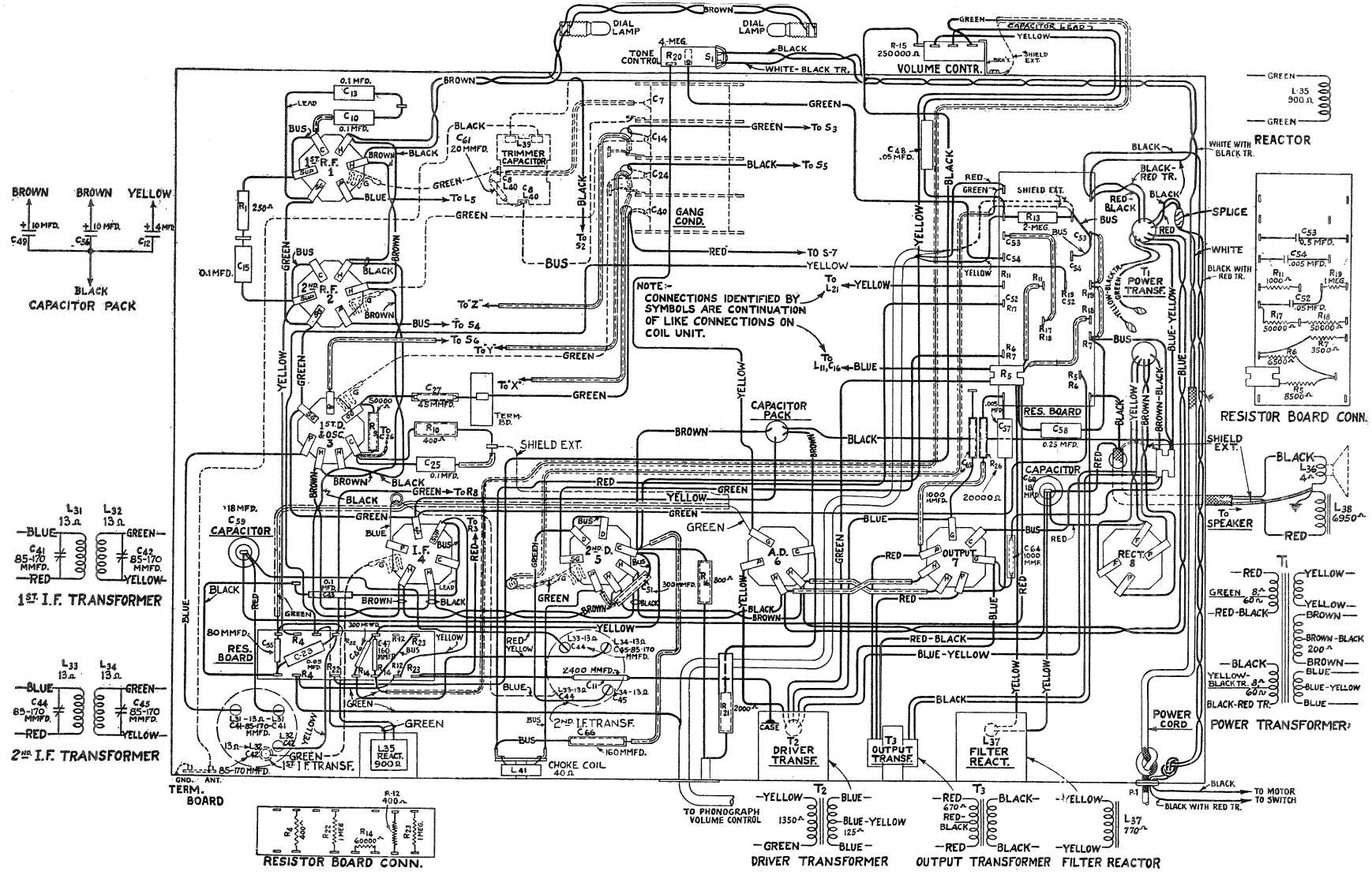


Figure B—Chassis Wiring

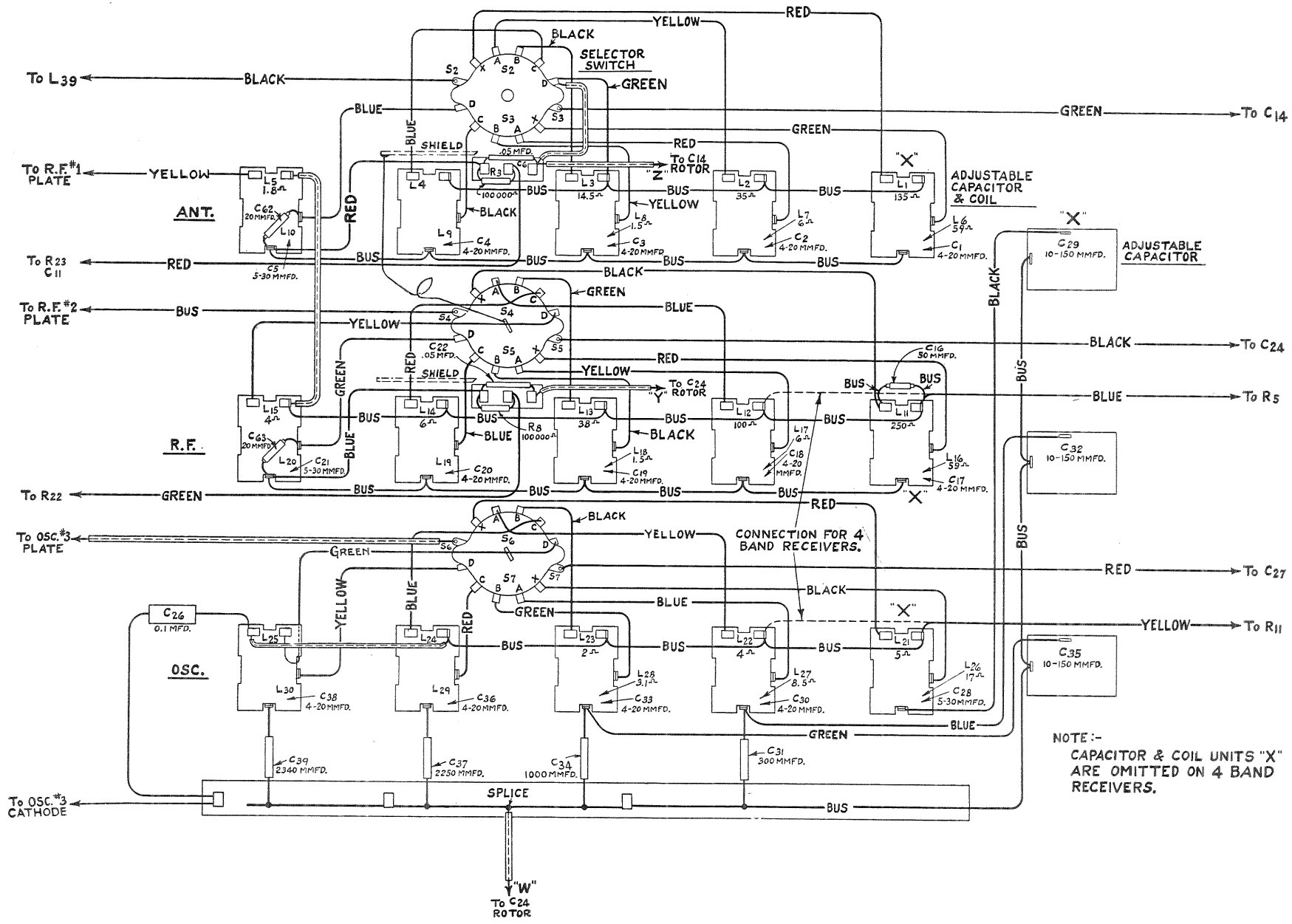


Figure C—Wiring Diagram of Coil Assembly

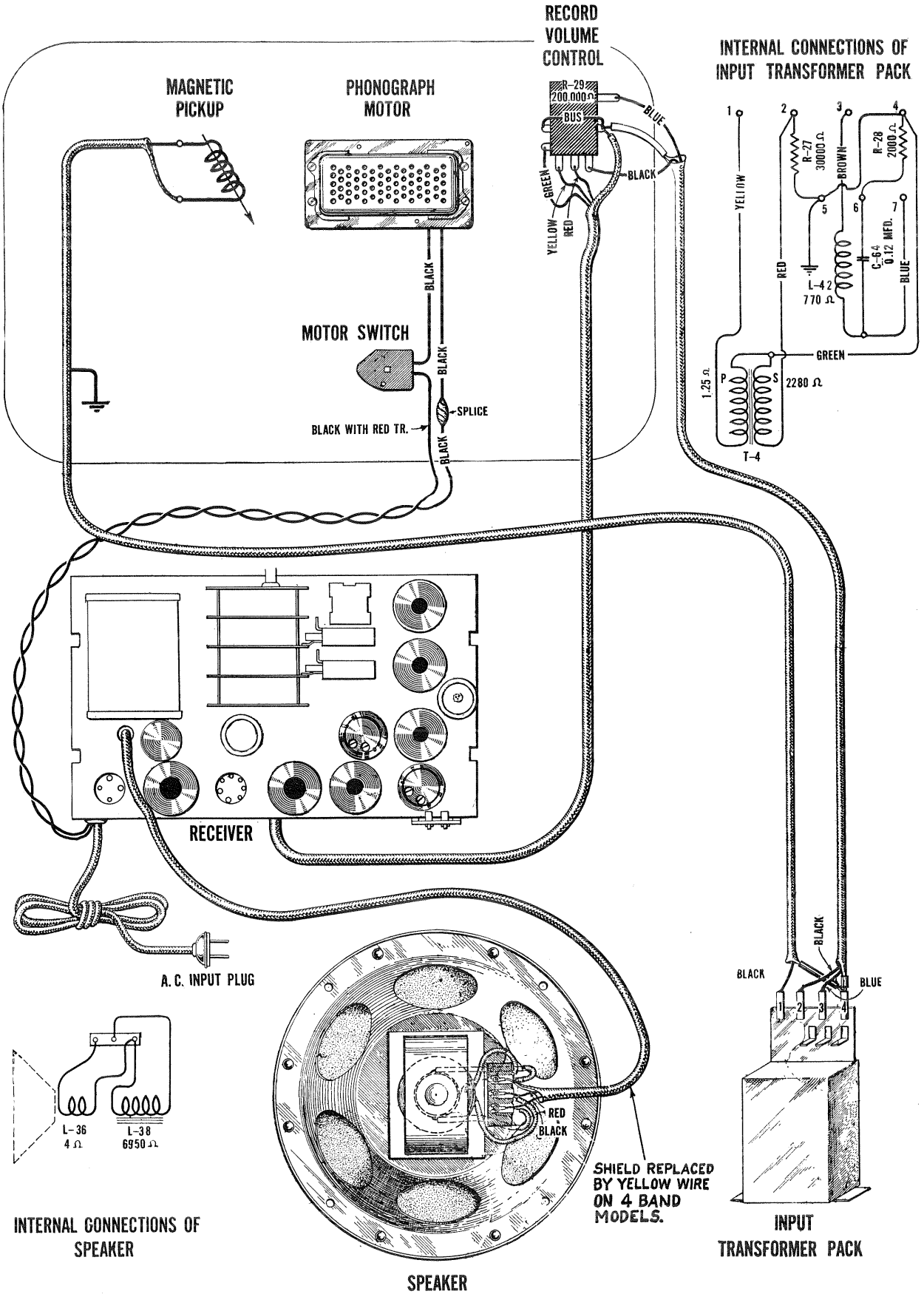


Figure D—Assembly Wiring

SERVICE DATA

Electrical Specifications

Voltage Rating.....105–125 Volts
Frequency Rating.....25, 30, 50 and 60 Cycles
Power Consumption.....140 Watts
Type and Number of Radiotrons....3 RCA-58, 1 RCA-2A7, 1 RCA-2B7, 1 RCA-56, 1 RCA-53, 1 RCA-80—Total 8
Type of Circuit.....Straight Superheterodyne for all frequencies with Class "B" output
Undistorted Output.....6 Watts

This all-wave combination instrument utilizes the new perfected continuous tuning superheterodyne chassis and the standard two speed motor-board assembly. Excellent quality of record reproduction, together with unusual radio performance, characterizes this instrument.

