

RADIO SERVICE MANUAL

18

STROMBERG-CARLSON RECEIVERS

MODELS 734, 744, 635, 636, 638, 641, 642, 645, 846, 10, 11, 12, 14, 16, 19, 20, 22, 25 AND 26

The wiring diagrams and service data in this Manual covers the latest models of Stromberg-Carlson radio receivers. In all wiring diagrams, the complete connections are clearly shown and the values of fixed condensers and resistors are given as an aid in making service tests.

The R. T. I. acknowledges with thanks the co-operation and help rendered by the Stromberg-Carlson Telephone Manufacturing Company in the preparation of this Manual. All of the material in it was supplied by them with their permission for its use by R.T.I. students.

RADIO AND TELEVISION INSTITUTE, Inc. « CHICAGO

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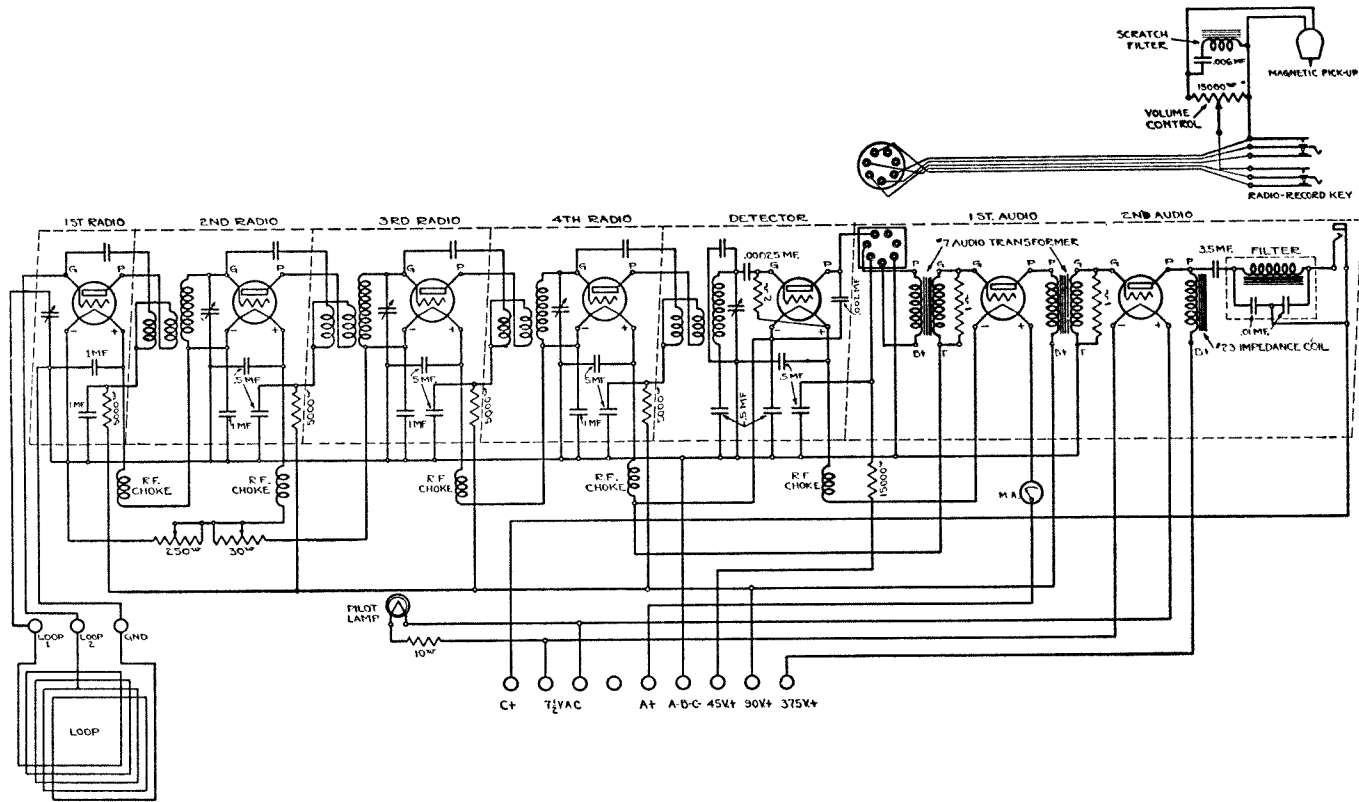


Fig. 2

While the 200-A detector is more sensitive than the 201-A, sometimes the increased noise due to the greater sensitivity of the tube may be objectionable, especially if the owner of the receiver is not particularly interested in the reception of distant stations. In such cases, it is best to use a 201-A or 301-A tube as a detector.

