Engineering Data Book

and

Installation Instructions

for

Stromberg-Carlson No. 638 Art Console Receiver for A. C. Operation

Copyright 1928
By Stromberg-Carlson Telephone Mfg. Co.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY

Kansas City, Missouri — Rochester, New York — Chicago, Illinois

United States of America

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY
OF CANADA, LTD.

Toronto, Ontario, Dominion of Canada

PC-18566 FORM 1377 PRINTED IN U.S.A.

INTRODUCTION

The Stromberg-Carlson No. 638 Receiver is an Art Console type with a built-in dynamic speaker. It employs seven tubes in addition to the rectifier tube. The No. 638-A Receiver is designed to work on 60 cycle alternating current supply with voltages ranging from 105 to 125 volts. The No. 638-B Receiver is designed for frequencies of 25 to 60 cycles, 105 to 125 volts.

The chassis of this receiver is self contained and is of the same general type as that used in the No. 636 Receiver, the receiver apparatus and complete power supply equipment being mounted on one metal base with all units permanently wired together. This chassis contains two groups of apparatus, that in the center and on the right-hand side of the base facing the rear of the chassis is the radio frequency amplifier, the tuning system, the detector, and the audio amplifier. The equipment on the left-hand side is the power supply, consisting of a power transformer, single tube full wave rectifier, and filter system. All "A", "B" and "C" voltages are supplied from this equipment as well as the power supply to the rectifier on the dynamic speaker assembly.

The chassis base is made of sheet steel, of sufficient height to enclose all wiring and part of the apparatus, such as balancing and aligning capacitors, volume control units, and hum balancing potentiometers.

The remainder of the apparatus is mounted above the base and each piece is enclosed in an individual metal casing. There is no exposed wiring, excepting the connections to the dial pilot lamp.

The dynamic speaker is mounted in a box type baffle above the chassis. This assembly is provided with two connecting cords to the chassis, one for the A. C. supply to the rectifier for the speaker field energizing current, and the other for the audio frequency output of the receiver. The field of the dynamic speaker is energized when the "On-Off" switch of the receiver is turned on. An external speaker may be used by connecting its cord to the pin jacks in place of the cord from the built-in speaker.

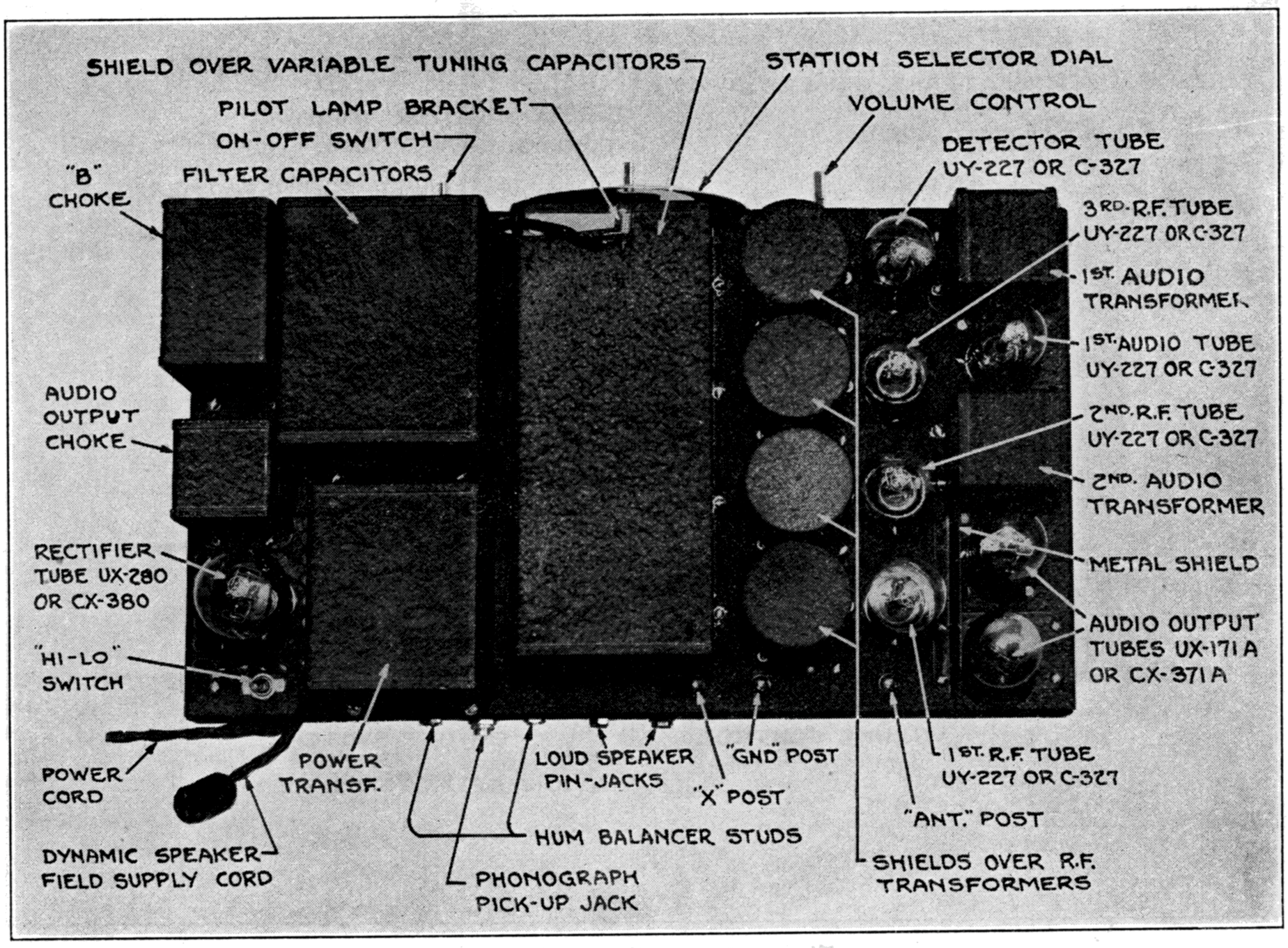


Fig. 1. Top View of Chassis.

Five UY-227 tubes are used for the radio stages, the detector, and the first audio stage. Two UX-171-A tubes are used for the output stage and the rectifier is the full-wave UX-280 type.

The tuning system consists of four tuned stages, using a new type antenna tuning stage and three intervening stages of tuned and neutralized radio frequency amplification. The tuning coils are of an efficient compact type and are enclosed in seamless aluminum shields. The four tuning capacitors are arranged in a single gang of rugged, durable construction and are enclosed in a metal shield.

The detector is of the grid leak and capacitor type. The audio amplification system, with the exception of the output tubes, is of the same type used in receivers of the Stromberg-Carlson Nos. 635 and 636 types. Two UX-171-A tubes, arranged in multiple, are used in the output stage to give increased undistorted power output. All coil windings are enclosed in compact metal casings filled with sealing compound to afford protection from moisture and mechanical damage.

The volume control is double and of new design, employing two variable resistor units, one in the antenna system to regulate the amount of signal admitted to the radio frequency amplifiers, and one in the third radio frequency stage to regulate the amount of signal admitted to the detector. These two units are on the same shaft and operate simultaneously by turning one control knob.

A phonograph pickup jack is provided in the rear of the receiver so that the plug of a No. 2-B Magnetic Pickup outfit can be inserted permanently. The pickup is connected into the circuit by turning the volume control counter-clockwise as far as possible to the "off" position. This actuates a cam switch which connects the magnetic pickup between grid and cathode of the detector tube.

The tuning capacitors have plates shaped so that the broadcast channels at the low wave-lengths are spread more than in previous models of Stromberg-Carlson Receivers, without impairing selectivity or unnecessarily crowding the channels at the longer wavelengths. This affords greater ease of mechanical selection of station channels at the lower wavelengths.

The amplification at the longer wavelengths has been somewhat increased, so that the response curve is practically flat for the entire broadcast band. The Station Selector (tuning) dial is calibrated in one hundred equal divisions, arranged so that in turning the knob in a clockwise direction the dial progresses in the same direction, and the numbering progresses from 0 to 100. The tuning range of this receiver is from 200 to 550 meters, or 1500 to 546 kilocycles.

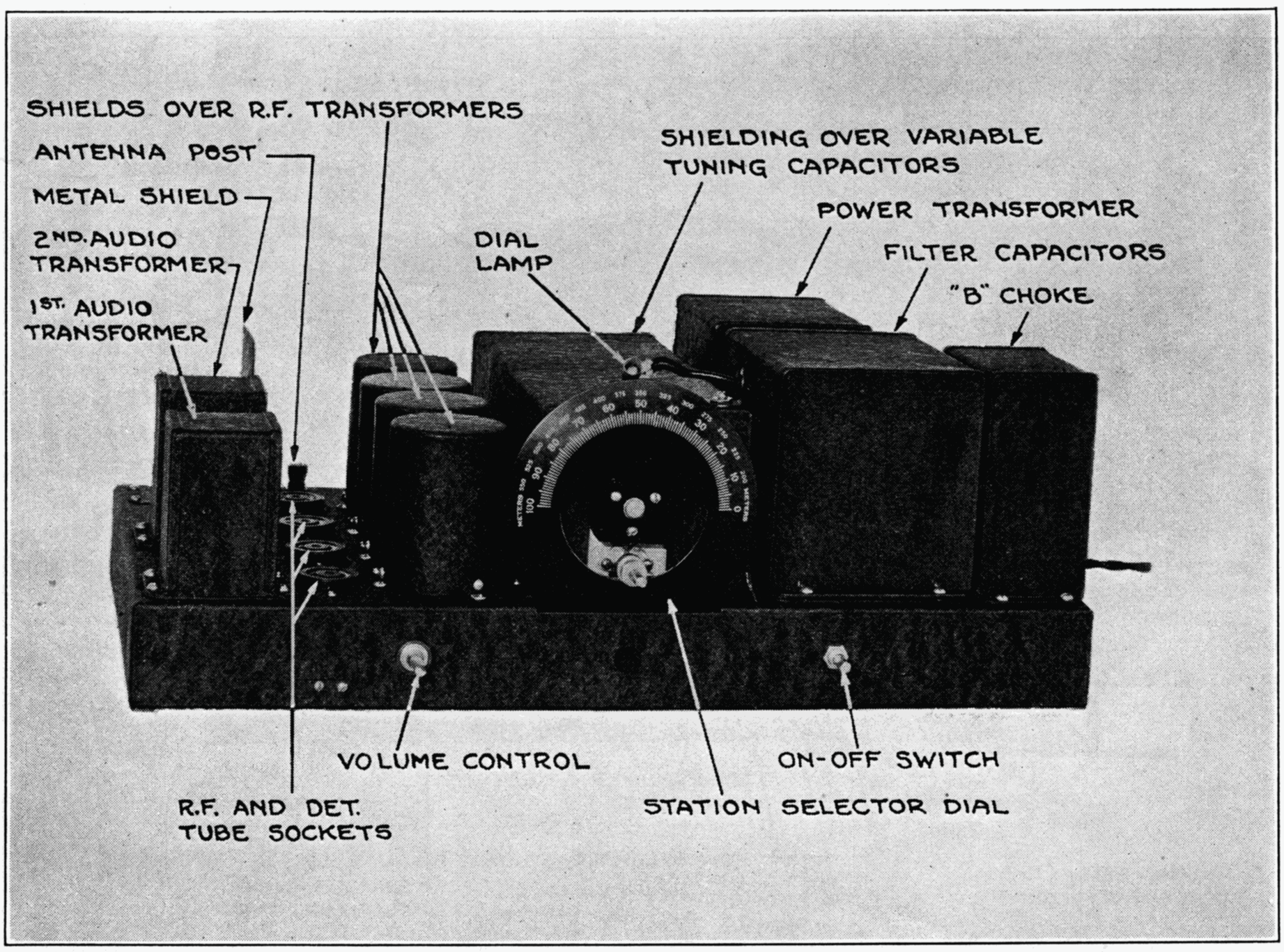


Fig. 2. Front View of Chassis.

The name plate will be found on the rear of the chassis base. It contains information such as the Piece Number and the Serial Number of the receiver, range of voltage and frequency over which the receiver will operate, and the power consumed.

The No. 638-A Receiver with P-18442 chassis is designed to work efficiently on 105-125 volts 60 cycles A. C.; the No. 638-B Receiver with P-18443 chassis on 105-125 volts, 25-60 cycles A. C.

The receiver is equipped with a switch to compensate for low and high line voltages. With voltages lower than those recommended for efficient operation of the receiver, the receiver may operate satisfactorily, but the amplification will be decreased and the quality somewhat impaired; and, with voltages greater than those recommended, the life of the tubes will be somewhat shortened. Line voltage fluctuations of fifteen or twenty volts will not make any appreciable change in loud speaker volume, when such fluctuations do not exceed the rated maximum and minimum operating limits of the receiver.