Service data for the magnetic pickup used on the tone arm of the motor-board assembly is given on the following pages. Service data for the radio receiver follows.

The tuning bands for the receiver chassis are as follows:

Selector Switch Position	*Frequency Range (Kilocycles)*	*Wave-Length Range (Meters)*
X	150–410	2000–732
A	540–1500	555–200
B	1500–3900	200–77.0
C	3900–10000	77.0–30.0
D	8000–18000	37.5–16.7

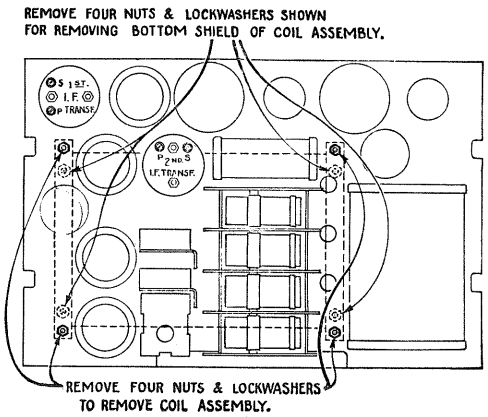


Figure E—Location of nuts and lockwashers holding coil assembly

This receiver will be supplied in two models, one including all bands and one with band X omitted. These instructions, however, will cover both types of the receiver. The variations in the wiring for the two models are plainly shown in the illustrations. Figures A, B and C show the schematic circuit and wiring diagrams.

The circuit consists of an R. F. stage using Radiotron RCA-58, a combined oscillator and first detector using Radiotron RCA-2A7, an I. F. stage using RCA-58, a second detector and A. V. C. using RCA-2B7, an A. F. driver using RCA-56, and a Class "B" output stage using an RCA-53. The RCA-80 functions as the rectifier in the power supply circuits.

The foregoing tubes and circuit functions apply to bands X, A, B and C only. In the case of band D, an additional R. F. stage utilizing an additional Radiotron RCA-58 is used. This is to increase the sensitivity and image frequency selectivity and to reduce the interference caused by tube hiss, static and signals corresponding to the intermediate frequency.

The intermediate frequency is 445 K. C. The use of this frequency gives an especially good image frequency ratio and facilitates alignment of the oscillator at the higher frequency bands.

Mechanical Construction

The chassis consists of two major assemblies, which must be disassembled for certain repair work. These assemblies consist of the chassis proper, including the main frame, power transformer, etc., and the coil assembly. The coil assembly consists of fifteen transformers supported upon individual tubular bakelite forms, each fastened to a separate porcelain strip upon which the coil terminals are mounted with their associate trimmer capacitor. This entire assembly with the selector switch is grouped in a shielded compartment which is mounted in the base of the main chassis assembly.

In order to remove this assembly it is necessary to remove the four nuts shown in Figure E and unsolder the connections of the fifteen leads shown in Figure C at the points where they connect to the main chassis. The leads should be allowed to remain on the coil assembly. After this is done, the coil assembly may be removed and repairs to it or to the main chassis may be easily made. If a coil or its associated trimmer is to be replaced, then only the bottom shield of the coil assembly must be removed. This is done by removing the four nuts that hold it to the chassis studs. This is shown in Figure E.

Line-Up Capacitor Adjustments

This receiver is aligned in a similar manner to that of a standard broadcast band receiver. That is, the three main tuning capacitors are aligned by means of three trimmers in each band and on the three lowest frequency bands a series trimmer is adjusted for aligning the oscillator circuit. The other two bands do not require this low frequency trimmer, it being fixed in value. In the case of band D, it is necessary to adjust four trimmers due to the additional R. F. stage used.

TUBE SOCKET VOLTAGES (RADIO OPERATION)

120 Volt A. C. Line

Radiotron No.	Control Grid to Cathode Volts	Screen Grid to Cathode Volts	Plate to Cathode Volts	Plate Current M. A.	Filament or Heater Volts
RCA-58, R. F.	**2.0	100	255	6.0	2.6
RCA-58, S. W. R. F.	**2.0	100	255	6.0	2.6
RCA-2A7, Det.-Osc.	**2.5	100	250	*5.0	2.6
RCA-58, I. F.	**2.0	100	255	6.0	2.6
RCA-2B7, 2nd Det.-AVC	**1.5	35	105	1.5	2.6
RCA-56, A. F. Driver	**12.0	—	245	6.0	2.6
RCA-53, Output	0	—	300	36.0	2.6
RCA-80, Rectifier	640 R. M. S. Plate to Plate			130 per Plate	5.0

* Voltages and current apply to detector portion of tube.
** These voltages cannot be measured because of the high resistance of the circuits.

The intermediate frequency amplifier is aligned in a similar manner to that of standard broadcast receivers except that it is aligned at 445 K. C. In order to properly align the receiver, it is essential that the Stock No. 9050 Test Oscillator be used. This oscillator covers the frequencies of 90 K. C. to 25,000 K. C. continuously, has good stability and includes an attenuator. In addition to the oscillator, a 300-ohm resistor for use as a "dummy" antenna, a non-metallic screwdriver (such as Stock No. 4160), and an output meter are required. The output meter should be preferably a thermocouple galvanometer connected either across or in place of the cone coil of the loudspeaker.