Stromberg-Carlson Model 744

In the model 744, there are four stages of tuned radio frequency amplification, detector and two stages of audio amplification. The connections are very similar to the model 734 as will be seen by comparing Fig. 2 with Fig. 1. However, in the model 744, an untuned antenna coupling stage is not used, and it is designed only for use with a loop antenna. In the model 744, as in the 734, the filaments of all tubes except the power tubes are connected in series and are supplied with direct current. The power tube filament is supplied with $7\frac{1}{2}$ volts alternating current from a low voltage secondary winding on the power transformer with which the set is equipped.

Models 635 and 636 Receivers

Three stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification are employed in both of these receivers. All tubes are of the type -27 heater

type except the audio output tube which is a -71A and the rectifier tube which is the -80.

Tuning is accomplished by a 4-gang condenser operated from a single control and the circuit is of the neutrodyne type.

As will be seen by an examination of Fig. 3, the neutrodyne circuit is used and the detector is connected for the grid bias or plate rectification method of detection.

There are five separate secondary windings on the power transformer, the first of which supplies approximately 2.3 volts for the heaters of the 3 R. F. tubes and the first audio tube. The second supplies 2.3 volts for the detector heater only which is rather unusual, the purpose being to reduce hum. The third winding supplies 5 volts for the power tube in the last stage of audio frequency amplification, the fourth one supplies the high voltage to the rectifier and the fifth one supplies low voltage for the filament of the rectifier tube.

The secondary winding supplying filament current for the detector is shunted with a 10 ohm potentiometer, with its variable contact grounded for hum balance and the secondary supplying the power tube is shunted with a 20 ohm potentiometer which also has its variable contact grounded.

Table No. 1 shows the correct filament, plate and grid voltages with varying line voltages and the hi-lo switch connected to the primary of the transformer in the different positions.

TABLE No. 1

Line Voltage..... "HI-LO" Switch.....	105 "LO"	110 "LO"	115 "LO"	115 "HI"	120 "HI"	125 "HI"
UX-280						
Filament Voltage (RMS).....	4.5	4.75	5.0	4.5	4.7	4.93
Voltage per anode (RMS).....	236.0	248.0	259.0	236.0	248.0	258.0
Amplifiers						
Heater Voltage (RMS).....	2.17	2.27	2.38	2.16	2.26	2.35
Plate Voltage.....	106.0	110.0	115.0	106.0	110.0	115.0
Grid Voltage.....	-5.0	-5.5	-5.75	-4.7	-5.2	-5.6
Detector						
Heater Voltage (RMS).....	2.11	2.22	2.32	2.1	2.2	2.3
Plate Voltage.....	39.0	40.0	42.0	38.0	40.0	41.0
Grid Voltage.....	-3.25	-3.5	-3.75	-3.25	-3.5	-3.75
Audio Output Tube						
Filament Voltage (RMS).....	4.5	4.75	5.0	4.53	4.72	4.94
Plate Voltage.....	167.0	175.0	184.0	165.0	174.0	182.0
Grid Voltage.....	-37.0	-40.0	-41.0	-36.0	-40.0	-41.0

NOTE: The grid voltage on the 1st audio tube will be slightly lower than that on the R. F. amplifier tubes, due to the drop in the secondary of the 1st audio transformer.

Grid bias for the R. F. tube is secured by three 1,500 ohm resistors, one connected between cathode and ground of each tube. A 10,000 ohm grid biasing resistor is connected between the cathode of the detector and ground while grid bias for the -71A power tube is obtained by the voltage drop through a section of the tapped resistor in the power pack which gives a negative grid bias of about 40.5 volts.

The volume control consists of two resistors operated by the same control knob. The first is a 10,000 ohm potentiometer shunting the primary of the antenna coupler with its variable contact grounded. The second part of the control is a 10,000 ohm variable resistor shunted across the primary of the third radio frequency transformer which controls the signal strength

supplied to the detector. Both units are mounted on one shaft and are insulated from each other by means of an insulation collar at one end of the shaft.

The arrangement of the volume control is shown in Fig. 4. To adjust the two resistors so they will operate together, loosen the hexagonal nut that holds the casing of the rear resistor to each mounting bracket and turn the volume control knob clockwise as far as possible. Next, rotate the casing of the rear resistance counter-clockwise as far as it will go. Next, retighten the hexagonal nuts so as to clamp the rear resistor in casing securely to its mounting bracket, taking care not to turn the resistor casing when the nut is tight.

Stromberg-Carlson Model 638

In this model there are four stages of tuned radio frequency amplification employing -27 tubes, a detector of the grid bias type and two stages of audio amplification. The first one employing a single -27 tube and the second two 71-A power tubes in push-pull.

A double volume control is provided, consisting of two 10,000 ohm resistors the first of which is shunted across the primary of the antenna coupler with its mid point grounded while the second is connected across the output of the third radio frequency stage. Both of these controls are mounted on the same shaft and operated by a single knob on the panel of the receiver.