Fig. 4 shows the front of the Art Console cabinet. The door concealing the control panel is opened by pulling forward on the small metal pendant, and when the door reaches a horizontal position sliding it directly back under the receiver chassis. The sliding doors back of the grille are shown in an open position in this picture, these doors being operated by moving the small metal lever immediately over the dial opening. Moving the lever from right to left opens the doors and from left to right closes the doors. These grille doors should always be open when the dynamic speaker is operated. The Station Selector knob is in the center below the dial, the Volume Control knob is to the left and the On-Off switch to the right.

Fig. 5 shows the rear of the No. 638 Receiver with the back cover removed and illustrates the construction of the box type baffle and dynamic loud speaker assembly. This box baffle may be removed by first disconnecting the two loud speaker connecting cords, and then removing the four fastening screws at the rear of the side members. Now the whole dynamic speaker assembly can be pulled out of the rear of the cabinet, the same as a desk drawer.

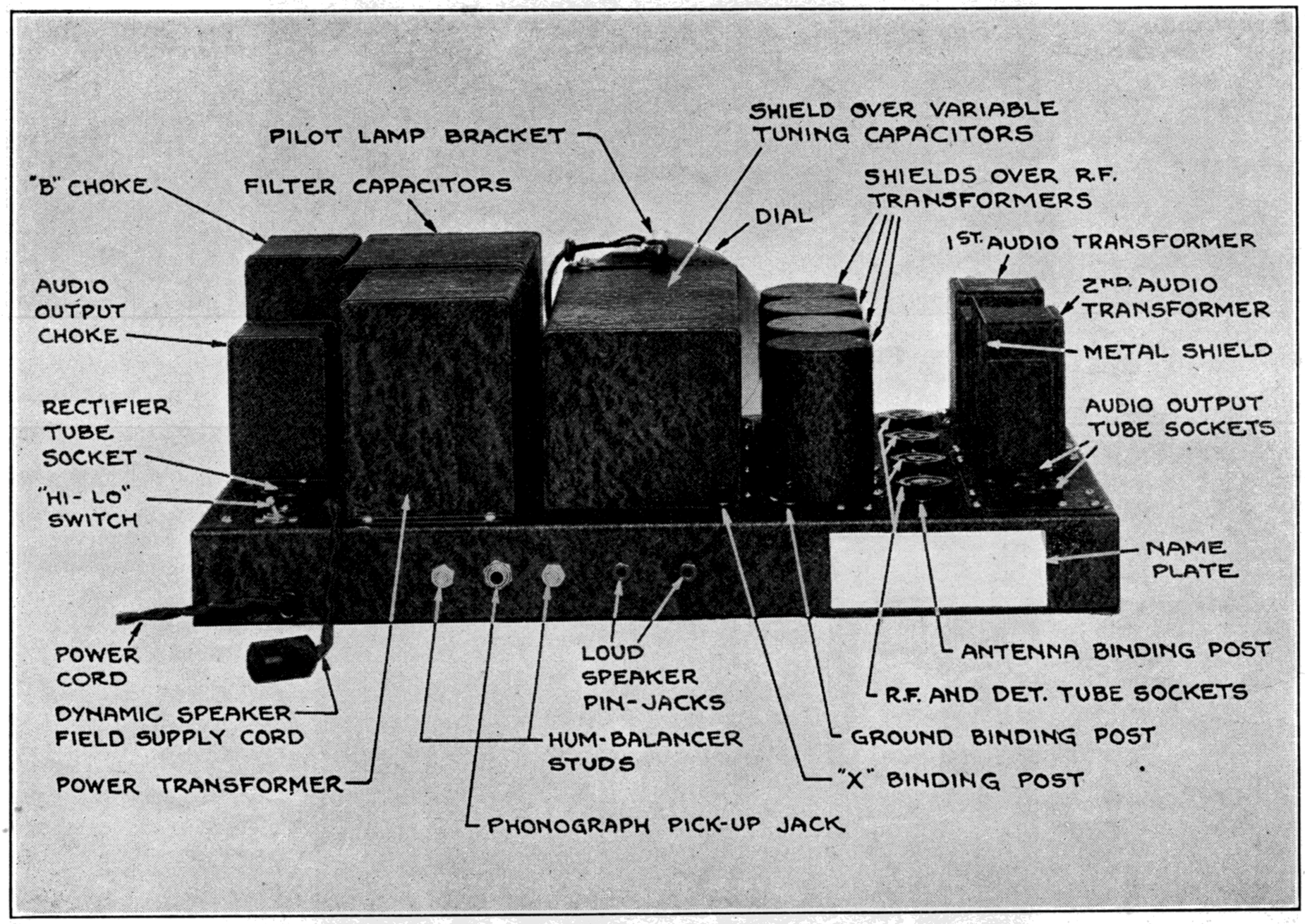


Fig. 3. Rear View of Chassis.

A summary of the features of the Stromberg-Carlson No. 638 Receiver is as follows:

(1) Complete receiver and power equipment arranged integrally in one compact unit.
(2) Fidelity of audio reproduction.
(3) Provision for phonograph operation and permanent connection of pickup outfit.
(4) Rugged construction.
(5) Practically flat response over broadcast band.
(6) Great ease of station selection.
(7) Total shielding.
(8) No exposed wiring.
(9) Operation direct from house lighting current using no batteries or liquids.
(10) Reasonable line voltage fluctuation will not affect operation of receiver.
(11) Single Station Selector (tuning control).
(12) Built-in dynamic speaker.

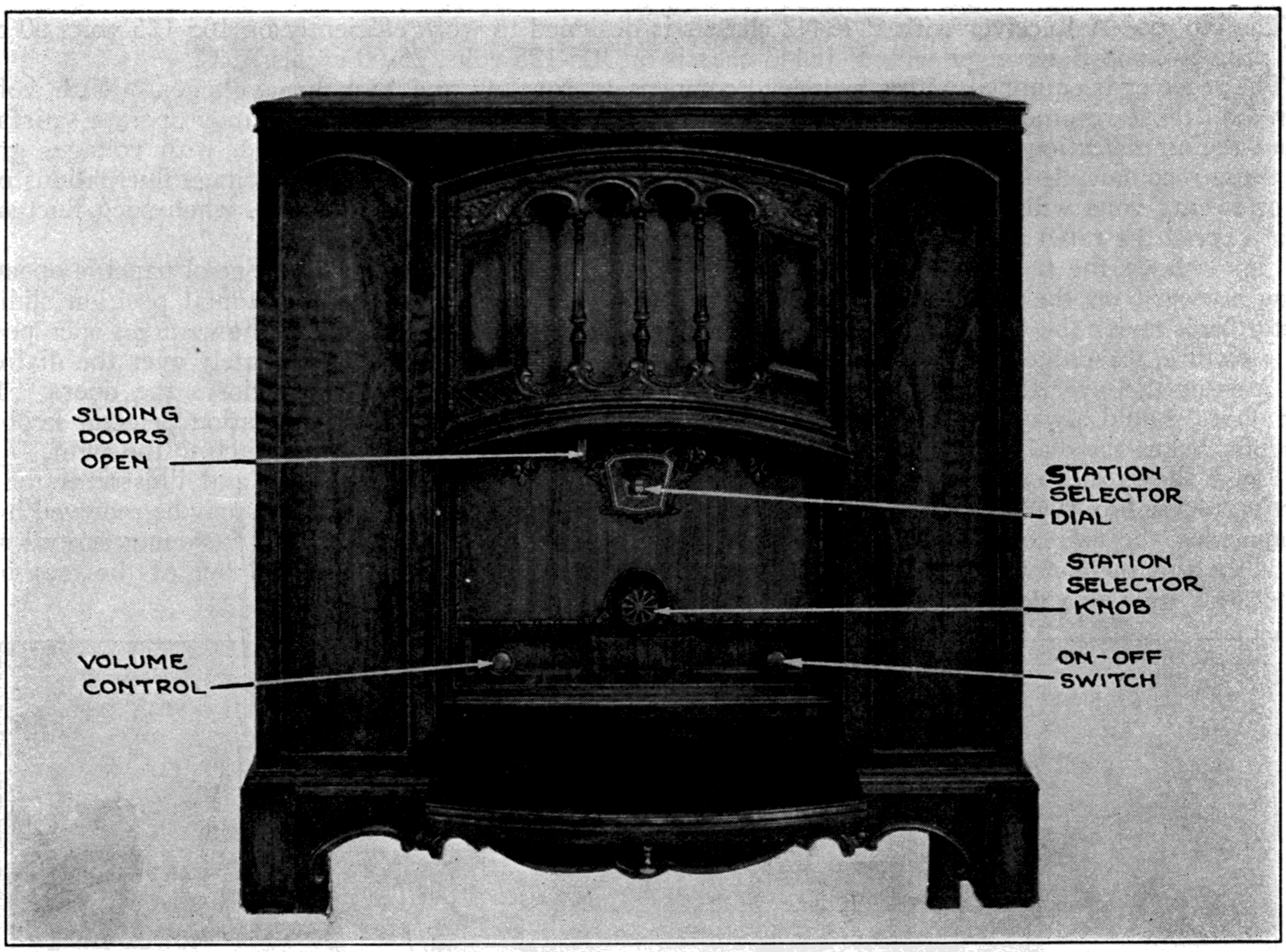


Fig. 4. Front View of No. 638 Receiver.

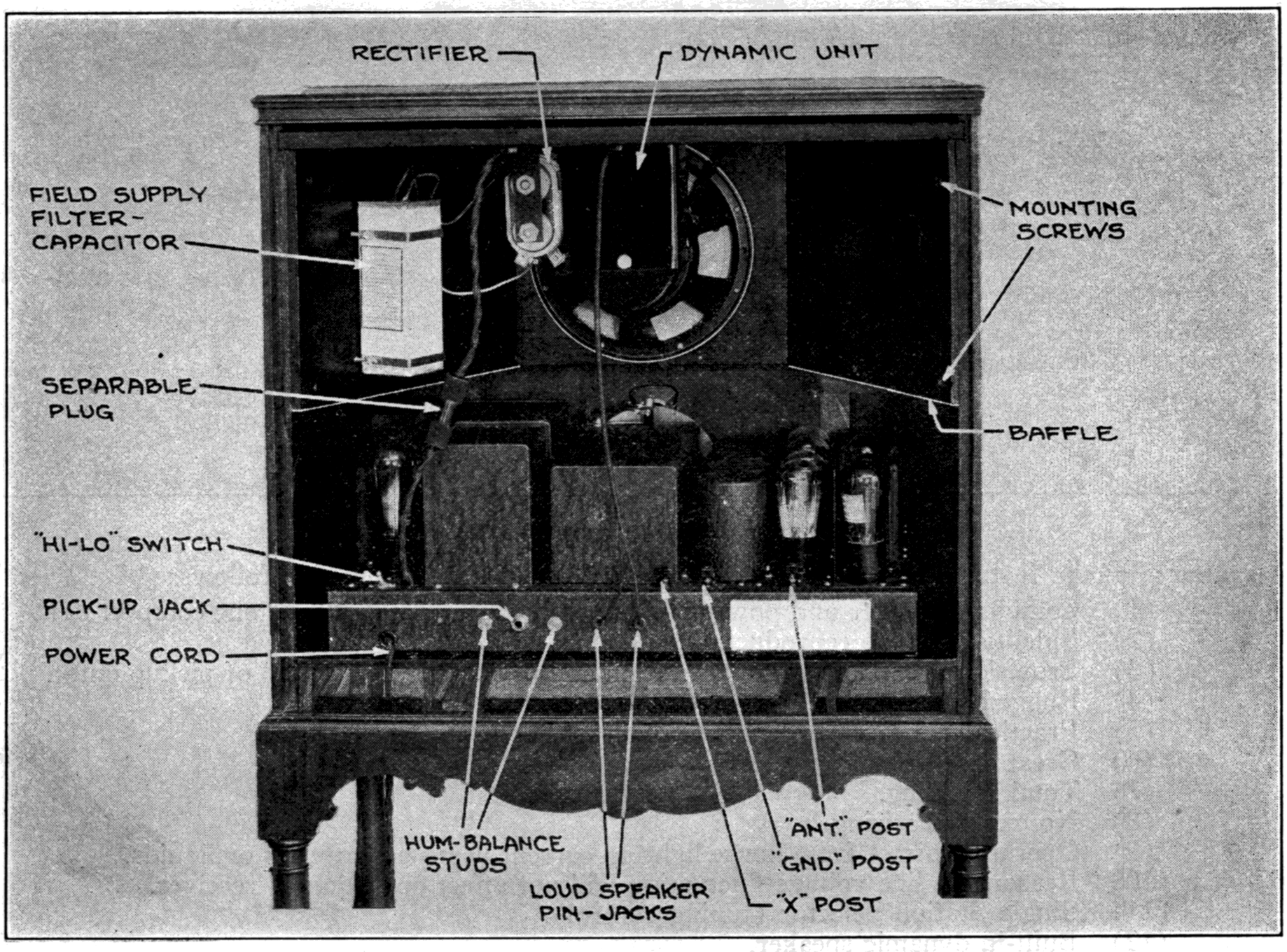


Fig. 5. Rear View of No. 638 Receiver with Back Removed.

