

# RCA VICTOR MODEL C 13-2

Thirteen-Tube, Five-Band, A-C, Superheterodyne, Console Receiver

## SERVICE NOTES

### ELECTRICAL SPECIFICATIONS

#### FREQUENCY RANGES

Band X.....	140— 410 kc.
Band A.....	540— 1,800 kc.
Band B.....	1,800— 6,000 kc.
Band C.....	6,000—18,000 kc.
Band D.....	18,000—60,000 kc.

#### ALIGNMENT FREQUENCIES

Band X.....	150 kc. (osc.), 400 kc. (osc., det., ant.)
Band A.....	600 kc. (osc.), 1,720 kc. (osc., det., ant.)
Band B.....	6,132 kc. (osc., det., ant.)
Band C.....	18,000 kc. (osc., det., ant.)
Band D.....	No adjustments required

#### VOLTAGE AND FREQUENCY

Rating A.....	105—125 volts, 50—60 cycles
Rating B.....	105—125 volts, 25—60 cycles
Rating C.....	100—130/140—160/195—250 volts, 40—60 cycles

#### RADIOTRON COMPLEMENT

(1) RCA-6K7 .....	Radio-Frequency Amplifier
(2) RCA-6L7 .....	First Detector
(3) RCA-6J7 .....	Heterodyne Oscillator
(4) RCA-6K7 .....	First Intermediate Amplifier
(5) RCA-6K7 .....	Second Intermediate Amplifier
(6) RCA-6H6 .....	Second Detector and A.V.C.
(7) RCA-6C5 .....	First Audio Amplifier
(8) RCA-6C5 .....	Audio Driver Amplifier
(9) RCA-6C5 .....	Audio Driver Amplifier
(10) RCA-6F6 .....	Power Output Amplifier
(11) RCA-6F6 .....	Power Output Amplifier
(12) RCA-5Z3 .....	Full Wave Rectifier
(13) RCA-6E5 .....	Tuning Indicator

#### MISCELLANEOUS

Power Consumption.....	140 watts	Loudspeaker.....	12 inch, Electrodynamic
Undistorted Output.....	10 watts	Voice Coil Impedance.....	7.5 ohms at 400 cycles
Maximum Output.....	15 watts	Intermediate Frequency.....	460 kc.

### MECHANICAL SPECIFICATIONS

Height .....	41 inches
Width .....	26 $\frac{1}{4}$ inches
Depth .....	15 $\frac{3}{4}$ inches
Weight (Net).....	100 pounds
Weight (Shipping).....	153 pounds
Chassis Base Dimensions.....	20 $\frac{3}{4}$ inches x 10 $\frac{1}{2}$ inches x 3 $\frac{1}{2}$ inches.