The three tuned stages of radio frequency amplification are neutralized by the adjustable neutralizing capacitors shown directly above the radio frequency tubes in Fig. 5.

One unusual feature of this receiver is the fact that a separate secondary winding is provided on the power transformer for the heater winding of the detector tube alone. This winding produces about 2.3 volts and has a 10 ohm potentiometer shunted across it with its variable contact grounded for hum balance. The heaters of the three radio frequency tubes and the first audio tube are supplied with 2.3 volts from another low voltage secondary on the power transformer. The third winding supplies about 4.5 volts for the filament of the -71A power tube. It is shunted by a 20 ohm potentiometer for hum balance, the middle point of which is grounded.

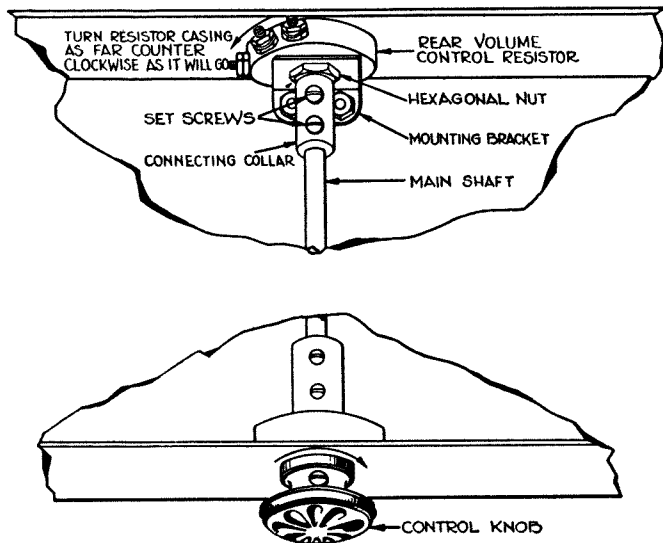


Fig. 4

TABLE No. 2

Line Voltage..... "HI-LO" Switch.....	105 "LO"	110 "LO"	115 "LO"	115 "HI"	120 "HI"	125 "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

The loud speaker is of the dynamic type, the connections being as shown in Fig. 6, the field of the speaker is supplied with current from one of the power transformer windings and a rectifier is included in the speaker assembly.

Balancing and neutralizing adjustments are made exactly the same as in other neutralized tuned radio frequency circuits.

The volume control adjustment is made by loosening the hexagonal nut that holds the casing of the rear resistor to its mounting bracket and turning the volume control knob as far clockwise as possible and holding it in that position while the casing of the rear resistor is turned counter-clockwise as far as it will go. The hexagonal nut is then retightened so as to clamp the rear resistor to the casing securely to its mounting bracket.

The volume control adjustment should be made so that the pick up switch closes just before the volume control hits the stop when turned counter-clockwise. If this is not done, the range of the volume control will be decreased and the signal will be cut off suddenly when the pick up switch operates before the volume control has reached the minimum.

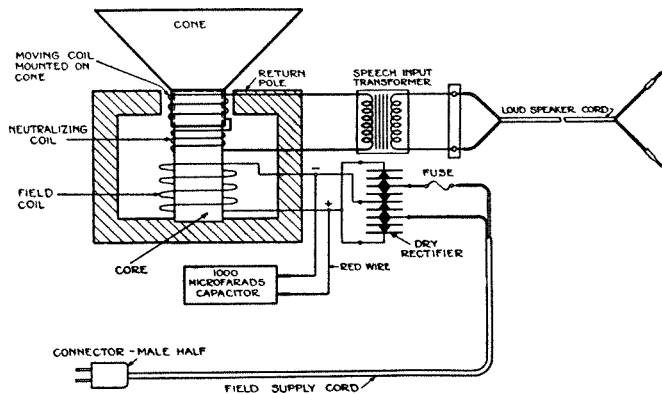


Fig. 6

Stromberg-Carlson Model 641 Receiver

The model 641 employs three stages of tuned radio frequency amplification, using -24 screen grid tubes, detector and 1 stage of audio amplification. Grid bias detection is used with a -27 detector tube. The single audio frequency amplifying tube is a -45.

In this receiver, as in several other Stromberg-Carlson models, a double volume control is used. A 20,000 ohm potentiometer is connected across the primary of the antenna coil with its variable point connected to ground. The other part of the volume control varies the C-bias on the grids of the first and second R. F. tubes through an 800 ohm potentiometer.

A diagram of the circuit is shown in Fig. 7. The capacity of all fixed condensers and the values of all resistors are shown on the diagram as an aid in making further tests.

The power transformer has four secondary windings, the first of which supplies about 2.4 volts for the heaters of the R. F. tubes and the detector. The second supplies about 2.4 volts for the filament of the -45 tube. The third winding supplies high voltage to the rectifier where it is changed to direct current for the plate supply and grid bias voltages. The fourth winding supplies about 4.7 volts for the filament of the -80 full-wave rectifier.