TECHNICAL DISCUSSION

I. THE TUNING SYSTEM.

(*a*) The tuning system of the Stromberg-Carlson No. 638 Receiver consists of one tuned antenna stage and three stages of tuned and neutralized radio frequency amplification.

(1) The antenna stage is a tuned coupling stage of new, highly efficient design.

(2) The radio frequency transformers are completely shielded and are very compact and efficient.

(3) One control operates all tuning capacitors simultaneously.

(4) Tuning capacitors are aligned electrically by means of padding capacitors shunted across them.

(5) The radio frequency stages are stabilized by means of balancing capacitors, and neutralizing inductances which are part of the secondary coils of the radio frequency transformers.

(6) The neutralizing capacitor and the aligning capacitor for each radio frequency stage are mounted on the same base, and have their stationary plates in common.

II. DETECTOR AND AUDIO SYSTEM.

(1) Grid rectification (grid leak) method of detection is employed.

(2) Two stages of high-quality transformer coupled audio amplification are employed, the ratio of the first transformer being 4 to 1, and that of the second being 2.8 to 1.

(3) The secondary of each audio transformer is shunted with a one-megohm resistor to obtain the desirable audio frequency characteristic.

(4) The output of the audio system is coupled to the loud speaker by means of a twenty-henry choke and a two-microfarad capacitor. A correctly-designed "high-frequency cut-off type" of audio filter is included in the audio output system. Insulated pin-type jacks are provided at the rear of the chassis for loud-speaker connections.

(5) A pickup jack is provided in the rear of the receiver. The plug on the cord of a No. 2-B Magnetic Pickup Outfit can be inserted in this jack and left there permanently. The pickup is connected into the grid circuit of the detector tube by means of a cam switch which is operated when the volume control is turned down (counter-clockwise) as far as possible.

III. VOLUME CONTROL.

(*a*) The volume control consists of two separate units operated simultaneously by the same control knob.

(1) The primary of the antenna transformer has a 10,000 ohm potentiometer shunted across it, with the variable contact grounded. This controls the amount of signal admitted to the radio frequency amplifiers.

(2) The second unit is a 10,000 ohm variable resistor shunted across the primary of the third radio frequency transformer. This controls the amount of signal admitted to the detector.

IV. THE LOUD SPEAKER ASSEMBLY.

This assembly contains a high quality dynamic speaker unit specially designed for this receiver. The loud speaker unit has a built-in "speech" input transformer, the primary leads of which plug into the pin jacks on the rear of the chassis of the receiver. The field energizing direct current is supplied from a dry rectifier also included in this assembly. The alternating current is supplied to this dry rectifier through a cord equipped with a separable connector and is obtained from the power transformer of the receiver chassis. This field current is controlled by the "On-Off" switch of the receiver.

This whole loud speaker assembly (See Fig. 7), including the box baffle, may be slid out of the cabinet after removing the four fastening screws located at the rear of the baffle side members. The mechanism of the sliding doors or panels for the grille opening is exposed when this dynamic speaker baffle box is withdrawn from the cabinet.

The circuit diagram of the loud speaker assembly is shown in Fig. 8.

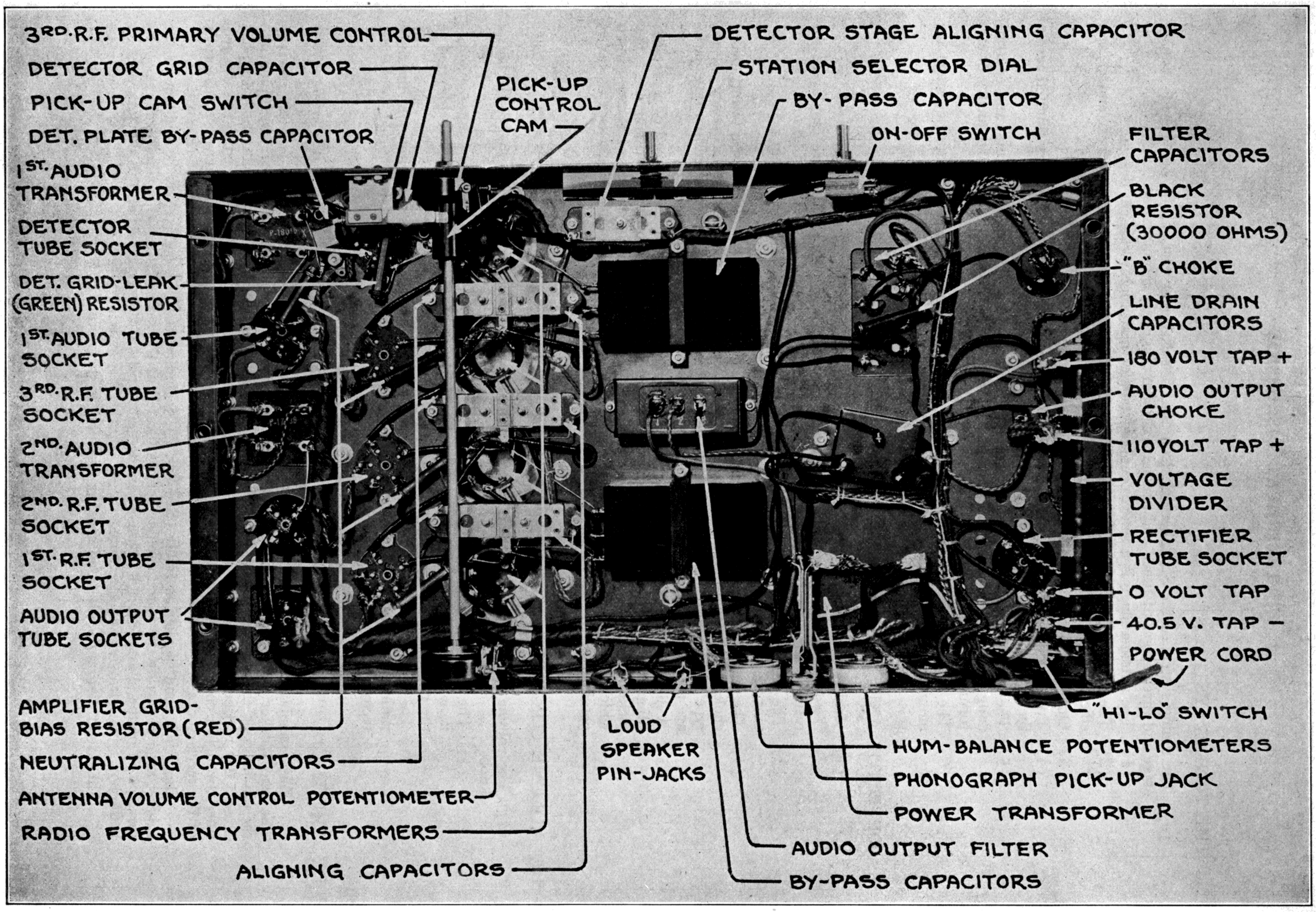


Fig. 6. Bottom View of Chassis.

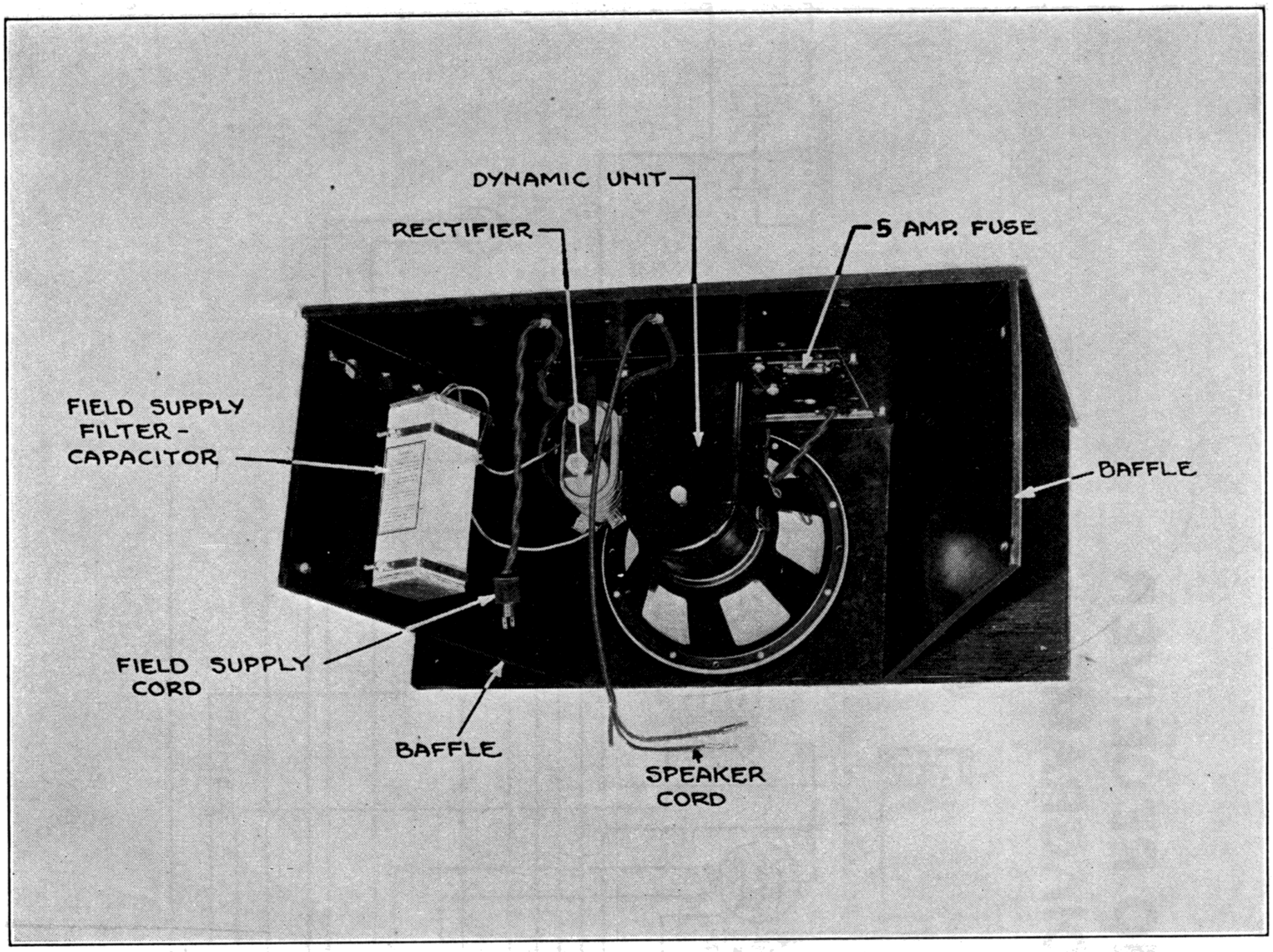


Fig. 7. Dynamic Speaker and Baffle Assembly Removed from Cabinet.