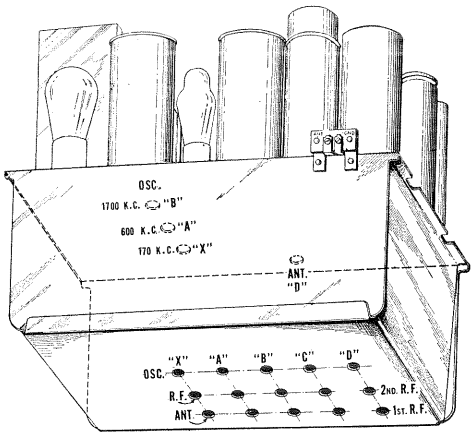


Figure F—Location of line-up capacitors

To align the intermediate frequency circuits, connect the output of the external oscillator to the grid of the first detector. For the R. F. and oscillator adjustments, the oscillator output should be connected to the antenna and ground terminals of the receiver with a 300-ohm resistor inserted in series with the antenna lead. In many cases, however, the signal strength obtained with this direct connection will be too great to permit proper alignment, even at the minimum setting of the oscillator attenuator. When this is true, the external oscillator must be loose-coupled to the receiver. This is done by connecting the 300-ohm resistor between the antenna and ground terminals of the receiver and attaching a short length of wire to the antenna post. Lay the free end of this wire across the oscillator case, adjusting its position as necessary to obtain the degree of pickup required.

The output of the external oscillator should be at the minimum value necessary to obtain a deflection in the output meter when the volume control is at its maximum position. All adjustments are made for a maximum deflection in the output meter.

The accuracy of line-up of each band may be checked without touching the trimmer condensers, by the use of the tuning wand, Stock No. 6679.

One end of the wand consists of a brass cylinder. When this is inserted in a coil the effective inductance of the coil is lowered.

The other end of the wand contains a special finely divided iron suitable for use at radio frequencies. When this is inserted in a coil the inductance is raised.

To use the tuning wand a signal is first tuned in at the frequency at which a check is desired on alignment. The wand is then inserted slowly in the Antenna and R. F. transformers, using first one end and then the other end of the wand. Unless the alignment is perfect, it will be found that the power output indicated by the meter will be increased to a peak for a critical position of the wand in the coils.

The end of the wand required indicates whether the coil is high or low.

Of course, alignment correction at the high-frequency end of a tuning range should be accomplished by the use of the trimmer condenser. If alignment correction should be required at the low-frequency end of a tuning range it may be accomplished by sliding the end coil of the transformer. The winding farthest from the trimmer panel is pushed toward the trimmer panel to increase the inductance, and farther away to decrease the inductance. On band D coils, the last two or three turns may be pushed in a similar manner to obtain the proper inductance.

This adjustment should not be attempted unless a quite appreciable improvement will result (as shown by the tuning wand).

The following chart gives the details of all line-up adjustments. The receiver should be lined up in the order of the adjustments given on the chart. Refer to Figure F for the location of the line-up capacitors.

Transformer Connections

The power transformer of the 50–60 cycle receiver uses two tapped primary windings. By connecting them in parallel or in series, the receiver may be used either on 110 or 220 volt lines. Figure H shows the proper manner of making the various connections possible for this transformer. Note: The transformer is normally connected for 115–125-volt lines, and a 100-volt motor supplied. The 220-volt connections must not be used unless the motor is also changed. However, 220-volt operation of the standard equipment may be obtained by using the Stock No. 9034 step-down line transformer.

The 25–60 cycle transformer uses only one 105–125-volt winding, a tap being provided for the lower voltages. Normally the transformer is connected for 115–125-volt lines, but the connection shown in Figure G may be used for 100–115-volt lines.

External Oscillator Frequency	Dial Setting	Location of Line-Up Capacitors	Position of Selector Switch	Adjust for	Number of Adjustments to be Made
445 K. C.	Any setting that does not bring in station.	At rear of chassis.	Any position that does not bring in station.	Maximum output.	4
370 K. C.	370 K. C.	Bottom of chassis.	X	Maximum output.	3
175 K. C.	Set for signal.	Top of chassis.	X	Maximum output while rocking dial back and forth.	1
1400 K. C.	1400 K. C.	Bottom of chassis.	A	Maximum output.	3
600 K. C.	Set for signal.	Top of chassis.	A	Maximum output while rocking dial back and forth.	1
3900 K. C.	3900 K. C.	Bottom of chassis.	B	Maximum output.	3
1710 K. C.	Set for signal.	Top of chassis.	B	Maximum output while rocking dial back and forth.	1
10 M. C.	10 M. C.	Bottom of chassis.	C	Maximum output. (See Note.)	3
15 or 18 M. C.	15 or 18 M. C.	Bottom and top.	D	Maximum output. (See Note.)	4

NOTE—It is important to note, when aligning bands C and D, that two peaks will be observed on the trimmers for the oscillator and for the first detector. The correct oscillator peak is the one obtained using the lower trimmer capacitance, whereas the correct detector peak is the one obtained with the greater capacitance. It is essential that the proper peak be chosen, as otherwise tracking and sensitivity will be very poor at other frequencies. When adjusting the detector trimmer, the tuning capacitor should be rocked, since there is a reaction on the oscillator tuning.