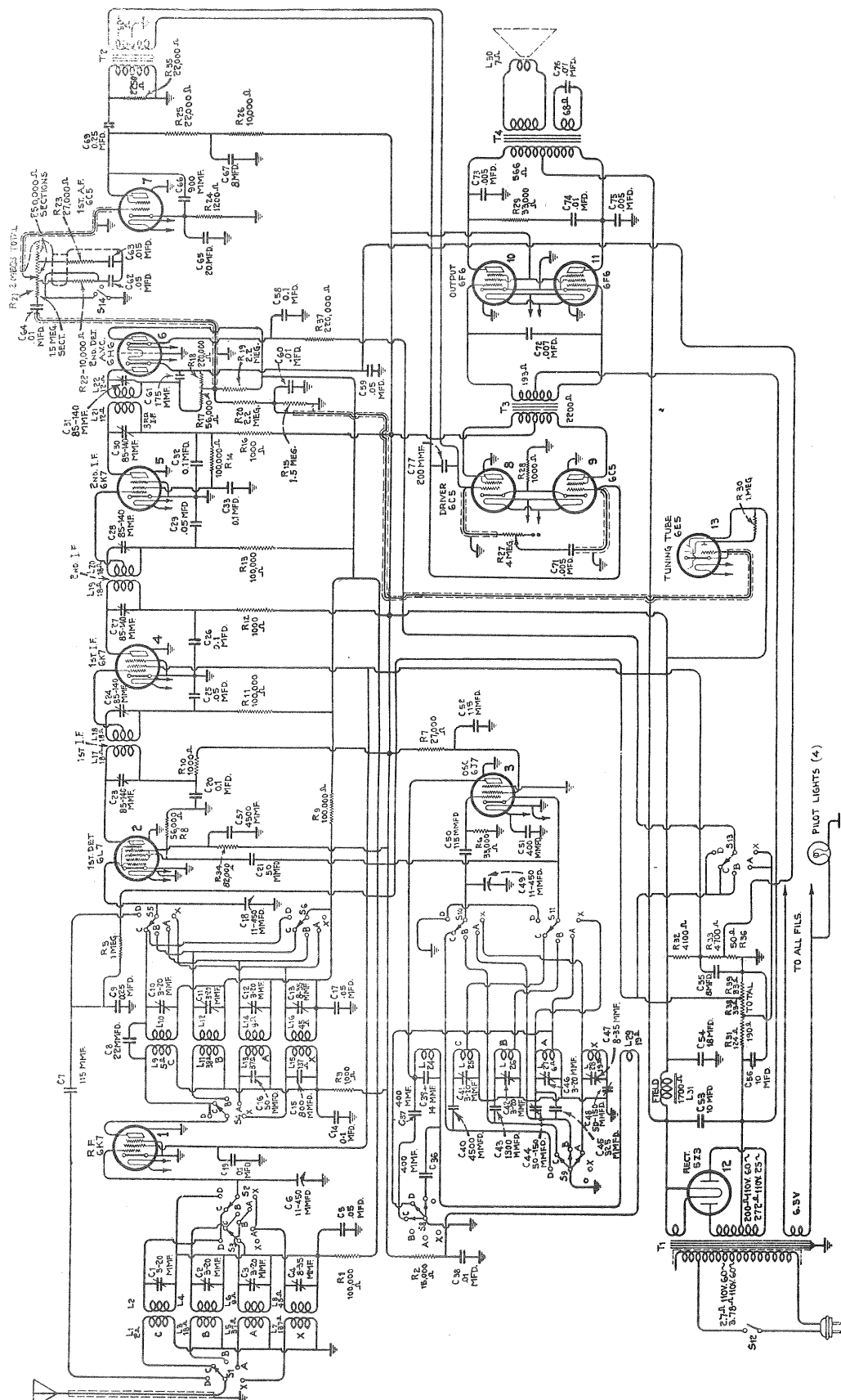


Figure 1—Schematic Circuit Diagram

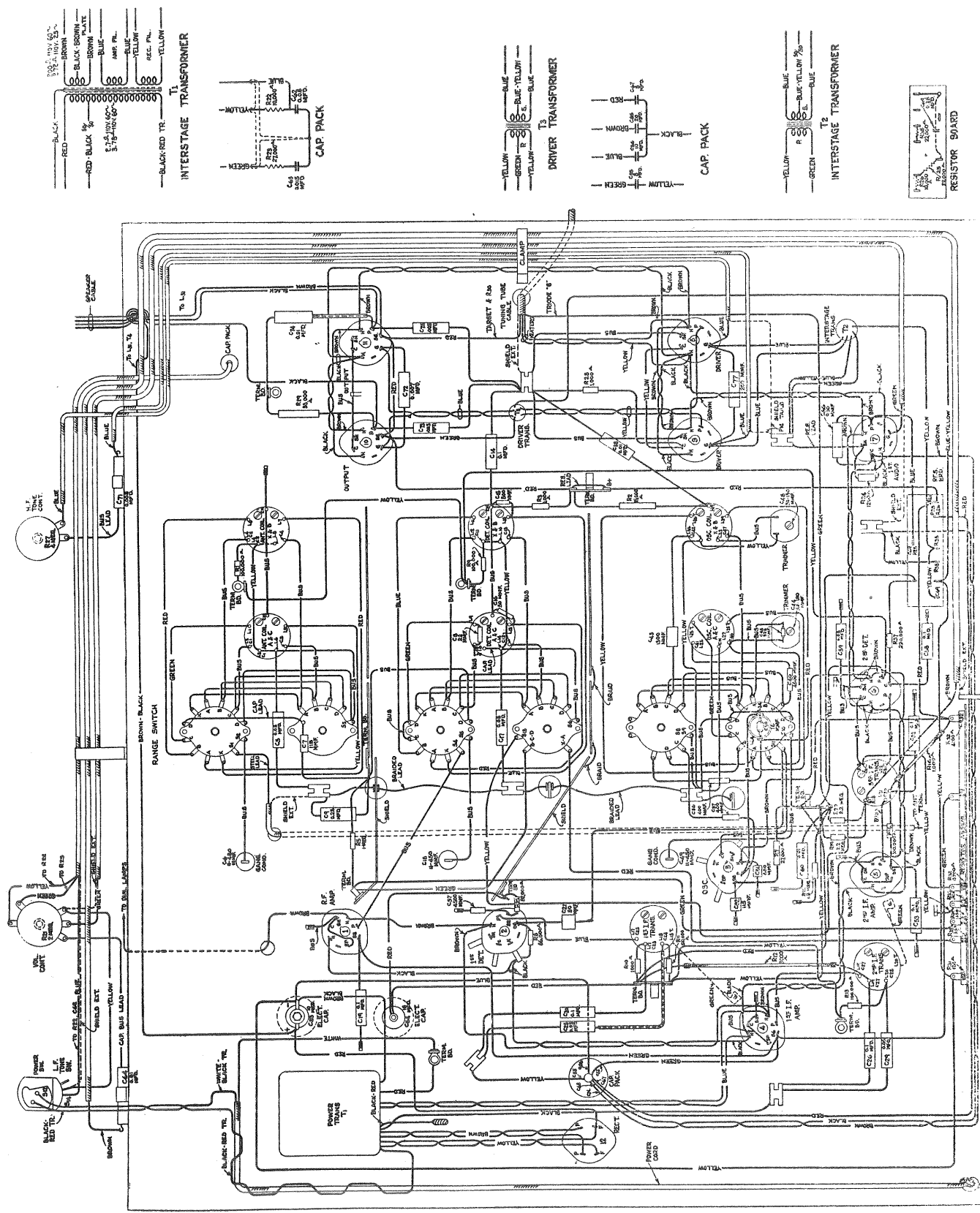


Figure 2—Chassis Wiring Diagram

## GENERAL FEATURES

### Metal Tubes

This receiver uses the new metal tubes which are much smaller in size than the corresponding glass types. The high frequency efficiency of these metal tubes is greater because of the shorter lengths of leads, lesser interelectrode capacitance and the more complete shielding of the metallic envelopes. Their rugged construction prevents breakage and reduces microphonic tendencies. The bases and sockets of all types have a standardized arrangement of connecting prongs.

### Receiver Chassis

Service convenience has been a controlling factor in the layout of the chassis parts and wiring. The assembly of these various elements is such that the number of conductors is minimized with all important connections being readily accessible. Further accessibility to all parts of the chassis is due to the open construction of the base and mounting supports. Trimmer adjustments are easily reached from the underside of the

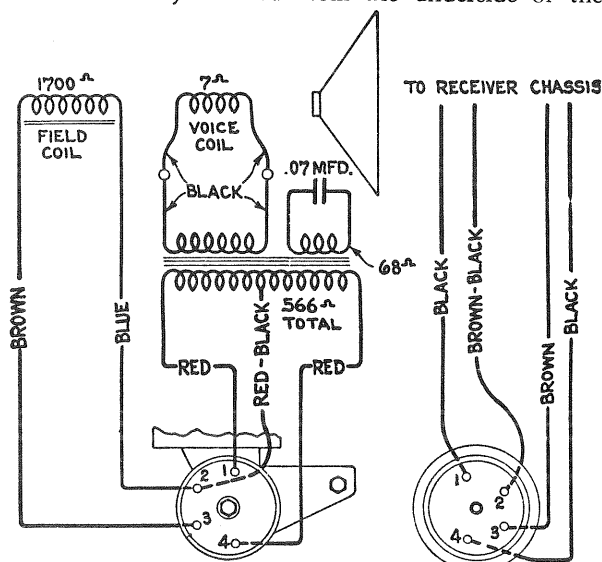


Figure 3—Loudspeaker Schematic and Wiring

chassis. The r-f, detector and oscillator coils are identified by markings on their bases, which for example read "AAO" to indicate the Band A, "antenna" and "oscillator" coils.

The circuit is based upon the Superheterodyne principle. The radio frequency and audio frequency amplification are balanced in such manner that the maximum of performance is obtained. The following general items cover the circuit arrangement and notable features involved:—

### Tuned Circuits

Six adjustable tuned circuits are used in the i-f system, each resonating at 460 kc. A three section variable condenser tunes the secondary of the antenna transformer, the secondary of the detector input transformer and the oscillator coil on all bands with the exception of D, which has only its detector and oscil-

### Dial Drive

The dial drive and station indicator system are of new and unique design. Five individual dial scales, each with full 180 degree band spread, are provided, one for use on each band. The scales are eccentrically arranged on a rotary disc and adapted to operate in connection with the band change switch so that as the switch is shifted to a certain band, the corresponding dial scale rotates into position. For other positions of the band switch, a similar scale selection takes place, there being only one scale visible at a time. The driving mechanism for the dial and condenser has tuning ratios of 10 to 1 and 50 to 1. Control may be interchanged between these two ratios by push-in operation of a positive action clutch which is actuated by the tuning knob. From the clutch and ratio controlling mechanism, the drive system interlinks with the tuning condenser, main dial pointer and vernier dial pointer through means of fibre and brass gears. The ratio of vernier rotation to the main pointer is 20 to 1. An intermediate gear is used in the system to reduce gear back-lash. This gear is suspended in position with two tension springs which maintain the proper mesh at all times. A flexible coupling disc is used between the drive and the condenser shaft permitting the dial drive mechanism to be rigidly mounted to the chassis base.

### Tuning Condenser

The variable tuning condenser is supported by a new design of shock-proof mount which has been developed by our engineers to minimize audio-frequency "howl" produced by chassis vibration.

### Power Transformer

The transformer is assembled flat against the chassis base which acts as a radiating fin to disseminate the heat developed in the windings. An improved electrostatic shield is used between the primary and secondary windings to reduce a-c line disturbances and to prevent the receiver from radiating into the line.

### Loudspeaker

A super-sensitive 12 inch electrodynamic speaker is employed. It is correctly adapted to the cabinet design to assure the best possible acoustic performance. Electrical connection is made from the speaker to the chassis through a plug and connector attachment, permitting easy removal for servicing.

## ELECTRICAL CIRCUIT

lator tuned. Each tuning range has its own group of r-f and oscillator coils, they being selected as desired by operation of the band-change switch. Trimmer condensers are provided on all of the tuned circuits for use in obtaining precise alignment.