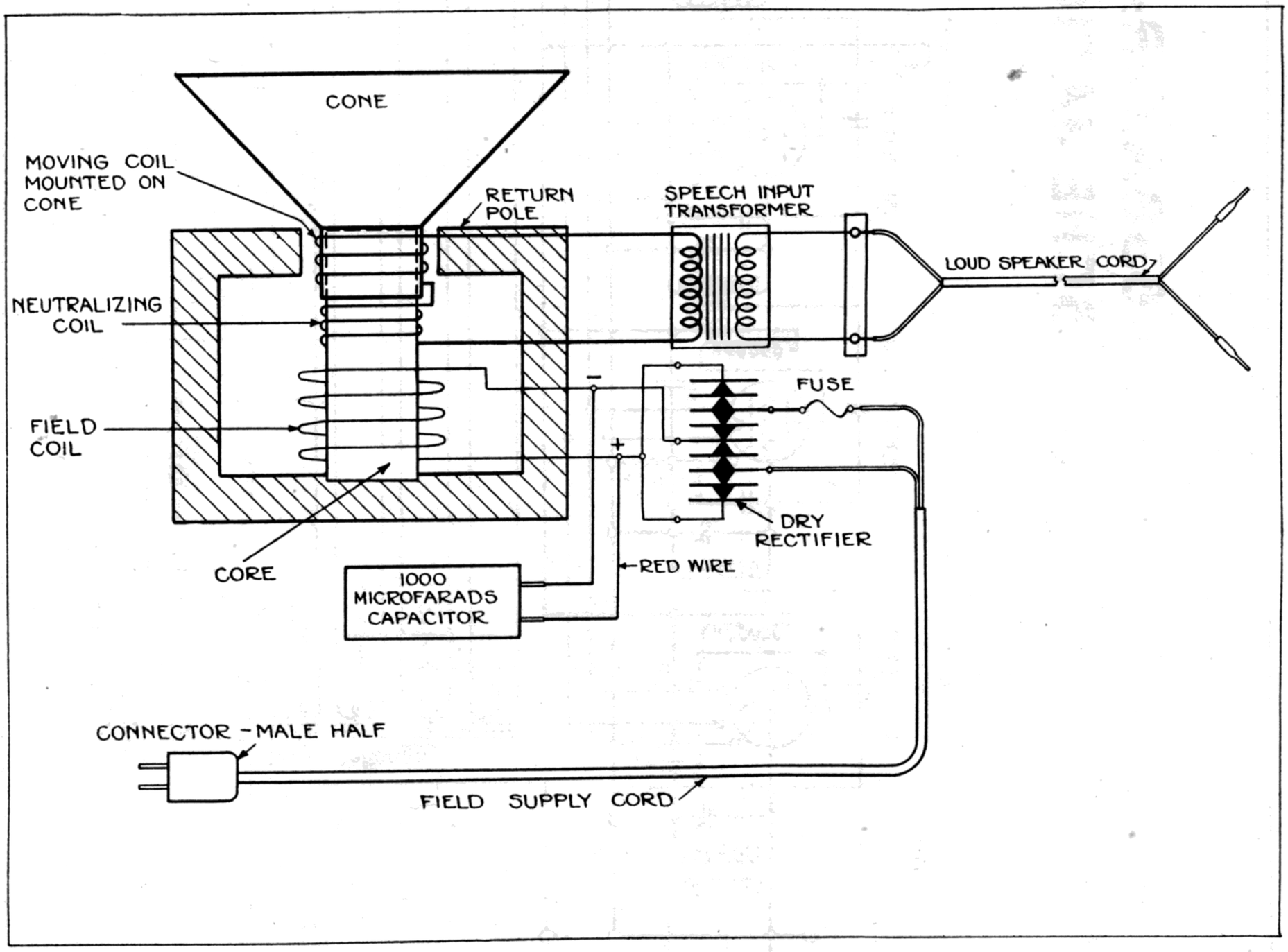


Fig. 8. Circuit Diagram of Dynamic Speaker Assembly.

NO.638A.C.RADIO RECEIVER
SCHEMATIC DIAGRAM

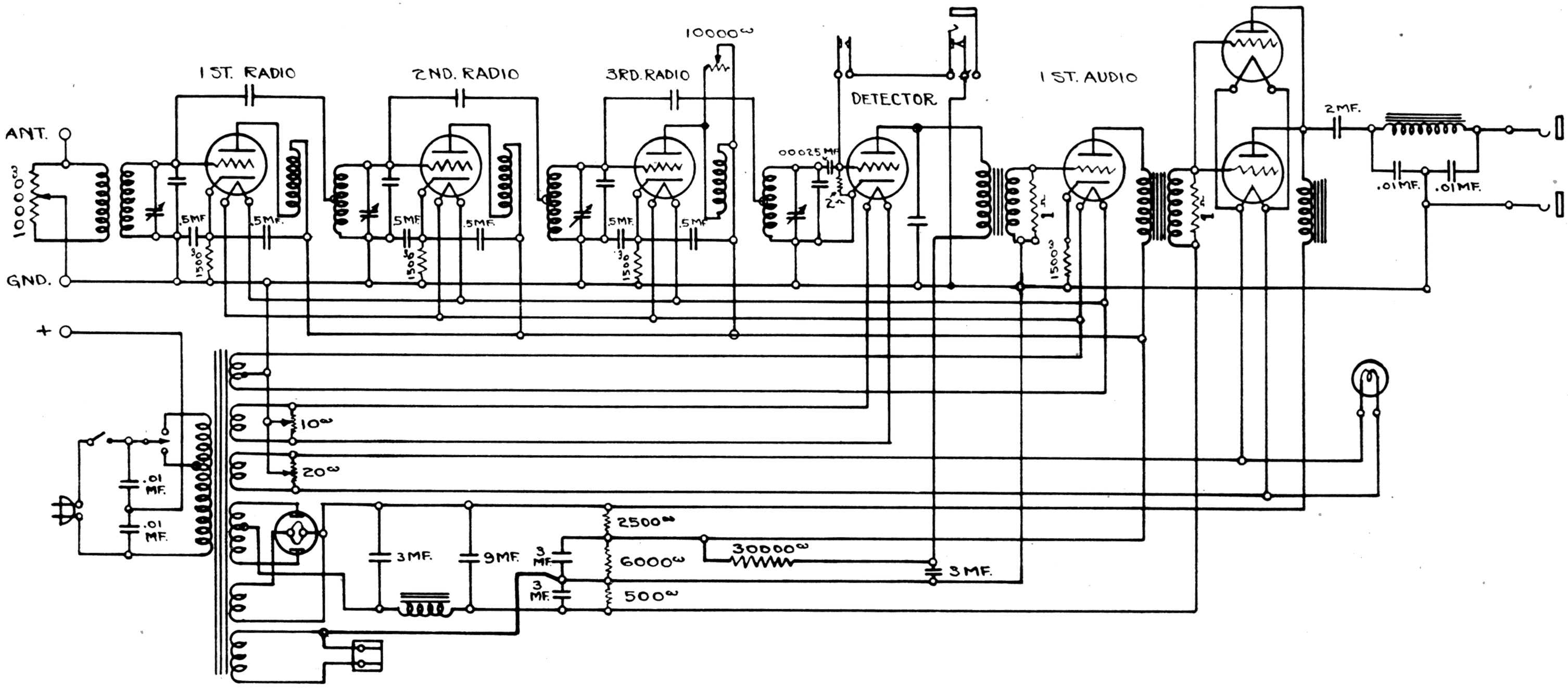


Fig. 9. Schematic Circuit Diagram.

V. A STUDY OF THE CIRCUITS OF THE RECEIVER.

The following is a study of the component circuits of the receiver, including that of the power equipment. Fig. 9 is the schematic diagram of the complete receiver circuit.

(*a*) *The "A" or Filament Circuits.*

(1) Fig. 10 shows the filament circuits of the receiver.

(2) The heaters of the three radio frequency and first audio tubes are connected in parallel, but with separate twisted pair connections to each tube from the power transformer secondary, which supplies approximately 2.3 volts to each of these tubes. Separate connections to each tube insure the same voltage on each tube. The power transformer secondary which supplies these tubes is provided with a grounded center tap for hum balance.

(3) A separate secondary of the power transformer supplies approximately 2.3 volts to the detector tube heater. This results in a better condition for suppressing hum. A 10-ohm potentiometer, with its variable contact grounded for hum balance, is shunted across the current supply to this tube.

(4) The filaments of the audio output tubes and the dial light are connected in parallel and are supplied with approximately 4.5 volts from the power transformer. A 20-ohm potentiometer with its variable contact grounded for hum balance, is shunted across this current supply.

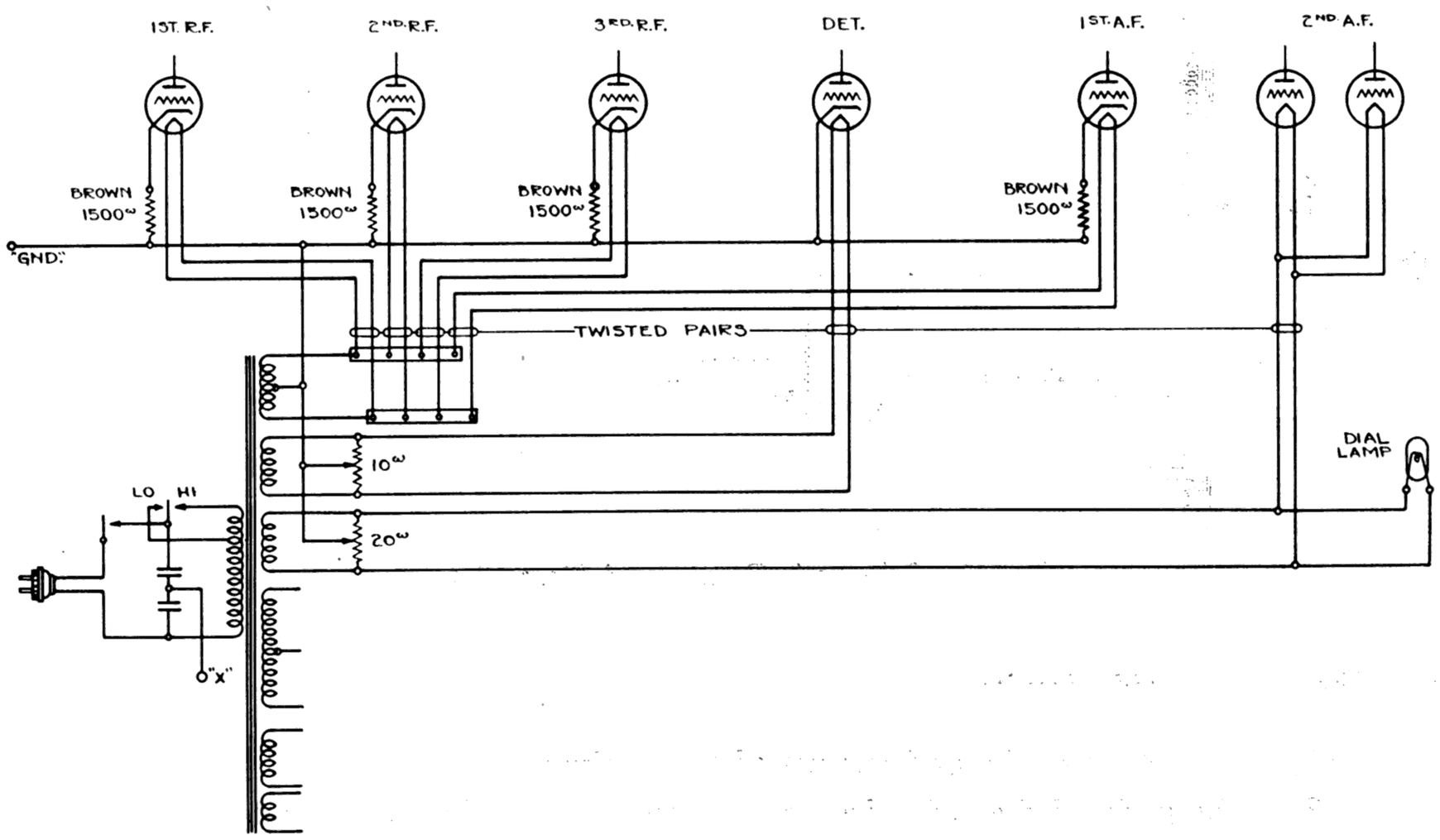


Fig. 10. Schematic Diagram of Filament Circuits.

(*b*) *The "B" or Plate Circuits.*

(1) Fig. 11 shows the plate circuits of the receiver.

(2) The plates of the radio frequency and first audio tubes are supplied with approximately 105 volts D. C. from the power equipment. The detector plate is supplied with approximately 35 volts D. C. and the audio output tubes are supplied with approximately 180 volts D. C. from the power equipment.

(3) The radio frequency and first audio plate supply is "by-passed" to ground by a 3-mfd. capacitor, which is contained in the power equipment.

(4) The plate supply to the radio frequency tubes is "by-passed" to the cathode at each radio frequency tube by a 0.5 mfd. capacitor.

(5) The detector plate supply is "by-passed" to ground by a 3-mfd. capacitor, which is contained in the power equipment.

(6) Any radio frequency current present in the detector plate circuit is "by-passed" to the cathode by a .002 mfd. capacitor.

(7) The audio frequency component of the output tubes is passed through the two microfarad capacitor, connected to the plates, through audio filter and the loud speaker input transformers and to the filaments of the two UX-171-A tubes.

(8) The audio output circuit is complete in itself so that if desired an external loud speaker can be used by removing the connecting cord to the built-in dynamic speaker from the pin jacks and plugging in the cord from the external speaker.

