NATIONAL RADIO INSTITUTE
Washington D. C.

Radio-Trician Service Manual

Compiled solely for Students & Graduates

ON

STROMBERG-CARLSON NOS. 635, 636 AND 638 RECEIVERS

The Stromberg-Carlson Nos. 635, 636 and 638 receivers are self contained, 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 of the base, facing the dial, and on the left-hand side is the radio frequency amplifiers with tuning system, the detector, and the audio amplifier and output system; and that on the right-hand side is the power supply equipment, consisting of a power transformer, single tube full wave rectifier, and filter system supplying A, B and C voltages for the receiver.

The tuning system consists of four tuned stages, using an antenna tuning stage and three stages of tuned neutralized radio frequency amplification. The four tuning capacitors are in a single gang and are enclosed in a metal shield.

A STUDY OF THE CIRCUITS OF THE RECEIVER

Fig. 1 shows the schematic diagram of the 635 and 636 circuit and power pack.

(A) **The A or Filament Circuit.** 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.

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A separate secondary of the power transformer supplies approximately 2.3 volts to the detector tube heater. A 10-ohm potentiometer, with its variable contact grounded for hum balance, is shunted across the current supply to this tube.

The filament of the audio output tube 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.

(B) **The B or Plate Circuit.** The plates of the radio frequency and first audio tubes are supplied with approximately 110 volts D. C. from the power equipment. The detector plate is supplied with approximately 36 volts D. C. and the audio output tube is supplied with approximately 180 volts D. C. from the power equipment.

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.

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

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

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

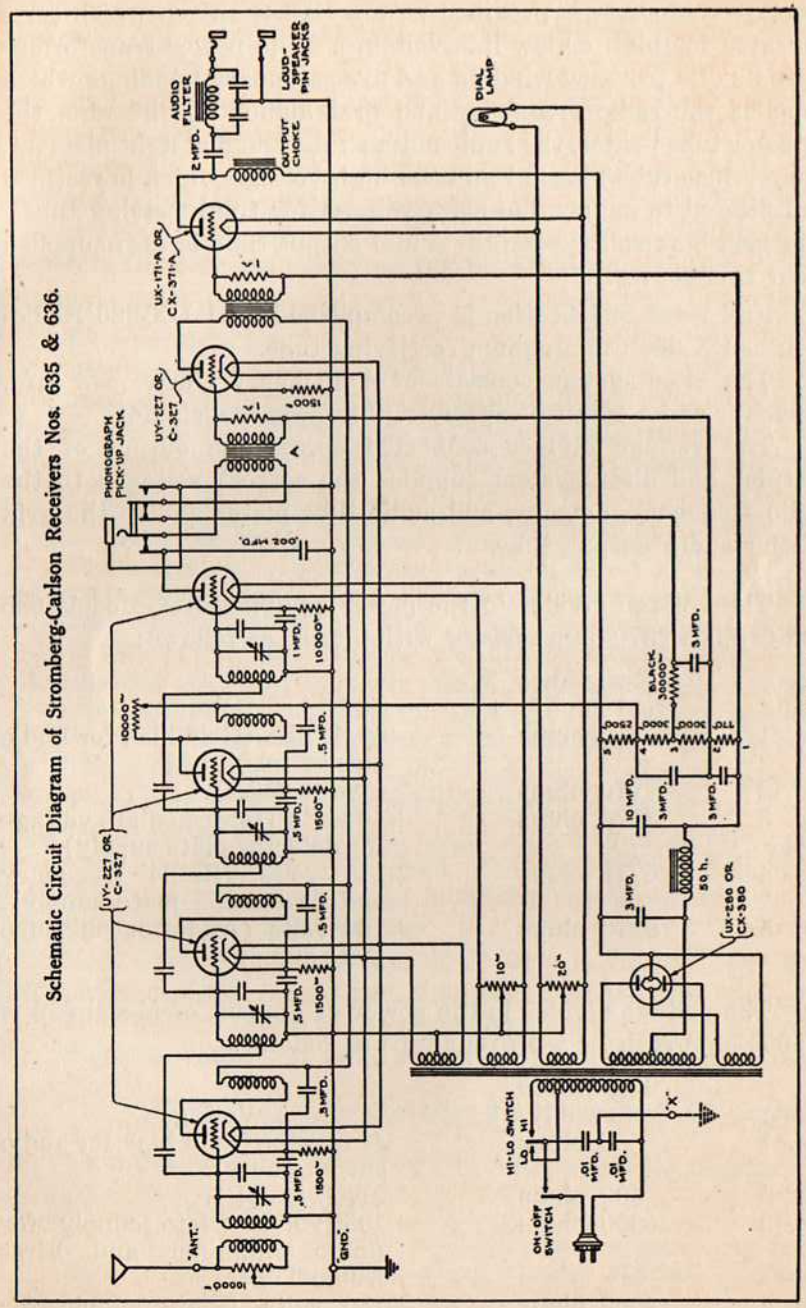
(C) **The C or Grid Circuit.** The grids of the radio frequency, detector and first audio tubes are all returned to ground.