### Band D Tuning

Special notice should be taken of the manner of tuning this band. The r-f stage is unused when the range switch is turned to its Band D position and the signal is fed from the antenna directly to the first detector input circuit. The inductance of this circuit consists of a short length of bus wire to which the antenna lead is tapped at a definite predetermined point. The

total length of this inductive wire from the stator of the tuning capacitor to ground represents the secondary of a high frequency autotransformer, while the inductive section included between the antenna lead tap and ground forms the primary. Alteration of the dimensions and position of this wiring will change the tuning and alignment of the circuit, resulting in total

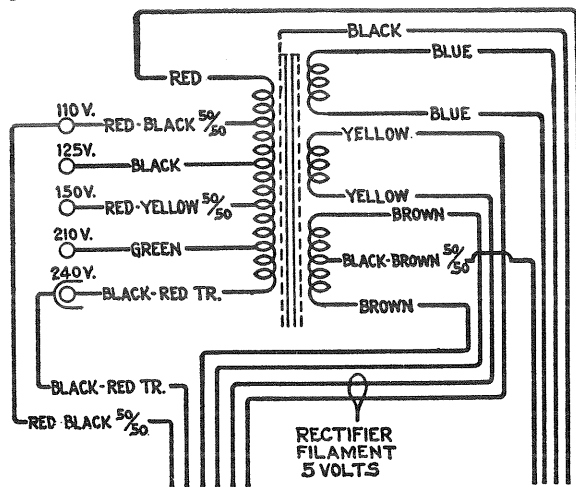


Figure 4—Universal Transformer Schematic and Wiring

Pri. Res.—4.89 Ohms, Total  
Sec. Res.—165 Ohms, Total

lack of operation or seriously poor operation. It is therefore necessary when servicing to avoid changes in the wiring which includes Band D detector and oscillator r-f circuits unless the arrangement is restored to its exact original condition. Similar caution should be observed when exchanging by-pass condensers in these same circuits, since their values, physical positions, length of leads, quality of dielectric etc. are critical and variations will definitely affect operation of the receiver. The small heater by-pass condensers and ground terminals installed at the tube sockets are very important in this respect.

#### Oscillator Stage

The heterodyne oscillator circuit used in this receiver is an improved type, having exceptional frequency stability and uniformity of output over its various tuning ranges. It operates on fundamental frequencies which are fed to the first detector hexode tube (RCA-6L7) on an auxiliary mixing grid. The oscillator generates a signal which is at all times above the frequency of the incoming signal by 460 kc. As shown by the schematic diagram, the cathode of the oscillator tube is above ground potential for r.f., while the plate is effectively at ground potential. This particular arrangement, together with the plate and screen series resistors, makes the circuit independent of supply voltage variations in regard to stability and uniformity of output. Separate coils are used for each of the tuning ranges. The switching of the different bands is such as to short circuit certain unused coils which would absorb energy from the circuits used.

#### Intermediate Amplifier

Two stages of i-f amplification comprising three tuned transformers and two RCA-6K7 tubes are ar-

ranged in cascade to operate at 460 kc. The transformers have their primaries as well as secondaries tuned by adjustable trimmer capacitors. These trimmers are designed to resist moisture, temperature and other detrimental factors which may affect their adjustments. Litz wire is used for the windings of the third transformer in order to provide the proper efficiency in driving the diode second detector.

#### Detection and A. V. C.

The modulated signal as obtained from the output of the i-f system is detected by an RCA-6H6 double diode tube. The audio frequency secured by this process is passed on to the a-f system for amplification and final reproduction. The d-c voltage which results from detection of the signal is used for automatic volume control. This voltage, which develops across resistor R-18, is applied as automatic control grid bias to the r-f, first detector and i-f tubes through suitable resistance-capacitance filter circuits. The second diode of the RCA-6H6 is used to supply residual bias for these controlled tubes under conditions of little or no signal. This diode, under such conditions, draws current, which flows through R-18, R-19, and R-37, thereby maintaining the desired minimum operating bias on such tubes. On application of signal energy above a certain level, however, the auxiliary bias diode ceases to draw current and the a.v.c. diode takes over the biasing function. The cathode and the anode of the signal-a.v.c. diode have positive potential in respect to chassis-ground and cathodes of the a.v.c. controlled tubes when no signal is being received.

#### Audio System

Several stages of audio amplification provide excellent fidelity and wide range of volume both for short wave as well as on the standard and long wave bands. The high gain of the system has necessitated thorough shielding and careful manufacture. All wiring, transformers, etc., should always be placed as originally installed if it has been necessary to remove such for service purposes. Hum difficulties are likely to occur if this caution is not observed. Manual volume control is by means of an acoustically tapered potentiometer which conveys the audio output of the second detector to the first a-f amplifier stage. This control has tone compensation produced by filters connected to two points thereon. This gives the correct aural balance at different volume settings. A music-speech switch is provided in one of the volume control filter circuits for use in obtaining good speech intelligibility. On the speech position, the low frequency tones are reduced. A push-pull driver stage is used between the first a.f. and the Class AB output amplifier. A continuously variable high frequency tone control is shunted across the grids of the driver tubes. A sharp, high audio frequency cut-off is obtained by a tertiary winding on the audio output transformer and by the correct design of the driver and interstage transformers. This cut-off feature results in quieter operation by the reduction of high frequency noise, especially on weaker stations.

#### Rectifier and Filter

An RCA-5Z3 full-wave rectifier tube is employed in the high voltage supply system. The loudspeaker field

coil serves as a filter reactor in conjunction with high capacity, electrolytic condensers. Fixed bias voltages are made available at the filter output on a divider system, which is likewise well filtered with large capacitors.

### Tuning Indicator

A cathode-ray tube is used as a means of visually indicating when the receiver is accurately tuned to the incoming signal. This tube is of new design and comprises an amplifier section and a cathode-ray section

built in the same glass envelope. The cathode-ray section consists of a conically shaped luminescent screen, upon which a pattern is formed by an effect of the detected signal after said effect has been amplified by the amplifier section which is fed from the detector diode circuit. The size of the pattern is determined by the strength of the signal voltage, so that any change of tuning may be readily observed in order to facilitate tuning to exact resonance.

## SERVICE DATA

The various diagrams of this booklet contain such information as will be needed to isolate causes for defective operation. In general, the ratings of the resistors, capacitors, coils, etc. are indicated adjacent to the symbols signifying these parts. Identification titles such as R-3, L-2, C-1, etc., are provided for reference between the illustrations and Replacement Parts List. The coils, reactors and transformer windings are rated in terms of their d-c resistances. Where the value is not given, the resistance is less than one ohm.

### Alignment Procedure

The extensive frequency range of this receiver necessitates a more or less involved method of alignment. However, if the following directions are carefully applied, the normal performance of the instrument will be obtained.

Circuits aligned by use of Cathode-Ray equipment will be as near to perfection as possible, hence this method is to be preferred in all cases. Alignment by other methods is oftentimes an approximation unless extreme care is taken and a good deal of time expended. The oscillographic method is particularly advantageous for trimming the i-f tuned circuits to obtain

### Equipment

The instruments required for placing this receiver in proper alignment should consist of an RCA Cathode-Ray Oscillograph, an RCA Full Range Oscillator, an RCA Frequency Modulator, a Tuning Wand and a non-metallic screw driver. These devices are illustrated and described on a separate page of this book. The Cathode-Ray Oscillograph is to be used as an output indicator to show precisely when the circuits are correctly aligned. The Full Range Oscillator is required as the source of standard alignment signals at the various frequencies. Visual alignment is made possible through use of the Frequency Modulator, which in conjunction with the Oscillograph and Oscillator, causes the characteristic wave shape of the circuit under test to be formed on the Oscillograph screen. The necessity for alignment and direction of required change may be tested with a Tuning Wand. Its use is as follows:—

The Tuning Wand, which consists of a bakelite rod having a small brass cylinder installed at one end and a core of finely divided iron at the other, may be inserted into a tuned coil to obtain an indication of the tuning. With a signal being supplied to the receiver at the alignment frequency of the circuit concerned, each end of the Wand should be placed through the center of the coil. Holes are provided in the r-f coil shields for this test. A change in tuning will be produced by the presence of the brass cylinder or iron core and consequent change of receiver output occurs. If there is a decrease of output when either of the two ends are inserted, the tuning is correct and will require no adjustment. However, should there be an increase of output due to the iron core and decrease with the brass cylinder, an increase in inductance or capacitance is indicated as necessary to bring the circuit into line. The trimmer involved should therefore be increased accordingly. If the brass cylinder end causes an increase in output, while the iron end causes a decrease, reduction of inductance will be necessary to bring the circuit into alignment. This will be equivalent to decreasing the trimmer concerned.