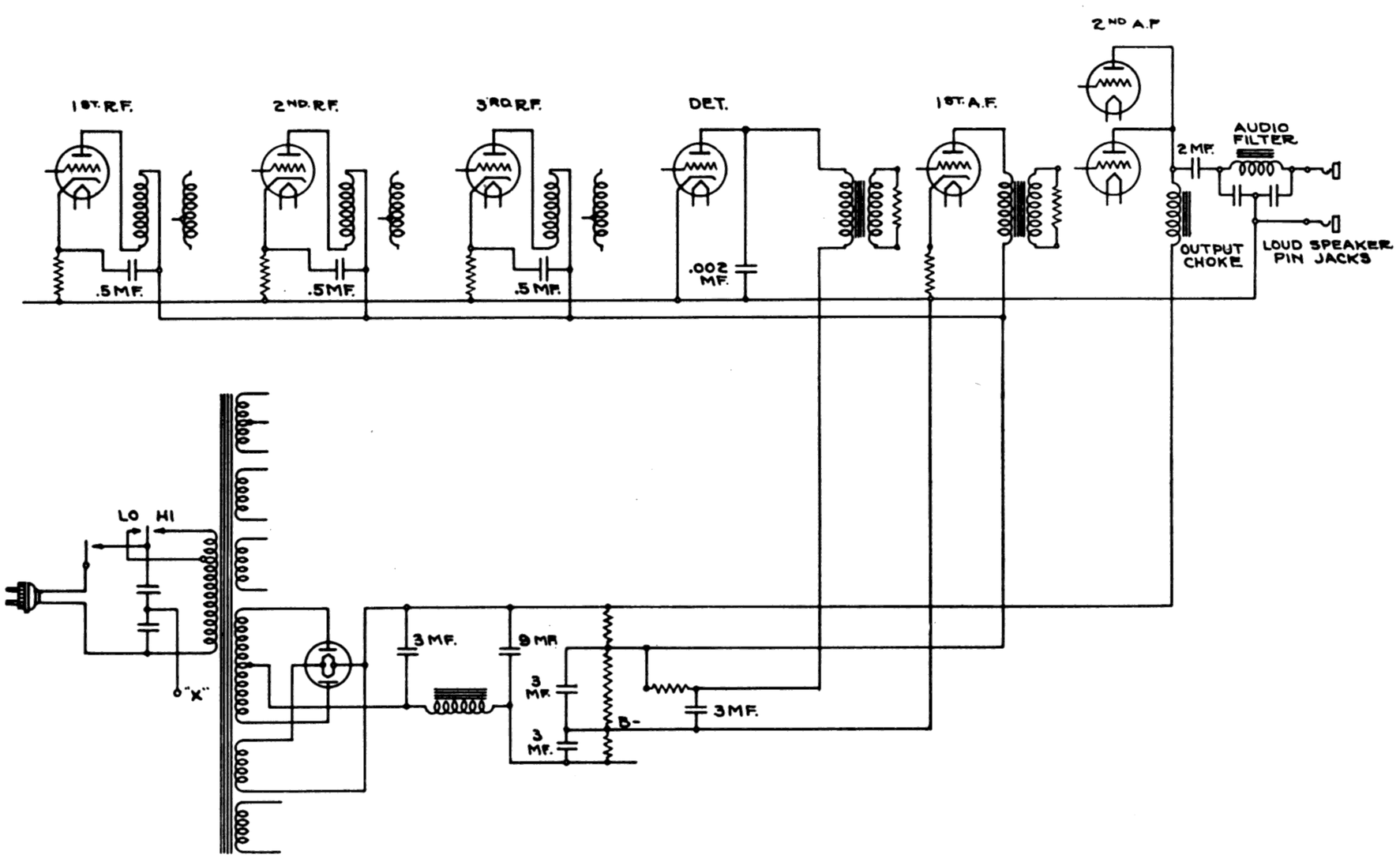


Fig. 11. Schematic Diagram of Plate Circuits.

(c) The "C" or Grid Circuits.

(1) Fig. 12 shows the grid circuits of the receiver.

(2) The grids of the radio frequency, detector, and first audio tubes are all returned to ground.

(3) The grids of the radio frequency and first audio tubes are biased negatively approximately 5 volts with respect to the cathodes, by means of a 1500 ohm resistor connected between each cathode and ground.

(4) These biasing resistors are "by-passed" by 0.5 mfd. capacitors in the radio frequency stages. This prevents the resistors from having any effect on the radio frequency current and insures stability. It is, of course, unnecessary to by-pass the resistor in the first audio stage.

(5) The power equipment supplies approximately 40.5 volts negative bias to the grid of the audio output tube.

(*d*) *The Power Supply Circuit.*

(1) Fig. 13 shows the circuit of the power equipment.

(2) The primary circuit of the power transformer is provided with a "HI-LO" switch, which compensates for high or low line voltages.

(3) The power transformer consists of a primary winding and five secondary windings which supply the radio frequency and first audio tube heaters, the detector tube heater, the audio output tube and dial light filaments, the rectifier tube filament, and the high voltage which is rectified and filtered to supply the plate voltage for the receiving tubes. The grid bias voltage for the audio output tube is also supplied from this source.

(4) Full wave rectification is accomplished by one UX-280 Radiotron or CX-380 Cunningham rectifier tube.

(5) The filter system consists of a 50-henry choke, a 3 mfd. capacitor, and a 9 mfd. capacitor.

(6) A voltage divider connected across the output of the rectifier and filter system supplies the correct voltages to the radio frequency, detector and audio tube plates and to the grid of the audio output tube.

(7) The alternating current supply for the dynamic speaker is taken from a winding on power transformer which is connected to the separable connector. One side of this winding is grounded to minimize ripple in the loud speaker. *This connection is not shown on the wiring diagram of this receiver, but it is shown in the schematic circuit, Fig. 9; also in Fig. 13.*

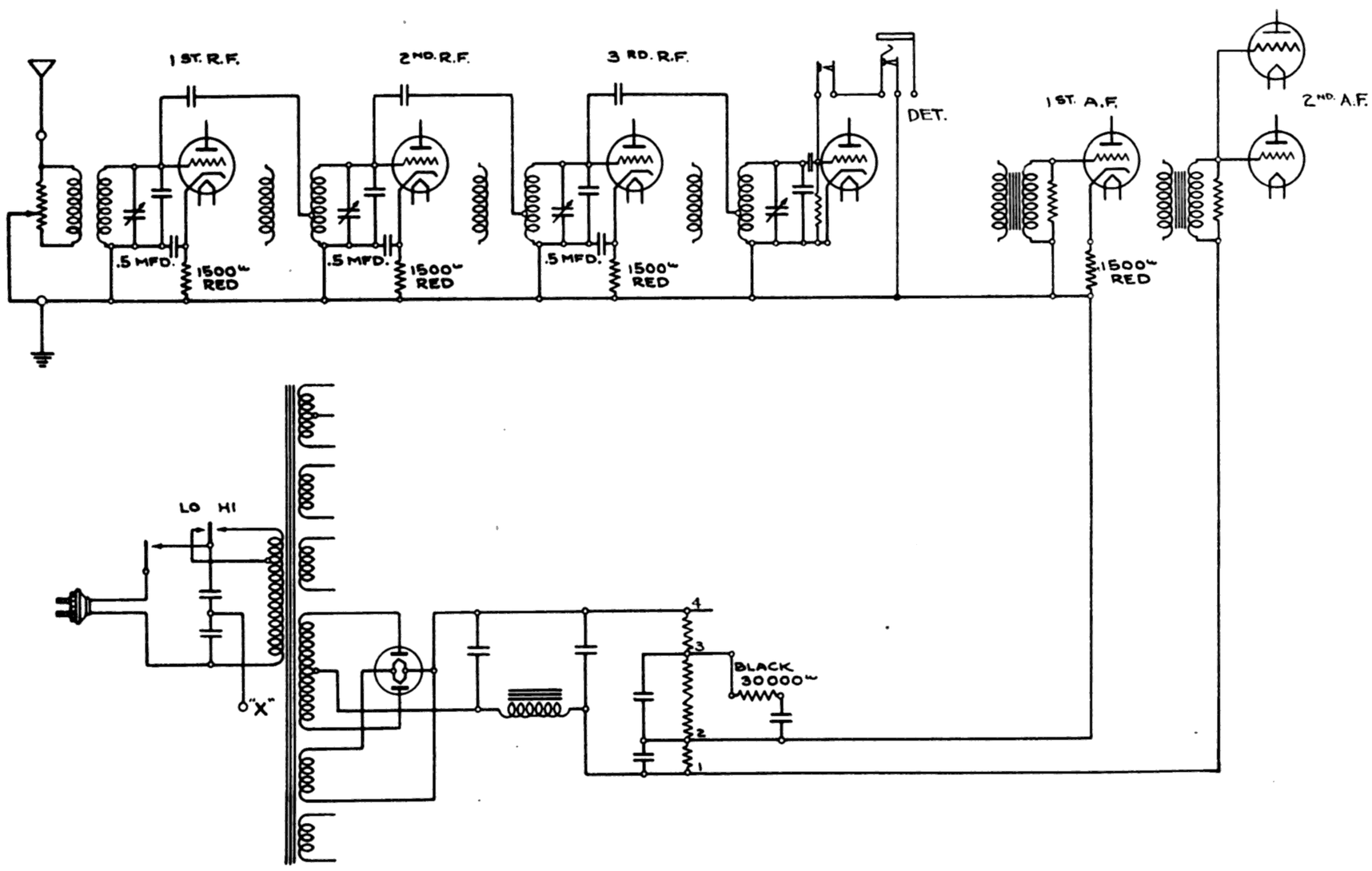


Fig. 12. Schematic Diagram of Grid Circuits.

(*e*) *The Magnetic Pickup Circuit.*

(1) The circuit for the magnetic pickup is arranged so that when the Volume Control knob is turned "off" (counter-clockwise) as far as possible the pickup will be connected across the grid and cathode of the detector tube. Only the No. 2-B Magnetic Pickup Outfit should be used with this receiver.

(2) The pickup jack in the rear of the chassis is so arranged that if a pickup is not plugged in the wire leading to the cam switch is automatically grounded. This is done to prevent oscillation which would be liable to occur if this wire were left "free".

(3) The adjustment of the cam and switch should be such that the switch does not operate until immediately before the volume control knob comes against the stop in the resistor units.

VI. GENERAL.

(1) UY-227 Radiotron or C-327 Cunningham heater type tubes are used in the radio frequency, detector and first audio stages. Two UX-171-A Radiotrons or CX-371-A Cunningham tubes are used in the audio output stage and a UX-280 or CX-380 tube must be used as the rectifier.

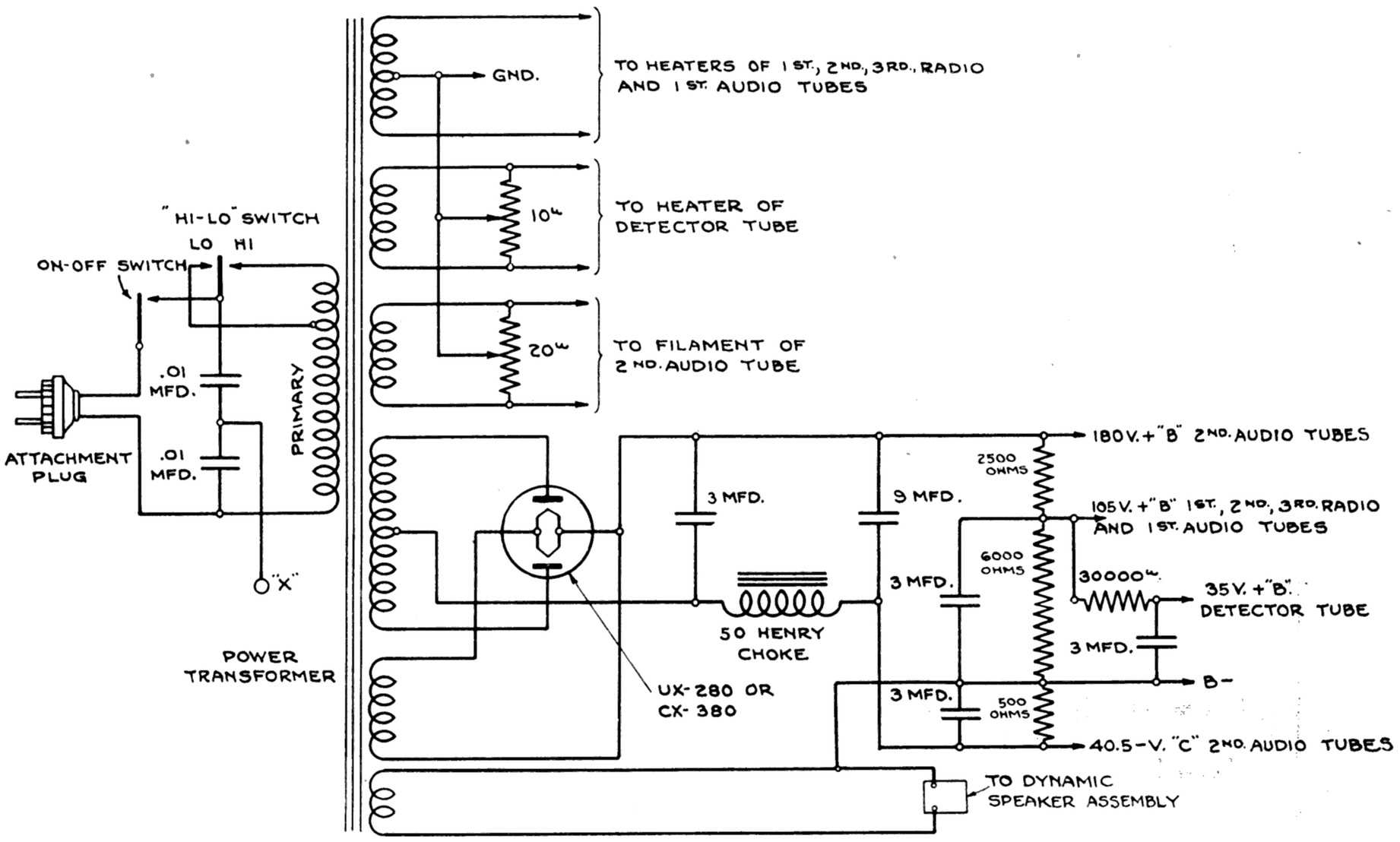


Fig. 13. Schematic Diagram of Power Circuits.