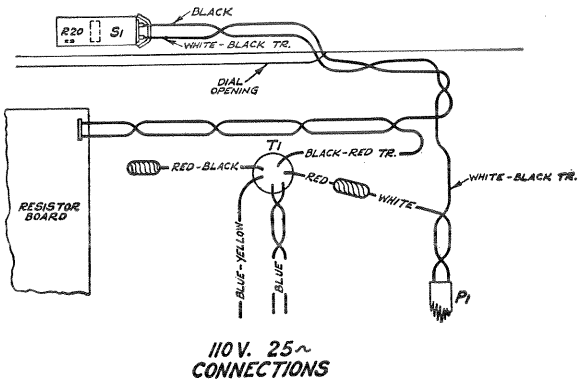


Figure G—100–115 Volt Connection of 25–60 Cycles Transformer

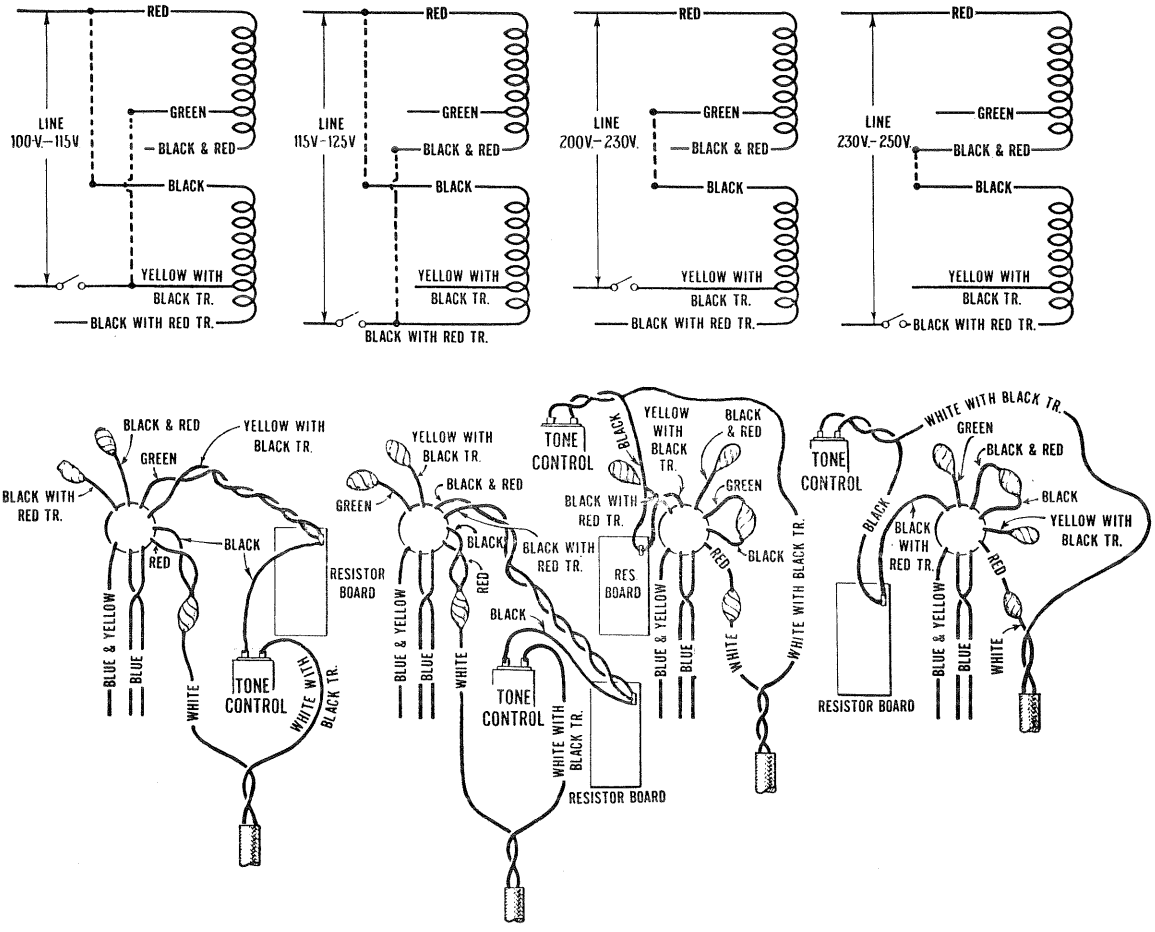


Figure H—Power Transformer Connections (50–60 cycles)

SERVICE DATA ON MAGNETIC PICKUP

The Magnetic Pickup used in this combination instrument is of a new design with an improved frequency range. While in physical appearance, it is similar to that of the older type, details of construction are considerably different. It consists essentially of a chromium steel magnet, two thin pole pieces, a mechanism support and bracket, a coil, and an armature that is damped by means of an anchored damping block.

The use of the anchored damping block eliminates any bad peaks in the frequency range. The frequency-response characteristic is substantially flat from 50 to 5,000 cycles.

Replacing Magnet Coil, Pivot Rubbers, Armature or Damping Block

In order to replace a defective coil or the hardened pivot rubbers (see Figure K), it is necessary to proceed as follows:

(a) Remove the pickup cover by removing the center holding screw and needle screw.

(b) Remove the pickup magnet and the magnet clamp by pulling them forward.

(c) Unsolder the coil leads and remove the mechanism assembly from the back plate by releasing the two mounting screws and the damping block clamping screw.

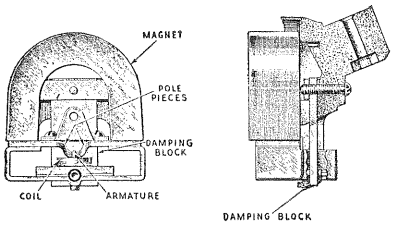


Figure I

(d) Remove screws A and B, Figure J, and then remove the mechanism assembly from the pole pieces.

(e) The coil or the front pivot rubber may now be removed and replaced. If it is desired to replace the rear pivot rubber, then the end of the armature soldered to the mechanism support must be unsoldered and the damping block removed. The rear pivot rubber now may be replaced. After putting the pivot rubbers in place a new damping block should be fastened to the armature as outlined in instructions on replacing the damping block.