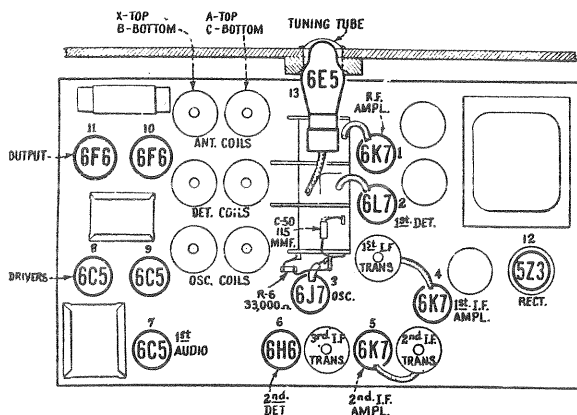


Figure 5—Radiotron and Coil Locations

the utmost in tone quality and at the same time the maximum of selectivity. Procedure to be followed when using a Cathode-Ray Oscillograph is therefore given in detail. Should this type of equipment be unavailable, a substitute indicator may be used,

END OF WAND USED	CHANGE OF SIGNAL OUTPUT	CHANGE REQ'D IN TRIMMER CAPACITY
{Brass . . . . .	Decrease}	. . . . . None
{Iron . . . . .	Decrease}	
{Brass . . . . .	Increase}	. . . . . Decrease
{Iron . . . . .	Decrease}	
{Brass . . . . .	Decrease}	. . . . . Increase
{Iron . . . . .	Increase}	

## I-F TRIMMER ADJUSTMENT

Six trimmers are associated with the three i-f transformers. Their locations on the chassis are shown by Figure 7. Each must be aligned to a basic frequency of 460 kc. The last i-f transformer should be adjusted first, the one preceding it second and the operation carried through successive stages until the first transformer has been aligned. For such a process, it is necessary to feed the output of the Full Range Oscillator to the stages in their order of alignment, adjusting the trimmers of each and observing the effect at the second detector output on the Cathode-Ray Oscillograph. The most convenient point for connection of the Oscillograph is at the detector diode load circuit, with the vertical "Hi" terminal attached to the juncture of R-17, R-18 and R-19, and the "Gnd" to the chassis. The "Ext. Sync." terminals of the Oscillograph should be connected to the Frequency Modulator as illustrated in Figure 6. A .001 mfd. capacitor installed in series with the Oscillator "Ant." output lead will prevent the voltage constants of the stage being aligned from becoming upset. Proceed further as follows:—

- (a) Place the receiver, Oscillograph and test Oscillator in operation. Set the receiver volume control to maximum and the range switch to Band "A". Tune the station selector to a point where no interference is caused by local stations or the local oscillator, removing the 6J7 tube if necessary. Turn the Oscillograph vertical "A" amplifier to "On" and advance the vertical gain control to its maximum position. Set the horizontal "B" amplifier to "Timing" and control its gain so that the luminescent spot sweeps a trace completely across the screen. Have the timing control adjusted to "Int."
- (b) Attach the output of the test Oscillator to the control grid cap of the second i-f tube (RCA-6K7) and chassis ground. Tune the Oscillator

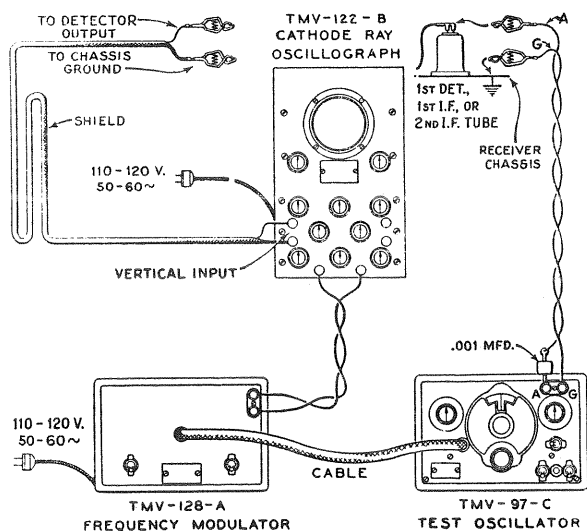


Figure 6—Alignment Apparatus Connections

to 460 kc. having its modulation switch turned to "On". Regulate the output control until

the signal produces a wave pattern on the Oscillograph screen, adjusting the Oscillograph frequency and range controls to give several complete cycles, the amplitude of which will afford an accurate peak indication. Cause the image formed to stand still on the screen by manipulation of the "Sync." control. Use as low a signal output from the Oscillator as can be accurately observed at the Oscillograph. Then tune the two trimmers, C-30 and C-31 of the third i-f transformer to produce maximum amplitude (vertical deflection) of the oscillographic image. Under this condition, the transformer will be sharply resonated to 460 kc.

- (c) The Frequency Modulator should then be placed in operation and interconnected with the Full Range Oscillator by means of the shielded patch cord provided. Figure 6 shows the proper arrangement. Set the Frequency Modulator sweep range switch to its "Lo" position and turn the Oscillator modulation switch to "Off". Change the timing (Sync.) control of the Oscillograph to "Ext." and place the range switch to its No. 2 position. Then shift the tuning of the Oscillator so as to increase its frequency, until two distinct and similar waves appear on the Oscillograph screen and become coincident at their highest points. These curves will be found to occur at an Oscillator setting of approximately 540 kc. They will be identical in shape but appearing in reversed positions. Adjust the frequency control of the Oscillograph in order to cause the waves to conform with these requirements and to make them remain motionless on the screen. This will require a setting of approximately  $\frac{1}{2}$  clockwise rotation of the frequency control. The trimmers C-30 and C-31 should then be re-adjusted so that the two curves move together and become exactly coincident throughout their lengths, maintaining the maximum amplitude at which this condition can be brought about.
- (d) Leaving the equipment connected and adjusted as above, change the Oscillator output to the control grid cap of the first i-f tube (RCA-6K7). Adjust the two trimmers C-27 and C-28 of the second i-f transformer until the forward and reverse waves appearing on the Oscillograph coincide throughout their lengths and have maximum amplitude.
- (e) Change the test Oscillator output to the control grid of the first detector tube (RCA-6L7) without disturbing the connections and adjustments of the other apparatus. Then align the trimmers C-23 and C-24 of the first i-f transformer to produce waves of maximum coincidence and maximum amplitude. The shape of the composite wave obtained from this operation is a true representation of the over-all tuning characteristic of the i-f system.