(2) The heaters of all the UY-227 (or C-327) tubes are operated at approximately 2.3 volts; and the filaments of both the UX-171-A (or CX-371-A) tube and the UX-280 (or CX-380) tube are operated at approximately 4.5 volts.

(3) The resistors connected between cathode and ground at the radio frequency and first audio tubes are colored brown.

(4) The voltage divider in the power equipment is a 9000-ohm resistor with four taps as follows:

Resistance from Tap No. 1		*Voltage*		
Tap No. 1	0 ohms	— 40.5	volts	(Grid bias for audio output tubes.)
Tap No. 2	500 ohms	0	volts	(—B.)
Tap No. 3	6000 ohms	+105	volts	(Plate supply for Radio Amplifier and First Audio Tubes.)
Tap No. 4	9000 ohms	+180	volts	(Plate supply for audio output tubes.)

These values of voltage are approximate and will vary slightly with different line voltages, which, however, has no appreciable effect on the operation of the receiver.

A 30,000-ohm resistor (colored black) is connected in series with Tap No. 3 of the voltage divider and the detector plate circuit. This is a part of the detector plate supply filter and prevents low-frequency oscillation known as "motor-boating".

The following table shows the variation of all the voltages in the receiver with change of line voltage. It should be remembered that these are approximate values and will vary slightly with different tubes and for each receiver. The plate voltages are all measured with a meter having a resistance of 1,000 ohms per volt and are measured between the plates and cathodes of the heater tubes and between the plate and mid tap of filaments of the output tubes. The grid voltages are measured across the various biasing resistors. For voltages below 30 volts

the low scale of the 1,000 ohms per volt voltmeter (having a resistance of 50,000 ohms). For voltages above 30 volts the high scale (having a resistance of 250,000 ohms) is used.

Line Voltage	105	110	115	115	120	125
HI-LO Switch	LO	LO	LO	HI	HI	HI
Filament Voltages						
Amplifier Heaters	2.15	2.25	2.35	2.15	2.25	2.35
Detector Heater	2.1	2.2	2.3	2.1	2.15	2.25
Audio Output Tubes	4.4	4.6	4.8	4.4	4.6	4.8
UX-280 Rectifier	4.42	4.65	4.87	4.42	4.6	4.8
Plate Voltages						
R. F. Amplifiers	98	102	106	97	101	105
Detector	33	34	35	33	34	35
1st Audio Amplifier	91	95	99	91	95	98
Audio Output Tubes	166	173	181	164	172	178
UX-280 (A. C. volts per anode)	263	276	290	263	275	287
Grid Bias Voltages						
R. F. Amplifiers	— 5	— 5.3	— 5.6	— 5	— 5.2	— 5.5
1st Audio Amplifier	— 4.1	— 4.4	— 4.7	— 4.1	— 4.4	— 4.7
Audio Output Tubes	—35	—37	—39	—35	—37	—39
Alternating voltage input to dry rectifier on loud speaker assembly	11.4	12	12.6	11.4	11.9	12.9
Direct voltage across field coil of loud speaker	10.5	11.2	11.9	10.5	11.2	11.9

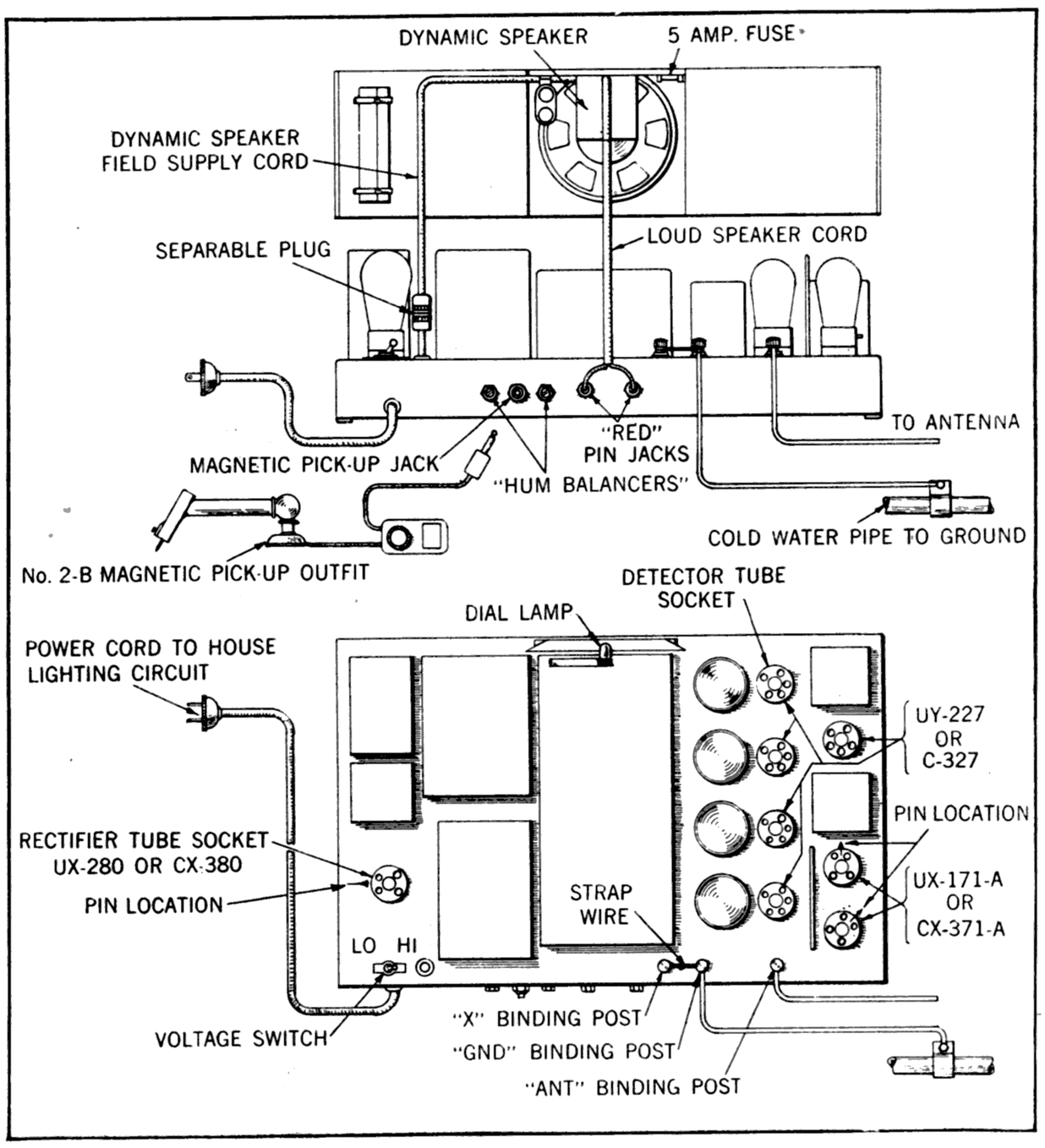


Fig. 14. Diagram Showing Connections of No. 638 Receiver. This Diagram is Printed on the Instruction Label Which is Placed in Each Receiver.

BOTTOM VIEW OF CHASSIS OF NO. 638 A.C. TYPE RECEIVER

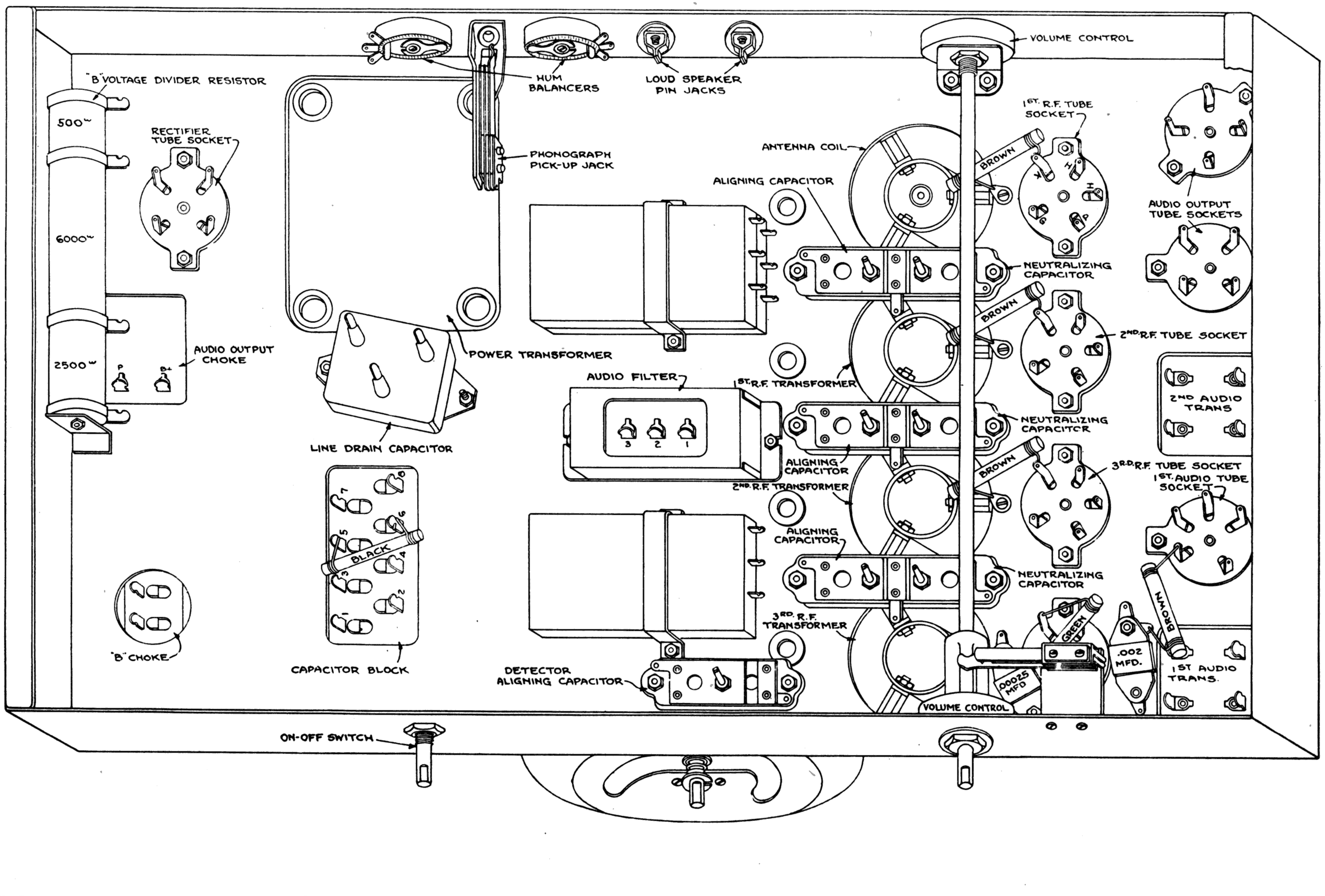


Fig. 15. Picture Diagram of Apparatus Arrangement of No. 638 Receiver.