(f) The mechanism should now be reassembled, except for the magnet, which must be magnetized. After being magnetized, the mechanism—with the pole pieces upward—should be placed so that the magnet may be slid from the magnetizer onto the pole pieces without breaking physical contact. After placing the pole pieces on the magnet, the entire assembly should be remagnetized thoroughly, being careful not to change the polarity obtained by the initial magnetization.

(g) After assembling to the mechanism, the entire assembly should be fastened to the back plate by means of the screws provided, making sure the damping block is securely clamped. At the same time, the metal dust cover must be placed in position.

(h) After remagnetizing, it is necessary to correctly center the armature. This may be done quite accurately by feeling its play after the needle is inserted. A little practice will quickly show which way an adjustment is necessary to have the armature centered properly. The adjustment is made by loosening screws A and B (Figure J), and sliding the mechanism slightly in relation to the pole pieces.

(i) The cover may be now replaced over the entire assembly, and the pickup returned to the tone arm.

In assembling, it may be desirable to check the armature air gap by means of a small Feeler Gauge. This air gap should be nine mils on each side of the armature. However, a little practice with the needle in place will quickly disclose whether or not the armature is centered.

Replacing the Damping Block

If it is desired to replace the damping block, it may be done in the following manner:

(a) Disassemble the pickup as described under the preceding section.

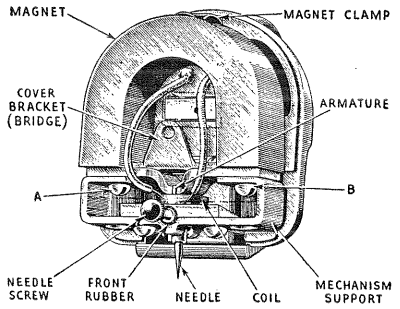


Figure J

(b) Remove the armature entirely by unsoldering it at its joint with the mechanism support.

(c) Remove the damping block from the armature and clean the bushing for holding the damping block with emery paper.

(d) Insert the armature through the new block so that it occupies the same position as that of the old. Also ascertain that the block is in correct vertical alignment with the armature. It will be noted that the hole in the damping block is somewhat smaller than the diameter of the armature. This is done so that a snug fit will be obtained.

(e) After properly locating the damping block, a soldering iron should be applied to the armature so that the block will melt slightly at its point of contact with the armature. A special tip, constructed as shown in Figure K, will prove desirable for fusing the block in place. The iron should be applied long enough to slightly melt the block and cause a small bulge on both side, but should not be applied long enough to cause any bubbling. The pickup should then be reassembled as described in the preceding section.

Only rosin core solder should be used for soldering the coil leads in the pickup. Also rosin core solder should be satisfactory for resoldering the end of the spring in the hole in the mechanism, since both these parts have been previously tinned. In case the parts are not well tinned, it will be necessary to scrape the end of the spring and the hole in the mechanism until bright. These parts may now be tinned by using as a flux a water solution of zinc chloride (commonly called

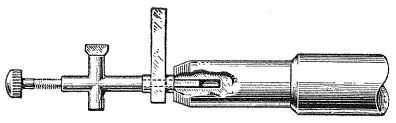


Figure K

acid flux). After tinning, dip the parts in water to wash off the acid flux and thereby prevent serious subsequent corrosion. After making sure that the pivot rubbers and damping block are properly in place, as described under (e) above, the armature may now be soldered in place in the mechanism by using rosin core solder, since the parts are now tinned. Care must be exercised to get the needle hole perfectly square with respect to the mechanism, or otherwise it will be difficult if not impossible to center the armature in the airgap as explained under (h).

REPLACEMENT PARTS

Insist on genuine factory tested parts, which are readily identified and may be purchased from authorized dealers