## ANTENNA, DETECTOR AND OSCILLATOR

For Bands A and X, adjustments must be made at the high and low frequency ends of the range. On Bands B and C, alignment is required only at the high frequency end. Band D is permanently adjusted dur-

ing manufacture, hence no alignment will be necessary in this range. Locations of the various antenna, detector and oscillator trimmers are shown on Figure 7. The test Oscillator should be removed from connection with the i-f system and its output attached to the antenna-ground terminals of the receiver. No changes are to be made in the attachment of the Oscillograph at the second detector. During the adjustments, the Oscillator output should be regulated as often as is necessary to keep the oscillographic image as low as is practically observable. Such procedure will obviate apparent broadness of tuning which would result from a.v.c. action on a stronger signal. The sequence of alignment should be Band A, Band X, Band B and Band C. Proceed with the adjustments as follows:—

#### Calibration

Set the receiver range switch to Band A and rotate the station selector until the tuning capacitor plates are in full mesh (maximum capacity). Then move the main dial pointer until it points exactly to the horizontal line at the low frequency end of the Band A scale. Correct the setting of the vernier second hand pointer to read zero.

#### Band A

- (a) With the receiver range switch on its Band A position, tune the station selector until the dial pointer is at a reading of 1720 kc. Adjust the Oscillator to 1720 kc. (modulation "On" and Frequency Modulator disconnected) and increase its output to produce a registration on the Oscillograph. Carefully align the oscillator, detector and antenna trimmers, C-46, C-12 and C-3 respectively, so that each brings about maximum amplitude of output as shown by the wave on the Oscillograph. It will be necessary to have the timing control of the Oscillograph on "Int." for this operation. Then shift the timing control to "Ext." and place the Frequency Modulator into operation with its connections to the Oscillator and Oscillograph as shown on Figure 6. Retune the test Oscillator (increase frequency) until the forward and reverse waves show on the Oscillograph and become coincident at their highest points. Adjust the trimmers C-46, C-12 and C-3 again, setting each to the point which produces the best coincidence and maximum amplitude of the images.
- (b) Remove the Frequency Modulator cable from the Oscillator and shift the signal frequency to 600 kc. Tune the receiver to pick up this signal, disregarding the dial reading at which it is best received. Then insert the Frequency Modulator plug and retune the Oscillator until the similar forward and reverse waves appear on the screen. It is advisable to shift the Oscillator to its 200—400 kc. range and use the third harmonic of the generated signal in order to obtain the desired range of sweep for this adjustment. The trimmer C-44 should then be adjusted until a point is reached where the waves have the greatest amplitude. It will be unnecessary to rock the tuning condenser for this operation inasmuch as the Frequency

Modulator is automatically producing the same effect. After completing this adjustment, the trimmer C-46 should be realigned as in (a) to correct for any change in the oscillator high frequency tuning which has been caused by the adjustment of C-44.

#### Band X

- (a) Disconnect the Frequency Modulator and tune the test Oscillator to a frequency of 400 kc. (Modulation "On"). Place the receiver range switch in its Band X position and turn the station selector until the dial pointer reads 400 kc. Adjust the Oscillograph timing control to "Int." Then align each of the trimmers C-47, C-13 and C-4 to the point producing maximum output at the Oscillograph. Place the Frequency Modulator in operation and attach it to the Oscillator in the normal manner. Change the Oscillograph timing to "Ext." Increase the frequency of the Oscillator (modulation "Off") until the two waves appear and become coincident at their highest points, approximately at 462 kc.. They may be made to remain stationary on the screen by manipulation of the Oscillograph range switch and frequency control. Readjust the three trimmers C-47, C-13 and C-4 to give maximum amplitude and complete coincidence of the waves.
- (b) Change the test Oscillator so that it delivers a signal of 150 kc. with the Frequency Modulator disconnected. Tune this signal on the receiver which has previously been set to Band X, disregarding the dial reading at which the signal is best received. Then interconnect the Frequency Modulator with the Oscillator and retune the latter to the point at which the two similar waves appear on the screen. Adjust the trimmer C-48, for maximum amplitude of the wave images. Rocking of the tuning condenser will not be necessary as the Frequency Modulator duplicates such an operation. Repeat the alignment of C-47 as outlined in (a) to correct for any reflective error brought about by the adjustment of C-48.

#### Band B

- (a) Advance the receiver range switch to its Band B position and tune the station selector to a dial reading of 6132 kc. Set the test Oscillator to this same frequency (Modulation "On" and Frequency Modulator disconnected) and increase its output until a suitable indication is apparent on the Oscillograph. Then adjust the trimmer C-42 to the point producing the maximum amplitude of the image. Two positions will be found on this trimmer which causes maximum amplitude. The one of least capacitance is correct and should be used. Check for the "image" signal, which will be received at 5212 kc. on the dial if the adjustment of C-42 has been properly made. An increase in Oscillator output may be necessary for this test, however its frequency should not be changed nor any trimmer adjustments made on the receiver.



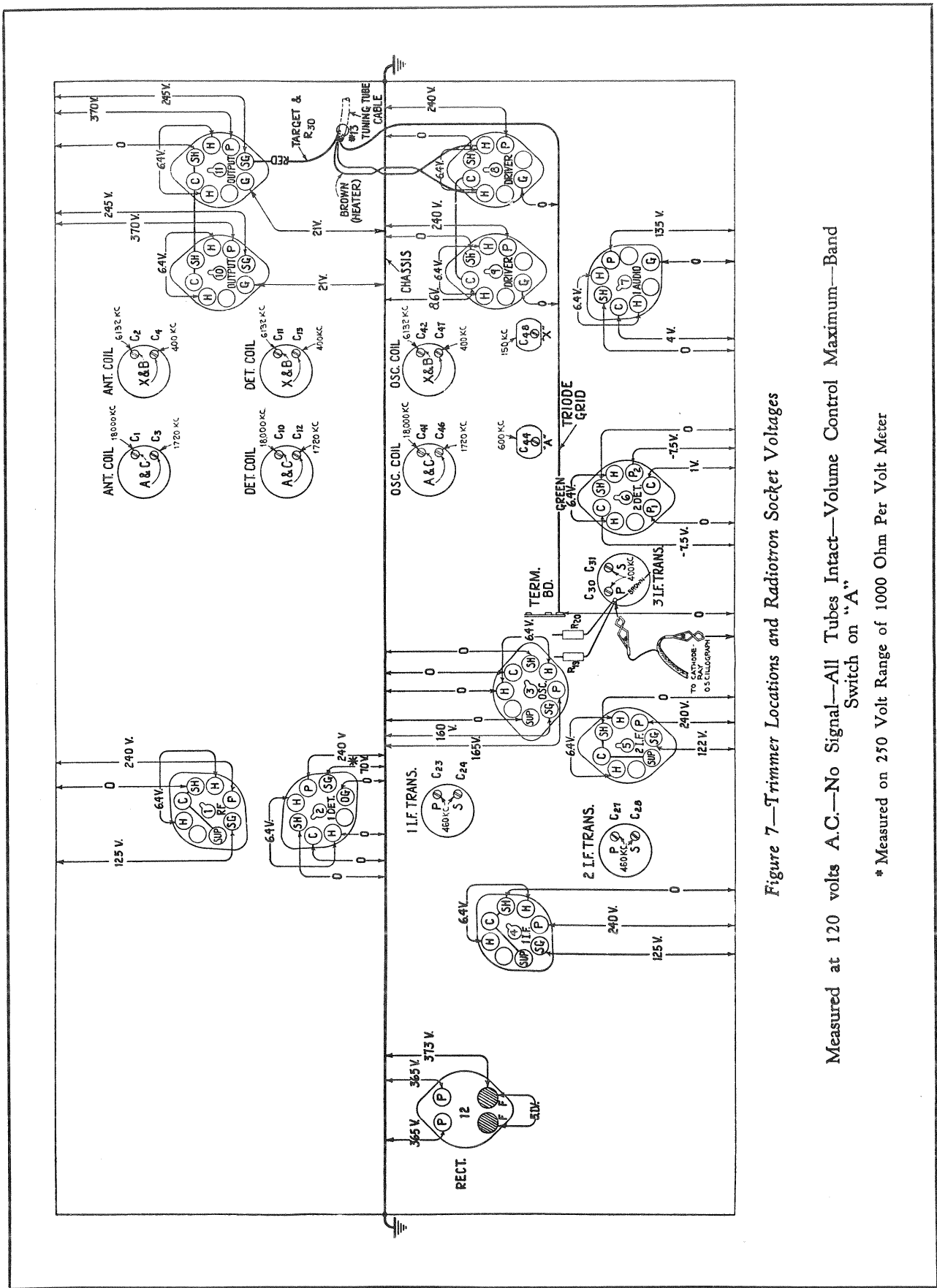


Figure 7—Trimmer Locations and Radiotron Socket Voltages

Measured at 120 volts A.C.—No Signal—All Tubes Intact—Volume Control Maximum—Band Switch on "A"