SERVICE INSTRUCTIONS

The four most frequent conditions in any receiver, which require the services of the dealer's technical man, are as follows:

1. The condition where no signal is obtained.
2. The condition where a weak signal is obtained.
3. The condition where audio distortion occurs.
4. Receivers operated from an alternating current supply provide an additional condition, which is "hum".

I. CHECKING INSTALLATION.

A systematic course should be adhered to when endeavoring to locate the cause of faulty operation in the Stromberg-Carlson No. 638 Receiver. The installation should first be checked thoroughly, making certain that the "Installation Instructions" have been followed, and that:

1. The house lighting current is not shut off by a burned-out fuse, or trouble on the line, or at the power station.
2. The connection from the receiver to the house lighting system is properly made.
3. The antenna and ground connections are properly made.
4. The antenna is not open or grounded.
5. The loud speaker connections are properly made.
6. The volume control is not turned too low.
7. All tube filaments are burning.

About a half minute should be allowed, after the set is turned on, for the tubes to reach the proper operating temperature.

If a No. 2-B Magnetic Pickup Outfit is at hand, insert the plug into the Pick-up Jack in the rear of the receiver chassis. Then by operating the phonograph it may be determined whether or not the faulty operation is in the audio system. If it does operate correctly it may be assumed that the trouble is not in the audio or rectifier systems.

A list has been compiled which contains possible causes of faulty operation of these Receivers. If thorough examination of the installation does not bring to light the source of trouble, this list should be consulted. The list is as follows:

A. No Signal in Loud Speaker.

1. Burned-out tube (UY-227 or C-327) in the first radio frequency, detector or first audio stages.
2. Burned-out tubes (UX-171-A or CX-371-A) in audio output stage.
3. Burned-out rectifier (UX-280 or CX-380).
4. Shorted .5 mfd. by-pass capacitor for the plate supply in the first, second or third radio frequency stage. This condition can be verified by the fact that the grid bias potential on the radio frequency tube which is affected by the shorted capacitor, will be increased from, approximately, —5 volts to, approximately, —40 volts. At the same time the grid bias on the other radio frequency tubes will be decreased from, approximately, —5 volts to, approximately, —2 volts. The plate voltage on the affected tube will be dropped to 0 potential, while that on the other radio frequency tubes will be decreased to, approximately, one-half its normal value.
5. Shorted .002 mfd. detector plate by-pass capacitor. This capacitor is at the detector tube socket. An appreciable degree of hum will be noticed when this condition is present.
6. The primary of the first audio transformer may be open. If there is an open circuit between the "—B" and "P" terminals, the above condition is true.
7. The secondary of the same transformer may be open. These terminals are marked "F" and "G".

8. The primary of the second audio transformer may be open.
9. The output choke may be open. This may be tested by using the same method employed in testing the transformers.
10. Open or shorted audio filter. If either or both of the capacitors in the filter are broken down, a short circuit may be obtained between terminal No. 3 and terminals Nos. 1 and 2 on the filter. If the filter is open, an open circuit may be obtained between terminals No. 1 and No. 2.
11. Open or shorted output capacitor. This is a 2-mfd. capacitor, which is located in the capacitor block. Its two terminals are marked Nos. "7" and "8".
12. Shorted 3-mfd. or 9-mfd. capacitor of the filter system of the power equipment. These capacitors are contained in the capacitor block. The terminals of the 3-mfd. capacitor are marked "1" and "2", and those of the 9-mfd. capacitor are marked Nos. "2" and "3".
13. Shorted 3-mfd. by-pass capacitor for the detector plate supply. This capacitor is contained in the capacitor block and its terminals are Nos. "4" and "6".
14. Shorted 3-mfd. by-pass capacitor for the radio frequency and first audio plate supply. This capacitor is contained in the capacitor block, and its terminals are Nos. "4" and "5".
15. Any open or short circuit in the voltage divider resistor.

B. Weak Signal in Loud Speaker.

1. Burned-out tube (UY-227 or C-327) in the second or third radio frequency stages (when strong station is being received).
2. Defective tube or tubes.
3. Open .5-mfd. by-pass capacitor in plate supply to the third frequency stage.
4. Shorted .5-mfd. by-pass capacitor for the 1500-ohm bias resistor in the first, second or third radio frequency stages.
5. Open 1500 ohm bias resistor in the first or second radio frequency stage, or in the first audio stage.
6. The secondary of the second audio transformer may be open. The terminals of the secondary are "G" and "F".
7. The 3-mfd. by-pass capacitor for the detector plate supply may be open. This capacitor is contained in the capacitor block, and its terminals are Nos. "4" and "6".
8. The 3-mfd. capacitor in the filter system of the power equipment may be open. This capacitor is contained in the capacitor block, and its terminals are Nos. "1" and "3".
9. The volume control may be turned too low.
10. The tuning capacitors may be out of electrical alignment.
11. Open grid circuit. This condition can be verified by the fact that the potential across the biasing resistor of the affected tube will be increased to approximately 10 volts, whereas the potential across the others will remain normal.

C. Audio Distortion.

1. Defective UX-171-A or CX-371-A tube or tubes in the audio output stage.
2. The 1500 ohm bias resistor in the third radio frequency stage may be open. This resistor is colored *brown*.
3. Shorted 3-mfd. by-pass capacitor for the grid bias supply to the audio output tube. This capacitor is contained in the capacitor block, and its terminals are Nos. "3" and "4".
4. The receiver may be in an unstable condition. This may be determined by squeals varying in pitch when the station selector is rotated, and also by a low-frequency rattle in the loud speaker. The tubes should be changed around in the radio frequency stages, and possibly new tubes substituted for one or more of those in use. (See paragraph on Oscillation.)

5. The hum balance may be out of adjustment so that the hum is modulating the incoming signal and thus producing distortion. It may be that the hum balance has not been adjusted properly, or that one or both of the two hum balancing potentiometers are open.

D. Hum Reproduced in Loud Speaker.

All A. C. operated receivers are subject to hum if not properly installed or adjusted. There are only two adjustments to make on the No. 638 Receiver for the suppression of hum. These are made by adjusting the two "hum balancers" at the rear of the chassis, next to the loud speaker pin jacks. The receiver should be tuned to a place on the dial where no station is heard, and the *volume control turned down to a point just above zero.* The adjustments should be made one at a time, until a minimum of hum is heard in the loud speaker.

It should be ascertained that only UX-171-A or CX-371-A tubes (be sure it is marked "A") are used in the audio output stage, as any other tubes will result in a condition in which desirable suppression of hum cannot be accomplished.

Should either of the hum balancing potentiometers be open, or should either side of the filament supply to any of the tubes in the receiver be grounded, suppression of hum cannot be accomplished.

This condition will occur if the dial pilot lamp bracket is too far forward. In this case one side of the dial pilot lamp socket will make contact with the dial, thereby grounding one side of the audio output tube filament supply.

A ground in the filament supply to the audio output tube can be detected by not being able to effect a hum balance with the "hum balancer" controlling that tube; and also by the fact that the dial pilot lamp will go out when the "hum balancer" is turned as far as it will go in one direction (try turning in both directions). The ground will then be found in the side of the audio output tube filament circuit, opposite to the side to which the "hum balancer" is turned.

The receiver should be thoroughly examined for loose or broken connections, and grounded filament, plate or grid circuits. If the .002 mfd. by-pass capacitor for the detector plate is broken down, an appreciable amount of hum will be noticed in the loud speaker. No signal can be obtained when this condition is present, however.

II. INSTABILITY OR OSCILLATION.

Oscillation which is the result of an unstable condition in the receiver, may be recognized by squeals varying in pitch when the station selector is rotated, and a low-frequency rattle in the loud speaker. This condition may be the result of one or more several causes. However, it is impossible to correct the difficulty in the field, unless the condition is the result of poorly selected or worn-out tubes. The tubes in the radio frequency stages should be changed around and possibly new ones substituted. The receiver should be sent to the nearest branch office for re-adjustment, if changing the tubes around or substituting new ones does not correct the condition.

III. RECEPTION OF ONE STATION AT TWO PLACES ON TUNING DIAL.

(a) Reception of One Station at Two Widely Separated Places on Tuning Dial.

The reception of a station at two widely separated places on the tuning dial is due to the receiver picking up the second harmonic (half wave-length) of the frequency upon which the station is broadcasting. It will be noticed that this second place is at half the wave-length of the station. This condition may occur when the receiver is located very near a powerful broadcast station. It will not occur with any station whose second harmonic frequency (half wave-length) is below the lower end of the tuning range of the receiver.

(*b*) *Reception at Two Places Only Few Divisions Apart.*

Reception at two places only a few divisions apart on the tuning dial, and with no null point between the two peaks, may be due either to the detector being overloaded, or to the tuning capacitors being out of electrical alignment.

The first condition is due to the fact that the *volume control is turned up too high for a near-by powerful station,* and can be corrected by cutting the volume down.

Instruct a new user to turn down the volume control, after bringing in a station signal, so as to make it possible to retune the station selector for maximum response (sharpest tuning), after which the volume control can be set for desired loudness of signal.

The second condition cannot be corrected in the field and the receiver will have to be sent to the nearest branch office to be readjusted.

IV. GENERAL.

(*a*) *Volume Control Adjustment.*

A double volume control is employed, both units being driven by one shaft and operated by one control knob. These units are insulated from each other by means of a moulded insulating collar at one end of the shaft. This insulating collar connects the main shaft to the shaft extension of the "3rd Radio Frequency Stage Volume Control Resistor". The other end of the main shaft is connected to the "Antenna Volume Control Resistor". The moulded insulating collar clamps the strip shafts by two springs within the collar which rest on flats on the shafts. To adjust the two resistors for simultaneous operation, proceed as follows:

1. Loosen the hexagonal nut that holds the casing of the rear resistor to its mounting bracket.
2. Turn the volume control knob to its *full clockwise* position, holding the knob in this position.
3. Now, rotate the casing of the rear resistor *counter-clockwise* as far as it will go without causing the volume control knob to turn in the fingers. (See Fig. 16.)

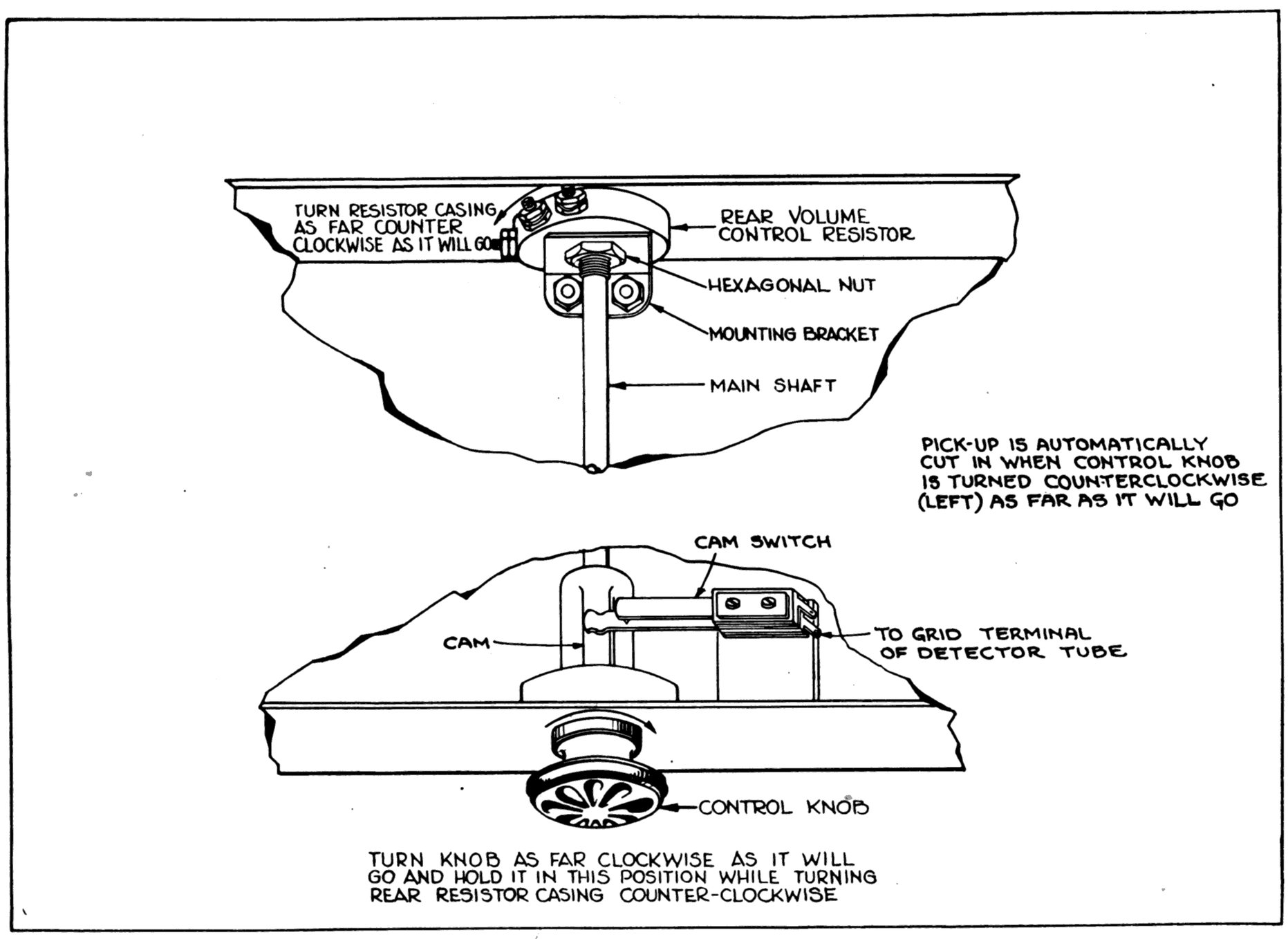


Fig. 16. Volume Control Adjustment.