Stock No.	DESCRIPTION	List Price
	RECEIVER ASSEMBLIES	
2747	Contact cap—Package of 5	$0.50
2816	Resistor — 1,000 ohms— Carbon type — ½ watt (R11)—Package of 5	1.00
3056	Shield—Output Radiotron shield—Pkg. of 2	.40
3076	Resistor—1 megohm—Carbon type—½ watt (R19, R22, R23)—Package of 5	1.00
3114	Resistor—50,000 ohms—Carbon type—¼ watt (R9)—Package of 5	1.00
3118	Resistor—100,000 ohms—Carbon type—¼ watt (R3, R8)—Package of 5	1.00
3435	Resistor—250 ohms—Carbon type—½ watt (R1)—Package of 5	1.00
3470	Resistor—6,500 ohms—Carbon type—1 watt (R6)—Package of 5	1.10
3526	Resistor — 2,000 ohms — Carbon type — ½ watt (R21)—Package of 5	1.00
3527	Resistor—800 ohms—Carbon type—½ watt (R16)—Package of 5	1.00
3529	Socket—Dial lamp socket	.32
3555	Capacitor—0.1 mfd. (C26)	.36
3572	Socket—7-contact Radiotron socket—First detector and oscillator	.38
3594	Resistor—50,000 ohms—Carbon type—½ watt (R17, R18)—Package of 5	1.00
3597	Capacitor—0.25 mfd. (C58)	.40
3602	Resistor—60,000 ohms—Carbon type—¼ watt (R14)—Package of 5	1.00
3616	Capacitor—300 mmfd. (C51)	.34
3622	Shield—Second detector Radiotron shield	.36
3641	Capacitor—0.1 mfd. (C10, C15, C25)	.35
3643	Capacitor—.005 mfd. (C57)	.25
3711	Capacitor—80 mmfd. (C55)	.40
3719	Socket—7-contact Radiotron socket	.30
3771	Resistor—8,500 ohms—Carbon type—3 watt (R5)	.25
3845	Capacitor—2,340 mmfd. (C39)	.50
3846	Capacitor—2,250 mmfd. (C37)	.50
3848	Capacitor—300 mmfd. (C31)	.30
3849	Capacitor—50 mmfd. (C16)	.30
3861	Capacitor—Adjustable trimmer (C29, C32, C35)	.78
3863	Resistor—400 ohms—Carbon type—½ watt (R4, R10, R12)—Package of 5	1.00
3864	Capacitor—300 mmfd. (C46)	.30
3865	Capacitor—160 mmfd. (C47)	.30
3888	Capacitor—.05 mfd. (C6, C22, C23, C52)	.25
3901	Capacitor—.05 mfd. (C48)	.36
3931	Capacitor—45 mmfd. (C27)	.30
3932	Capacitor—.0024 mfd. (C11)	.30
3973	Capacitor—1,000 mmfd. (C64, C65)	.34
4019	Capacitor—1,000 mmfd. (C34)	.34
4030	Bracket—Tone or volume control mounting bracket	.10
4033	Capacitor—20 mmfd. (C61, C62, C63)	.34
4103	Shield—First detector and R. F. Radiotron shield	.20
4104	Shield—I. F. Radiotron shield	.20
4205	Coil—Second detector choke (L41)	.50
4207	Capacitor—0.1 mfd. (C13, C43)	.34
6136	Resistor—3,500 ohms—Carbon type—1 watt (R7)—Package of 5	1.10
6188	Resistor — 2 megohms — Carbon type — ½ watt (R13)—Package of 5	1.00
6300	Socket—4-contact Radiotron socket	.35
6303	Resistor—20,000 ohms—Carbon type—½ watt (R26)—Package of 5	1.00
6512	Capacitor—.005 mfd. (C54)	.28
6603	Condenser—4-gang variable tuning condenser (C7, C14, C24, C40)	3.80
6604	Capacitor—0.5 mfd. (C53)	.50
6605	Transformer—Output transformer (T3)	1.48
6606	Reactor—Filter reactor (L37)	$1.66
6607	Reactor—Tone control reactor (L35)	1.14
6608	Transformer—Audio driver transformer (T2)	2.04
6609	Capacitor—18. mfd. (C59)	1.10
6612	Volume control (R15)	1.20
6613	Drive—Variable condenser drive assembly—Complete	1.00
6626	Capacitor pack—Comprising one 4. mfd., and two 10. mfd. capacitors (C12, C49, C56)	1.86
6628	Capacitor and coil—Antenna coil and capacitor assembly—8,000–18,000 kilocycles—4- or 5-band (L39, L40, C8)	1.50
6629	Switch—5-band selector switch	3.48
6630	Switch—4-band selector switch	3.48
6631	Coil and capacitor assembly—Antenna coil and capacitor—150–410 kilocycles—5-band (L1, L6, C1)	2.16
6632	Coil and capacitor—R. F. coil and capacitor assembly — 150–410 kilocycles — 5-band (L11, L16, C17)	2.10
6633	Coil and capacitor—Oscillator coil and capacitor assembly—150–410 kilocycles—5-band (L21, L26, C28)	1.40
6634	Coil and capacitor—Antenna coil and capacitor assembly—540–1,500 kilocycles—4- or 5-band (L2, L7, C2)	1.86
6635	Coil and capacitor—R. F. coil and capacitor assembly—540–1,500 kilocycles—4- or 5-band (L12, L17, C18)	2.00
6636	Coil and capacitor—Oscillator coil and capacitor assembly—540–1,500 kilocycles—4- or 5-band (L22, L27, C30)	1.40
6637	Coil and capacitor—Antenna coil and capacitor assembly—1,500–4,000 kilocycles—4- or 5-band (L3, L8, C3)	1.56
6638	Coil and capacitor—R. F. coil and capacitor assembly—1,500–4,000 kilocycles—4- or 5-band (L13, L18, C19)	1.66
6639	Coil and capacitor—Oscillator coil and capacitor assembly—1,500–4,000 kilocycles—4- or 5-band (L23, L28, C33)	1.40
6640	Coil and capacitor—Antenna coil and capacitor assembly—4,000–10,000 kilocycles—4- or 5-band (L4, L9, C4)	1.54
6641	Coil and capacitor—R. F. coil and capacitor assembly—4,000–10,000 kilocycles—4- or 5-band (L14, L19, C20)	1.60
6642	Coil and capacitor—Oscillator coil and capacitor assembly—4,000–10,000 kilocycles—4- or 5-band (L24, L29, C36)	1.34
6643	Coil and capacitor—Antenna or R. F. coil and capacitor assembly — 8,000–18,000 kilocycles—4- or 5-band (L5, L10, C5—L15, L20, C21)	1.52
6644	Coil and capacitor—Oscillator coil and capacitor assembly—8,000–18,000 kilocycles—4- or 5-band (L25, L30, C38)	1.54
6675	Shaft—Shaft for condenser drive assembly—Comprising shaft, ball race with retainer and set screw	.35
6679	Wand—Tuning wand for R. F. and oscillator adjustments	.75†
6889	Capacitor—18 mfd. (C60)	1.55
6890	Transformer—First intermediate frequency transformer (L31, L32, C41, C42)	2.40
6891	Transformer—Second intermediate frequency transformer (L33, L34, C44, C45)	2.40
6892	Tone control (R20)	1.50
6955	Shield—Second R. F. Radiotron shield	.25
6956	Shield—Radiotron shield top	.15
7484	Socket—5-contact Radiotron socket	.35

.0889 † Full discount not allowed.