\* Measured on 250 Volt Range of 1000 Ohm Per Volt Meter

- (b) Return the station selector to the **6132 kc.** reading and align the detector and antenna trimmers C-11 and C-2 respectively, for maximum (peak) output as shown by the Oscillo-graph. No further adjustments are to be made on Band B.

#### Band C

- (a) Turn the range switch of the receiver to its Band C position and tune the station selector until the dial pointer reads **18,000 kc.** Set the test Oscillator to this same frequency (Modulation "On" and Frequency Modulator disconnected), regulating its output to the level required for convenient observation. Adjust the trimmer C-41 to the point producing maximum output as indicated on the Oscillo-graph. Check for the presence of "image" signal by tuning the receiver to **17,080 kc.** The **18,000 kc.** signal of the Oscillator will be received at this point if the adjustment of C-41 has been properly made, using the position of minimum capacitance giving maximum receiver output. It may be necessary to increase the output of the Oscillator in order to get an indication of the "image". *No adjustments should be made during this check.*
- (b) Return the receiver tuning to **18,000 kc.**, re-align C-41 if necessary, and then adjust the detector and antenna trimmers C-10 and C-1 for maximum signal output as evidenced by the oscillographic image. No further adjustments are to be made on Band C.

#### Band D

No adjustments are required on this band.

### Output Meter Alignment

To align the receiver by other methods than that explained above will require the use of a standard test oscillator, such as the Stock No. 9595, and a suitable output indicator, such as the Stock No. 4317. The indicator should be connected either to the voice coil circuit or across the output transformer primary. For each adjustment, the volume control should be maintained at maximum and the Oscillator output regulated until the indication is barely perceptible. The smaller the amount of glow, the more accurate will be the indication. The signal level will also be below the range of the receiver a.v.c., preventing broadness of tuning.

**I-F Adjustments**—Connect the output of the test Oscillator from the RCA-6L7 first detector control grid to chassis-ground and adjust its frequency to **460 kc.** Tune the receiver to Band "A", setting the station selector at a point where no interference is received from local stations or the local oscillator. Then tune the i-f trimmers C-31, C-30, C-28, C-27, C-24 and C-23 in order, each for maximum indicated receiver output.

**R-F Adjustments**—Connect the Oscillator output to the antenna-ground terminals of the receiver. Keep the output indicator attached to the receiver output as above. For each adjustment, use the minimum signal which will give a perceptible indication on glow indicator.

#### BAND A

- (a) Set the range switch of the receiver to its Band

A position and tune the selector to a dial reading of **1720 kc.** Tune the Oscillator to this same frequency and adjust trimmers C-46, C-12 and C-3 to produce maximum indicated receiver output.

- (b) Shift the Oscillator to **600 kc.** and tune the receiver to pick up this signal, disregarding the dial reading at which it is best received. Then adjust trimmer C-44, simultaneously rocking the tuning control backward and forward through the signal, until maximum output is obtained from the combined operations. Repeat the alignment of C-46 as in (a) to correct for any change caused by adjustment of C-44.

#### BAND X

- (a) Change the range switch to its Band "X" position. Tune the receiver to read **400 kc.** and set the Oscillator to produce this same frequency. Adjust trimmers C-47, C-13 and C-4 to produce maximum receiver output.
- (b) Shift the Oscillator frequency to **150 kc.** and tune the receiver to pick up this signal, disregarding the dial reading at which it is best received. Then tune the oscillator series trimmer C-48, simultaneously rocking the tuning control (receiver) backward and forward through the signal, until maximum output results from the combined operations. Repeat the alignment of C-47 as in (a) to correct for any change caused by the adjustment of C-48.

#### BAND B

Place the receiver range switch in its Band "B" position and tune the station selector to a dial reading of **6132 kc.** Set the frequency of the Oscillator to **6132 kc.**

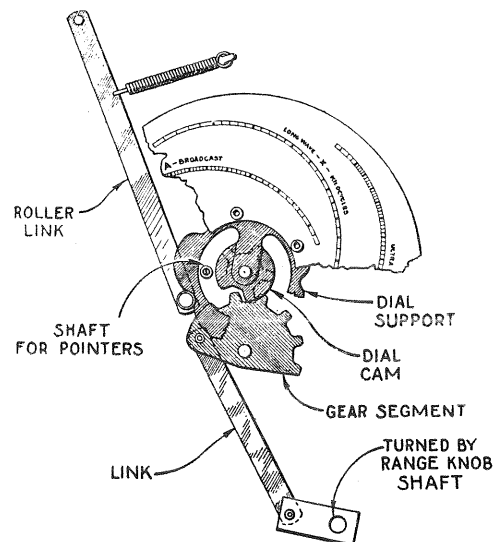


Figure 8—Selector Dial Change Mechanism

Then adjust trimmer C-42 to give maximum receiver output. Two positions may be found which fulfill this condition. The one of least capacitance is correct. To assure that the right peak has been used; tune the receiver to **5212 kc.** and increase the Oscillator output. The "image" of **6132 kc.** will be received at this point if C-42 has been adjusted to the proper point of maximum output. *No trimmer adjustments are to be made*

during this check. Return the receiver tuning to 6132 kc., readjust C-26 if necessary, and then tune the detector and antenna coil trimmers, C-11 and C-2 to produce maximum (peak) receiver output as indicated on the glow meter.

#### BAND C

Turn the receiver range switch to its Band "C" position and set the tuning control to a dial reading of 18,000 kc. Tune the Oscillator to this same frequency. Adjust the oscillator parallel trimmer C-41 to produce maximum receiver output. Two positions of the trimmer will be found which fulfill such a condition. The one of least capacitance is correct. To assure that the right position has been used, check for the "image" of the 18,000 kc. signal which will be received at 17,080 kc. on the dial if C-41 is correctly adjusted. An increase in Oscillator output may be necessary. No trimmer adjustments should be made during this check. Return the receiver tuning to 18,000 kc., readjust C-41 if necessary, and then tune the detector and antenna trimmers C-10 and C-1 to give maximum receiver output.