From Terminal	*To Terminal*	*Correct Result*	*Incorrect Result*
32	105	Reading.	No reading, open wiring.
33	70	Reading.	No reading, open wiring.
34	76	Reading.	No reading, open wiring.
35	111	Reading.	No reading, open wiring.
36	110	Reading.	No reading, open wiring.
37	GND	Reading.	No reading, open 1500 ohm resistor.
38	68	Reading.	No reading, open wiring.
39	63	Reading.	No reading, open wiring.
40	111	Reading.	No reading, open wiring.
41	110	Reading.	No reading, open wiring.
42	GND	Reading.	No reading, open 1500 ohm resistor.
43	60	Reading.	No reading, open wiring.
44	55	Reading.	No reading, open wiring.
45	111	Reading.	No reading, open wiring.
46	110	Reading.	No reading, open wiring.
47	GND	Reading.	No reading, open 1500 ohm resistor.
48	49	Reading.	No reading, open wiring.
49	53	Reading.	No reading, open wiring.
50	GND	Reading.	No reading, open wiring.
51	52	Reading.	No reading, open wiring.
52	53	Reading.	No reading, open antenna primary.
54	55	Reading.	No reading, open antenna secondary.
55	GND	Reading.	No reading, open wiring.
56	54	Reading.	No reading, open wiring.
57	55	Reading.	No reading, open wiring.
58	62	Reading.	No reading, open wiring.
60	59	Reading.	No reading, open R. F. primary.
61	95	Reading.	No reading, open wiring.
62	61–63	Reading.	No reading, open R. F. secondary.
64	GND	Reading.	No reading, open wiring.
65	63	Reading.	No reading, open wiring.
66	71	Reading.	No reading, open wiring.
67	99	Reading.	No reading, open wiring.
68	67	Reading.	No reading, open R. F. primary.
69	70	Reading.	No reading, open R. F. secondary.
70	73	Reading.	No reading, open wiring.
71	69–70	Reading.	No reading, open R. F. secondary.
72	GND	Reading.	No reading, open wiring.
74	79	Reading.	No reading, open wiring.
75	90	Reading.	No reading, open wiring.
76	75	Reading.	No reading, open R. F. primary.
77	78	Reading.	No reading, open R. F. secondary.
79	77–78	Reading.	No reading, open R. F. secondary.
80	75	Reading.	No reading, open wiring.
81	76	Reading.	No reading, open wiring.
82	78	Reading.	No reading, open wiring.
83	33–70	Reading.	No reading, open wiring.
84	39–63	Reading.	No reading, open wiring.
85	44–55	Reading.	No reading, open wiring.
86	82	Reading.	No reading, open wiring.
87	GND	Reading.	No reading, open wiring.
88	77	Reading.	No reading, open wiring.
89	37	Reading.	No reading, open wiring.
90	128	Reading.	No reading, open wiring.
91	92	No reading.	Reading, shorted .01 mf.
91	100	No reading.	Reading, shorted .01 mf.
91	93	No reading.	Reading, shorted open audio filter coil.
92	GND	No reading.	Reading, shorted open audio filter coil.
92	93	No reading.	Reading, shorted .01 mf.
93	116	No reading.	Reading, shorted .01 mf. audio filter condenser.
94	95	No reading.	Reading, shorted .01 mf. audio filter condenser.
95	96	No reading.	Reading, shorted .5 mf.
96	47	Reading.	No reading, open wiring.

From Terminal	*To Terminal*	*Correct Result*	*Incorrect Result*
96	98	No reading.	Reading shorted, .5 mf.
97	42	Reading.	No reading, open wiring.
97	95	No reading.	Reading, shorted .5 mf.
97	99	No reading.	Reading, shorted .5 mf.
98	128	Reading.	No reading, open wiring.
99	128	Reading.	No reading, open wiring.
101	103	Reading.	No reading, open wiring.
102	104 (wires)	Reading.	No reading, open power transformer.
102	104 (terminal)	Reading.	No reading, open 20 ohm potentiometer.
103	102–104 (terminal)	Reading.	No reading, open 20 ohm potentiometer.
106	101–108	Reading.	No reading, open wiring.
106	105	Reading.	No reading, open contacts.
107	109 (wires)	Reading.	No reading, open power transformer.
107	109 (terminal)	Reading.	No reading, open potentiometer 10 ohms.
108	107–109 (terminal)	Reading.	No reading, open potentiometer 10 ohms.
108	129	Reading.	No reading, open wiring.
110	111	Reading.	No reading, open power transformer.
112	139	Reading.	No reading, open wiring.
113	131	Reading.	No reading, open wiring.
114	146	Reading.	No reading, open wiring.
114	112	No reading.	Reading, shorted .01 mf.
114	113	No reading.	Reading, shorted .01 mf.
115	125	Reading.	No reading, open wiring.
116	115	No reading.	Reading, shorted 2 mf.
117	128	Reading.	No reading, open wiring.
117	118	Reading.	No reading, open resistor 30,000 ohms.
117	120	No reading.	Reading, open 3 mf.
118	120	No reading.	Reading, open 3 mf.
119	120	No reading.	Reading, open 3 mf.
119	121	No reading.	Reading, open 9 mf.
119	123	Reading.	No reading, open wiring.
120	129	Reading.	No reading, open wiring.
121	127	Reading.	No reading, open wiring.
122	124	Reading.	No reading, open wiring.
122	121	No reading.	Reading, shorted, 5 mf.
123	130	Reading.	No reading, open wiring.
123	124	Reading.	No reading, open "B" choke.
124	133–135	Reading.	No reading, open wiring of power transformer.
125	126	Reading.	No reading, open audio output choke.
126	127	Reading.	No reading, open wiring.
127	128	Reading.	No reading, open 2500 ohm sect. "B" resistor.
127	136	Reading.	No reading, open wiring.
128	129	Reading.	No. reading, open 6,000 ohm sect. "B" resistor.
129	110–111	Reading.	No reading, open wiring on power transformer.
129	130	Reading.	No reading, open 500 ohm sect. "B" resistor.
130	11	Reading.	No reading, open wiring.
132	142	Reading.	No reading, open wiring.
133	135	Reading.	No reading, open power transformer.
134	136	Reading.	No reading, open power transformer.
137	113	Reading.	No reading, open power transformer.
138	113–137	Reading.	No reading, open power transformer.
139	147	Reading.	No reading, open wiring.
139	138 Switch on "Lo"	Reading.	No reading, open switch.
140	141	Reading.	No reading, open power transformer.
142	143 (terminal) sw. on	Reading.	No reading, open switch.
142	143 (terminal) sw. off	No reading.	Reading, shorted switch.
143	112	Reading.	No reading, open wiring.
144	21	Reading.	No reading, open wiring.
145	20	Reading.	No reading, open wiring.
147	137 Sw. on "Hi"	Reading.	No reading, open switch.

REPLACEMENT PARTS FOR NOS. 638-A AND 638-B RADIO RECEIVERS

The piece numbers of the various replacement parts may be found on the wiring diagram in the center of this book

~~**(Order by Piece Number and Name)**~~

~~**All prices subject to change without notice**~~

Piece No.	*Name of Part*	*Required per Set*	*Price Each*
	Radio Frequency System		
P-18430	Cam, Volume Control Shaft (moulded)	1	$ .40
P-17109	Capacitor, By-pass (Double)	3	1.50
P-17952	Capacitor, Four Gang Tuning	1	20.00
P-17986	Capacitor, Combined Aligning and Neutralizing	3	1.00
P-18614	Capacitor, Single Aligning	1	.75
P-17950	Collar, Station Selector Dial Shaft	1	.50
P-17949	Dial, Station Selector	1	2.00
P-18645	Drive Assembly, Variable Tuning Capacitor	1	2.00
P-18429	Knob, Station Selector (Moulded)	1	.50
P-18405	Knob, Volume Control (Moulded)	1	.40
P-18421	Potentiometer, Volume Control Antenna (10,000 ohm) (with long shaft)	1	2.50
P-18422	Potentiometer, Volume Control Detector Input (10,000 ohm) (with short shaft extensions)	1	2.25
P-17957	Resistor, Biasing (Brown 1500-ohms)	3	.50
P-18228	Socket, Vacuum Tube (5-Pin)	3	.45
P-6210	Screws, for attaching Tuning Capacitor Drive	3	.03
P-16152	Screws, Set (For Dial Shaft Collar)	2	.05
P-17908	Transformer, Interstage R. F., with shield	3	6.00
P-17907	Transformer, Antenna R. F., with shield	1	6.00
P-15472	Washers, Lock, for attaching Tuning Capacitor Drive (also 3 used for Dial attaching screws)	3	.02
	Detector System		
P-18252	Capacitor, Grid (.00025 mfd.)	1	.30
P-17964	Capacitor, Plate By-Pass (.002 mfd.)	1	.40
P-17955	Potentiometer, Hum Balance (10 ohms)	1	1.00
P-18228	Socket, Vacuum Tube (5-Pin)	1	.45
P-18248	Resistor, Grid Leak (Green, 2 megohms)	1	.50
	Audio System		
P-18215	Coil, Audio Output Choke	1	6.00
P-18000	Filter, Audio (Assembly)	1	3.20
P-18417	Jack, Phonograph Pick-up	1	1.00
P-17956	Potentiometer, Hum Balance (20 ohms)	1	1.00
P-18229	Socket, Vacuum Tube (4-Pin)	2	.45
P-18228	Socket, Vacuum Tube (5-Pin)	1	.45
P-18420	Switch, Phonograph Pick-up Cam	1	.90
P-18015	Transformer, First Audio	1	7.00
P-17988	Transformer, Second Audio	1	7.00

Power Supply System

P-18014	Condenser Block (Assembly)	1	21.50
P-16400	Condenser, Line Drain (Assembly)	1	1.00
P-17972	Coil, "B" Circuit Choke	1	12.00
P-18047	Cord, Power Supply (with attachment plug)	1	1.50
List 3014	Connector, Dynamic Speaker Field Supply (Female half, less connecting cord)	1	.75
P-17962	Jack, Loud Speaker (Pin Type)	2	.35
P-18405	Knob, Off-On Switch (Moulded)	1	.40
P-18020	Lamp Bracket, Pilot (Assembly)	1	.50
P-17959	Resistor, Detector "B" Supply (Black 30,000 ohm)	1	.50
P-18411	Resistor, Voltage Divider	1	2.50
P-18229	Socket, Rectifier Tube (4-Pin)	1	.45
P-18425	Switch (Assembly) "OFF-ON" Power Switch	1	1.00
P-17737	Switch "HI-LO" Voltage	1	1.00
P-18445	Transformer, Power (For 60-cycle A. C.)	1	25.00
P-18446	Transformer, Power (For 25-60 cycle A. C.)	1	30.00

Loud Speaker System

List 3007	Coil, Field (Including Core)	1	20.00
List 3008	Condenser, Dynamic Speaker Filter (1000 mfd.)	1	6.00
List 3009	Cone Head Assembly, Dynamic	1	21.00
List 3010	Connector, Field Supply (Male Half)		.75
P-18452	Cord, Field Supply (30 inches long)		.50
P-18453	Cord, Speech Input (30 inches long)		1.00
List 3011	Fuse, Dynamic Speaker (5-Amp.)	1	.15
List 3012	Rectifier, Dynamic Speaker Field	1	18.00
List 3013	Transformer, Dynamic Speaker Speech Input	1	10.00