REPLACEMENT PARTS—(Continued)

Insist on genuine factory tested parts, which are readily identified and may be purchased from authorized dealers

Stock No.	DESCRIPTION	List Price
7485	Socket—6-contact Radiotron socket	$0.40
9042	Transformer—Power transformer—105–250 volts—50–60 cycles (T1)	6.84
9046	Transformer—Power transformer—105–125 volts—25–40 cycles	9.22
10194	Ball—Steel ball for condenser drive assembly—Package of 20	.25
	MOTOR ASSEMBLIES	
3398	Motor mounting washer and spring assembly—Comprising 2 cup washers, 4 springs and 1 "C" washer	.48
3817	Stud—Motor mounting stud—Package of 3	.18
8989	Motor—Motor complete 105–125 volts—60 cycle	18.52
8990	Motor—Motor complete 105–125 volts—50 cycle	18.52
8991	Motor—105–125 volts—40 cycle	23.36
8992	Motor—Motor complete 105–125 volts—25 cycle	23.36
8993	Rotor and shaft for 105–125 volts, 60 cycle motor	7.00
8994	Spindle—Turntable spindle with fibre gear for 60 cycle motor	4.75
8995	Rotor and shaft for 105–125 volts, 50 cycle motor	7.00
8996	Spindle—Turntable spindle with fibre gear for 50 cycle motor	4.75
8997	Rotor and shaft for 105–125 volts, 40 cycle motor	8.00
8998	Spindle—Turntable spindle with fibre gear for 40 cycle motor	5.50
8999	Rotor and shaft for 105–125 volts, 25 cycle motor	8.00
9001	Spindle—Turntable spindle with fibre gear for 25 cycle motor	5.50
	PICKUP, PICKUP ARM ASSEMBLIES	
3386	Cover—Pickup cover	.56
3387	Screw assembly—Pickup mounting screw assembly, comprising one screw, one nut and one washer—10 sets	.40
3388	Screw—Pickup needle holding screw—Package of 10	.60
3389	Rod—Automatic brake trip rod with lock nut—Package of 5	.40
3390	Escutcheon—Pickup arm esctucheon complete with mounting rivets	.46
3417	Armature—Pickup armature	.72
3419	Screw—Pickup cover mounting screw—Package of 10	.40
3516	Damper and bushing assembly—Comprising one upper and one lower damper, one upper bushing and one lower bearing—Located in bottom of pickup arm base	.14
3521	Cover—Pickup back cover	.18
3728	Coil—Pickup coil (L41)	.50
6346	Back—Pickup housing back	.45
6601	Pickup—Pickup unit complete	4.54
7706	Arm—Pickup arm complete less escutcheon, pickup, pickup mounting screw, nut and washer	4.30
	TURNTABLE ASSEMBLIES	
3261	Bushing—Rubber bushing—Used on turntable spindle for long-playing records—Package of 5	.40
3338	Ring—Clamp ring assembly—Comprising spring, latch lever and stud	.50
3340	Washer—Thrust washer—Package of 2	.56
3341	Pin—Groov-Pin—Package of 2	.56
3342	Spring—Latch spring—Located on clamping ring—Package of 2	.56
3343	Sleeve—Sleeve complete with ball race	2.86
3344	Cover—Grease retainer cover—Package of 2	$0.70
3346	Bushing—Speed shifter lever bushing—Package of 4	.66
3347	Spring—Speed shifter lever spring—Pkg. of 2	.30
3399	Lever—Speed shifter lever with mounting screws	.50
7084	Cover—Suede cover for turntable	.40
8948	Turntable—Complete	5.50
	MISCELLANEOUS PARTS	
2947	Leather—Friction leather—Package of 20	.50
3055	Cushion—Chassis support cushion—Package of 4	.30
3322	Switch — Automatic brake switch with mounting screws	.75
3391	Suspension spring and washer for motor board—Comprising one bolt, one top spring, one bottom spring, 2 cup washers, one "C" washer and one nut	.50
3430	Box—Needle box with lid—Package of 2	.90
3829	Knob—Radio or phonograph volume or tone control knob—Package of 5	1.10
3830	Knob—Station selector knob—Package of 5	1.08
3831	Knob—Range switch knob—Package of 5	1.08
3876	Cable—3-conductor cable for loudspeaker—4-band	.60
3878	Screws—No. 4–40—3/16" fillister head screw and washer for fastening station selector pointer—Package of 20	.25
3952	Escutcheon—Volume control escutcheon	.10
3953	Escutcheon—Range switch escutcheon—5-band	.10
3992	Escutcheon—Range switch escutcheon—4-band	.10
3994	Cover—Automatic brake switch cover	.26
4053	Cable — 3-conductor cable — From phonograph volume control to resistor boards	.90
4160	Screwdriver— Combination insulated screwdriver and socket wrench for I. F. and R. F. adjustments	1.00
6614	Glass—Station selector dial glass	.30
6615	Ring—Retaining ring for dial glass—Package of 5	.34
6616	Bezel—Metal bezel for station selector dial	.50
6671	Cable—2-conductor shielded for loudspeaker—5-band	.36
6672	Screen—Translucent celluloid screen—For dial lamps—Package of 5	.30
6673	Pointer—Station selector pointer—Pkg. of 5	.64
6677	Dial—Station selector dial—5-band—Pkg. of 5	2.90
6678	Dial—Station selector dial—4-band—Pkg. of 5	2.80
6766	Volume control—Phonograph volume control and switch (R29, S9)	2.28
6767	Transformer—Input transformer—Comprising one 30,000 ohm resistor, one 2,000 ohm resistor, one .12 mfd. capacitor, one compensating reactor and one transformer (T4, R27, R28, C64, L42)	5.62
6768	Cable—3-conductor shielded—From phonograph volume control to input transformer	.40
8837	Support—Metal support for chassis—Pkg. of 4	.48
9050	Oscillator—Test oscillator—90–25,000 K.C.	29.50†
10174	Springs—Automatic brake springs—One set of 4 springs	.50
10184	Plate—Automatic brake latch trip plate with mounting screws—Package of 5	.40
	REPRODUCER ASSEMBLIES	
8969	Cone—Reproducer cone complete (L36)—Package of 5	6.35
9438	Reproducer complete	6.88
9439	Coil assembly—Field coil, magnet and cone support (L38)	5.22

.0890 †Full discount not allowed.