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

The detector tube grid is biased negatively approximately 3.5 volts with respect to the cathode by means of a 10,000-ohm resistor connected between the cathode and the ground.

These biasing resistors are by-passed by 0.5 mfd. capacitors in the radio frequency stages and by 1 mfd. capacitor in the first detector stage. 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.

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



Schematic Circuit Diagram of Stromberg-Carlson Receivers Nos. 635 & 636.

Fig. 1.

(D) **The Power Supply Circuit.** The primary circuit of the power transformer is provided with a HI-LO switch which compensates for high or low line voltages. The power transformer consists of a primary winding and five secondary windings which supplies the radio frequency and first audio tube heaters, the detector tube heater, the audio output tube and dial light filament, 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.

Full wave rectification is accomplished by 1 UX-280 Radiotron or CX-380 Cunningham rectifying tube.

The filter system consists of a 50 henry choke, a 3 mfd. capacitor and a 10 mfd. capacitor (9 mfd. in Model 638).

The 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.

The voltage divider in the power equipment of Models 635 and 636 is a 9270-ohm resistor with 5 taps, as follows:

Taps	Resistance from Tap No. 1	Voltage
No. 1	0 ohms	—40.5 volts (Grid bias for audio output tube).
No. 2	770 ohms	0 volts (—B).
No. 3	3770 ohms	+40 volts (Intermediate voltage for detector plate supply).
No. 4	6770 ohms	+110 volts (Radio frequency and first audio plate supply).
No. 5	9270 ohms	+180 volts (Audio output tube plate supply).

The voltage divider in the power equipment of Model 638 is a 9000-ohm resistor with four taps as follows:

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

SERVICE INSTRUCTIONS

The four most frequent conditions in any A. C. receiver, which require the services of a Radio-Trician, 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 alternating current supply provide an additional condition which is hum.

A systematic course should be adhered to when endeavoring to locate the cause of faulty operation in these receivers.

No Signal in Loud Speaker.

1. Burned out tubes.
2. 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.
3. 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.
4. The primary of the first audio transformer may be open.
5. The secondary of the same transformer may be open.
6. The primary of the second audio transformer may be open.
7. The output choke may be open. This may be tested by using the same method employed in testing the transformers.
8. Open or shorted audio filter.
9. Open or shorted output capacitor. This is a 2-mfd. capacitor.
10. Shorted 3-mfd. or 10-mfd. (9-mfd. in Model 638) capacitor of the filter system of the power equipment.
11. Shorted 3-mfd. by-pass capacitor for the detector plate supply.
12. Shorted 3-mfd. by-pass capacitor for the radio frequency and first audio plate supply.
13. Any open or short circuit in the voltage divider resistor.

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 radio 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.
7. The 3-mfd. by-pass capacitor for the detector plate supply may be open.
8. The 3-mfd. capacitor in the filter system of the power equipment may be open.
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.

Audio Distortion.

1. Defective UX-171-A or CX-371-A tube in the audio output stage.
2. The 1500-ohm bias resistor in the third radio frequency stage may be open.
3. Shorted 3-mfd. by-pass capacitor for the grid bias supply to the audio output tube.
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.