#### Dial Adjustment

Figure 8 illustrates the relations of the various parts of the dial mechanism when it is in its A—Broadcast position and the range switch is likewise turned to its Band A setting. In re-assembling the dial after repair, see that the gears are meshed in accordance with the

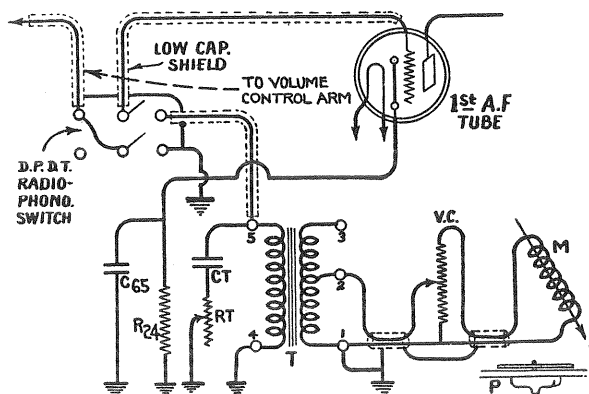


Figure 9—General Phonograph Connections

#### INSTALLATION

Change the receiver circuits and add phonograph connections to conform with the above schematic. Thoroughly shield leads where indicated, keeping them clear of a-c circuits and transformers. Place transformer T so as to obtain minimum lengths of secondary leads and mount it in the position which does not cause hum.

#### PARTS REQUIRED

- |  |                                       |
|--|---------------------------------------|
| M—Magnetic Pickup                        | P—Phono Turntable Mechanism           |
| —Low Impedance                           |                                       |
| VC—Volume Control                        | CT—Condenser—.05 mfd.                 |
| —100 ohms                                |                                       |
| T—Phono Input Transformer—Stock No. 7445 | RT—Variable Resistor—0 to 10,000 ohms |

diagram, at the same time noting that the lever which is attached to the range switch shaft is in the position as shown.

#### Phonograph Attachment

The audio system of this receiver may be adapted for use in the reproduction of phonograph records by proper connection and arrangement of an external turntable and its associated accessories. The relatively high amplification due to the number of a-f stages employed, necessitates that great care be taken when the circuits are changed for phonograph input. It is recommended that the pickup used be fed directly to the grid circuit of the first audio stage, with suitable switching installed for changing between radio and phonograph operation. Diagrams covering suggested methods of phonograph attachment are given in Figures 9 and 10 with installation details. Hum may possibly be encountered from lack of shielding and improper placement and shielding of the input transformer if these items are not taken care of during rearrangement of the circuits. All wiring should be installed in a substantial and permanent manner.

#### Radiotron Socket Voltages

The voltage values indicated from the Radiotron socket contacts to ground on Figure 7 will serve to assist in locating causes for faulty operation when existent. Each value as specified should hold within  $\pm 20\%$  when the receiver is normally operative at the rated supply voltage. Variations in excess of this limit will usually be indicative of trouble in the basic circuits. The voltages given on the diagram are actual operating values and do not allow for inaccuracies which may be caused by the loading effect of a voltmeter's internal resistance. This resistance should be duly considered for all readings. The amount of circuit resistance shunting the meter during measurement will determine the accuracy to be obtained, the error increasing as the meter resistance is comparable to or less than the circuit resistance. For the majority of readings, a meter having an internal resistance of 1000 ohms per volt will be satisfactory when the range used for each check is chosen as high as possible consistent with good readability.

#### Universal Transformer

The wiring of the special transformer used in some models of this receiver is given by Figure 4. This transformer is adaptable to several ranges of voltage, hence, in cases of receiver inoperation, the connections should be checked to assure that they are correct for the voltage being used.

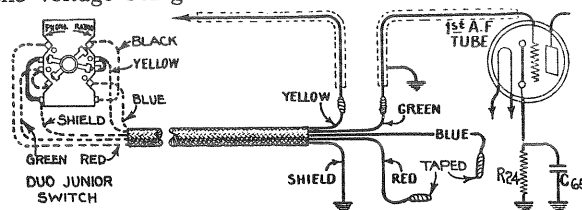


Figure 10—Duo Junior Connections

#### INSTALLATION

Arrange connections from Duo Junior output cable to receiver so that completed wiring is in accordance with schematic above. Add two jumpers shown by heavy full lines to Duo Junior Radio-Phono switch. Keep all leads as short as possible and well shielded where indicated.

#### PARTS REQUIRED

Model R-93—Duo Junior Phonograph

# MODEL C13-2 REPLACEMENT PARTS

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

STOCK No.	DESCRIPTION	LIST PRICE	STOCK No.	DESCRIPTION	LIST PRICE
<b>RECEIVER ASSEMBLIES</b>					
4427	Bracket—Low frequency tone control switch, volume control or high frequency tone control mounting bracket.....	\$0.18	11283	Resistor—1200 ohms—Carbon type—1/4 watt—(R24)—Package of 5.....	\$1.00
5237	Bushing—Variable capacitor mounting assembly—Package of 3.....	.43	3381	Resistor—10,000 ohms—Carbon type—1/4 watt (R26)—Package of 5.....	1.00
11255	Cable—Radiotron tuning lamp cable complete with socket.....	1.20	5114	Resistor—15,000 ohms—Carbon type—1 watt (R2).....	.22
5241	Capacitor—Adjustable capacitor—(C44, C48).....	.40	8070	Resistor—22,000 ohms—Carbon type—1/2 watt (R25)—Package of 5.....	1.00
11286	Capacitor—14 Mmfd. (C39).....	.24	11305	Resistor—22,000 ohms—Carbon type—1/4 watt (R35)—Package of 5.....	1.00
11292	Capacitor—22 Mmfd. (C8).....	.24	8065	Resistor—27,000 ohms—Carbon type—1/2 watt (R7)—Package of 5.....	1.00
11289	Capacitor—50 Mmfd. (C16, C21).....	.26	5033	Resistor—33,000 ohms—Carbon type—1 watt (R29)—Package of 5.....	1.10
11291	Capacitor—115 Mmfd. (C7, C50, C52).....	.24	11300	Resistor—33,000 ohms—Carbon type—1/10 watt (R6)—Package of 5.....	.75
11295	Capacitor—200 Mmfd. (C77).....	.30	11282	Resistor—56,000 ohms—Carbon type—1/10 watt (R8)—Package of 5.....	.75
11294	Capacitor—325 Mmfd. (C45).....	.32	8064	Resistor—82,000 ohms—Carbon type—1/2 watt (R34)—Package of 5.....	1.00
11290	Capacitor—400 Mmfd. (C36, C37, C51).....	.25	3118	Resistor—100,000 ohms—Carbon type—1/4 watt (R11, R13, R14)—Package of 5.....	1.00
11269	Capacitor—800 Mmfd. (C15).....	.30	11281	Resistor—100,000 ohms—Carbon type—1/10 watt (R1, R9)—Package of 5.....	.75
11293	Capacitor—900 Mmfd. (C66).....	.40	5158	Resistor—220,000 ohms—Carbon type—1/4 watt (R37)—Package of 5.....	1.00
11335	Capacitor—1300 Mmfd. (C43).....	.30	3033	Resistor—1 megohm—Carbon type—1/4 watt (R5)—Package of 5.....	1.00
11287	Capacitor—4500 Mmfd. (C40, C57).....	.30	4241	Resistor—1.5 Megohms—Carbon type—1/4 watt (R15)—Package of 5.....	1.00
4838	Capacitor—.005 Mfd. (C73, C75).....	.20	11151	Resistor—2.2 megohm—Carbon type—1/4 watt (R19, R20)—Package of 5.....	1.00
5242	Capacitor—.005 Mfd. High frequency tone control capacitor (C71).....	.52	11209	Resistor—Voltage divider resistor—Comprising one 4100 ohm, one 4700 ohm, one 50 ohm, two 33 ohm and one 124 ohm sections—(R31, R32, R33, R36, R38, R39).....	1.16
5148	Capacitor—.007 Mfd. (C72).....	.20	5249	Shield—Antenna, Detector or Oscillator coil shield.....	.20
4624	Capacitor—.01 Mfd. (C64).....	.54	5250	Shield—Intermediate frequency transformer shield.....	.22
4883	Capacitor—.01 Mfd. (C38).....	.20	11273	Shield—Rectifier Radiotron shield.....	.25
4937	Capacitor—.01 Mfd. (C74).....	.25	4794	Socket—4 contact rectifier Radiotron socket.....	.15
4836	Capacitor—.05 Mfd. (C5, C17, C25, C29, C59).....	.30	11197	Socket—6 contact Radiotron socket—For first audio or driver radiotrons—(6C5).....	.14
4886	Capacitor—.05 Mfd. (C60).....	.20	11198	Socket—7 contact Radiotron socket—For 6K7, 6H6, or 6F6 radiotrons.....	.15
4841	Capacitor—.1 Mfd. (C19, C58).....	.22	11278	Socket—7 contact oscillator Radiotron (6J7) socket.....	.20
4885	Capacitor—.1 Mfd. (C14, C20, C26, C32, C33).....	.28	11279	Socket—7 contact First Detector Radiotron (6L7) socket.....	.20
4840	Capacitor—.25 Mfd. (C9).....	.30	11199	Socket—Dial lamp socket.....	.14
3597	Capacitor—.25 Mfd. (C69).....	.40	5224	Switch—Low frequency tone control switch and power switch (S12, S14).....	1.00
11203	Capacitor—10 Mfd. (C53).....	1.18	5225	Switch—Range switch—(S1, S2, S3, S4, S5, S6, S8, S9, S10, S11, S13).....	3.75
5212	Capacitor—18 Mfd. (C54).....	1.16	5238	Terminal—Antenna terminal board and clip with insulating strip and rivets.....	.14
11204	Capacitor Pack—Comprising one 10 Mfd., one 20 Mfd., and two 8 Mfd. capacitors C55, C56, C65, C67).....	3.44	5222	Tone Control—High frequency tone control—(R27).....	1.04
11208	Capacitor Pack—Comprising one .015 Mfd. and one .05 Mfd. capacitor and one 27,000 ohm and one 10,000 ohm resistors C62, C63, R22, R23).....	1.32	5232	Transformer—Audio driver transformer—(T3).....	2.50
11272	Clamp—Cable clamp—Located on top surface of chassis near variable tuning condenser.....	.10	5228	Transformer—First Intermediate frequency transformer—(L17, L18, C23, C24).....	1.80
4693	Clamp—Electrolytic capacitor mounting clamp—for Stock No. 11204.....	.15	5234	Transformer—Interstage Audio transformer—(T2).....	3.40
5215	Coil—Antenna coil—A and C Bands—(L1, L2, L5, L6, C1, C3).....	2.32	8061	Transformer—Power transformer—105-125 volts 50/60 cycles—(T1).....	6.75
5218	Coil—Antenna coil—X and B Bands—(L3, L4, L7, L8, C2, C4).....	2.58	8062	Transformer—Power transformer—105/125 volts 25/50 cycles.....	9.84
5216	Coil—Detector coil—A and C Bands—L9, L10, L13, L14, C10, C12).....	2.34	11194	Transformer—Power transformer—105/125/150/210/250 volts 40/60 cycles....	7.08
5219	Coil—Detector coil—X and B Bands—(L11, L12, L15, L16, C11, C13).....	2.58			
5217	Coil—Oscillator coil—A and C Bands—(L25, L27, C41, C46).....	2.20			
5220	Coil—Oscillator coil—X and B Bands—(L26, L28, L29, C42, C47).....	2.24			
5221	Coil—Oscillator coil—D Band—(L24).....	.64			
5214	Condenser—3 gang variable tuning condenser—(C6, C18, C49).....	4.42			
5226	Lamp—Pilot lamp—Package of 5.....	.70			
11710	Lead—Shielded lead for antenna.....	.40			
8041	Plate—I.F. or R.F. coil shield locking plate—Package of 2.....	.12			
5112	Resistor—1000 ohms—Carbon type—1/4 watt (R3, R10, R28)—Package of 5.....	1.00			
11285	Resistor—1000 ohms—Flexible type—(R12, R16)—Package of 5.....	1.00			

## 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	Stock No.	DESCRIPTION	LIST PRICE
11206	Transformer—Second Intermediate frequency transformer—(L19, L20, C27, C28).....	1.82	11191	Bracket—Radiotron tuning lamp mounting bracket—Less clamp.....	.12
5230	Transformer—Third Intermediate frequency transformer—(L21, L22, C30, C31, C61, R17, R18).....	2.76	11192	Clamp—Radotron tuning lamp mounting clamp—Less bracket.....	.12
11205	Volume Control—Complete (R21).....	1.30	11193	Cover—Reproducer cover.....	.82
	<b>DRIVE ASSEMBLIES</b>		11276	Escutcheon—Radiotron tuning lamp escutcheon.....	.40
5243	Arm—Band indicator operating arm.....	.42	11379	Escutcheon—Station selector escutcheon and crystal.....	1.08
10194	Ball—Steel ball for drive assembly—Package of 20.....	.25	11346	Knob—Station selector knob—Package of 5.....	.75
8054	Cam—Five position cam—For station selector drive assembly.....	.28	11347	Knob—Volume control, tone control range switch or power switch knob—Package of 5.....	.75
4422	Clutch—Tuning condenser drive clutch assembly—Comprising drive shaft, balls, ring, spring and washers assembled.....	1.00	11382	Resistor—1 megohm—Carbon type—1/10 watt—Used in tuning tube socket—Package of 5 (R30).....	.75
8048	Coupling—Flexible coupling for variable capacitors—Includes indicator shaft.....	.70	5210	Screw—Chassis mounting screw assembly—Package of 4.....	.16
11336	Dial—Dial scale with mounting rivets....	.60	11348	Screw—8-32x7/16" Headless cupped point set screw for knob No. 11346—Package of 10.....	.32
8045	Disc—Drive disc and gear assembly.....	.46	11381	Socket—Radiotron tuning tube socket and cover.....	.45
11380	Drive—Tuning condenser drive assembly complete.....	6.35	11349	Spring—Retaining spring for knob (Stock No. 11347)—Package of 5.....	.15
8044	Escutcheon—Dial escutcheon and vernier label.....	1.08		<b>REPRODUCER ASSEMBLIES</b>	
8050	Gear—Gear sector and band indicator operating link—(Link connects to arm on band switch).....	.15	8059	Board—Terminal board (2 terminals)....	.14
8046	Gear—Indicator shaft drive gear and vernier idler with one spring.....	.72	8060	Bracket—Output transformer mounting bracket.....	.14
8053	Indicator—Station selector vernier pointer.....	.12	11200	Cable—Reproducer cable.....	.50
11793	Indicator—Station selector indicator pointer.....	.15	8058	Clamp—Cone rim clamp—Package of 4....	.44
8051	Link—Complete with roller and spring....	.30	11189	Coil—Field coil—magnet and cone housing (L31).....	10.60
8049	Pinion—Vernier pointer drive pinion and shaft.....	.55	8056	Cone—Reproducer cone (L30).....	1.58
4669	Screw—8-32x5/32" Square head set screw for drive assembly—Package of 10.....	.25	5039	Connector—4 contact male connector for reproducer.....	.25
8047	Spring—Coil spring for indicator shaft drive gear and vernier idler (Stock No. 8046).....	.12	5040	Connector—4 contact female connector for reproducer cable.....	.25
8052	Spring—Coil spring for link—Package of 5.....	.32	9620	Reproducer—Complete.....	16.32
8042	Stud—Band indicator operating arm stud—Package of 5.....	.25	8057	Transformer—Output transformer (T4, C76).....	3.22
	<b>MISCELLANEOUS ASSEMBLIES</b>				
5211	Bolt—Reproducer mounting bolt assembly—Package of 2.....	.24			