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 Nos. 635, 636 and 638 receivers 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.

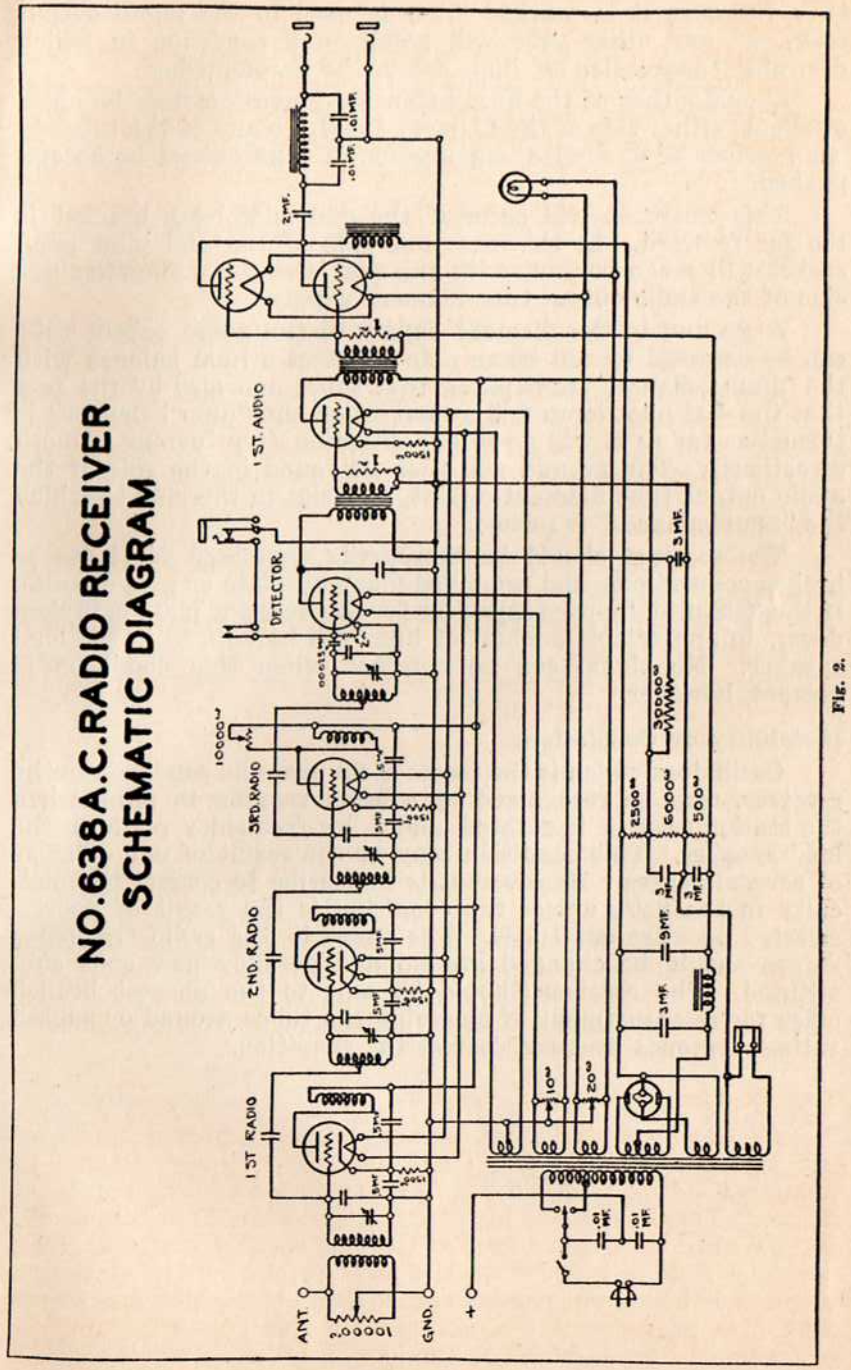


Fig. 2.

It should be ascertained that only a UX-171-A or CX-371-A tube (be sure it is marked "A") is used in the audio output stage, as any other tube 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.

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 of several causes. However, it is impossibe 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.