Since -24 screen grid tubes are used in the R. F. stages, no means of neutralizing is required. Each of the tuning condensers is provided with a small trimmer. These trimming condensers are used to balance or equalize the capacity of the main tuning condensers to allow perfect one dial tuning.

The correct plate voltage for the R. F. tubes is about 140 volts, for the detector about 250 volts and for the power tubes about 250 volts. The correct grid biases are as follows: 1st and 2nd R. F. tubes, from 2 to 3 volts; 3rd R. F. tubes, 1.5 to 2 volts; for the detector, about 28 volts, and for the power tubes, approximately 46 volts. The screen grid voltages for the R. F. amplifier tubes should be about 60 to 65 volts.

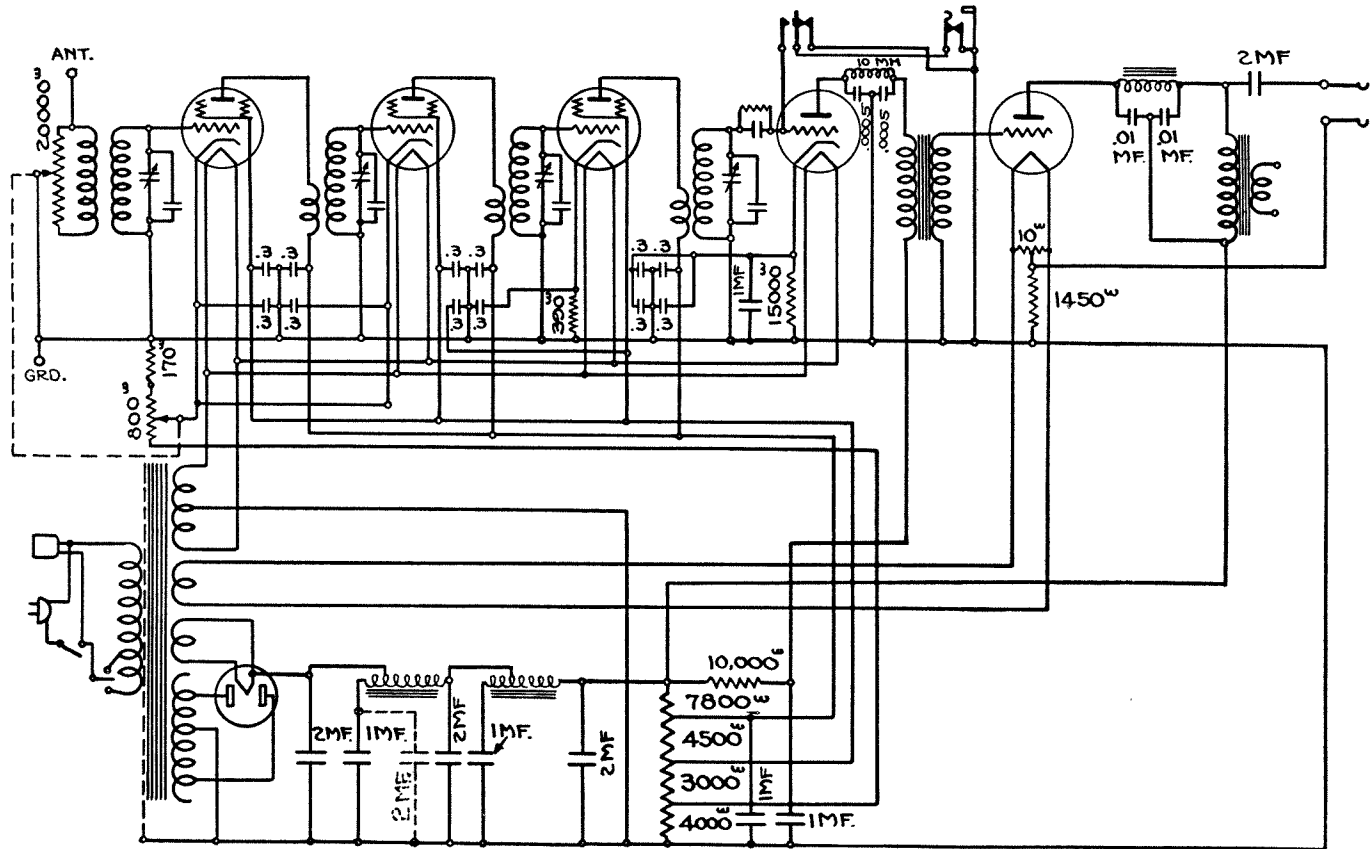


Fig. 7

The antenna volume control varies the amount of energy flowing through the primary of the antenna coupler, while the amplifier volume control varies the C-bias on the control grids of the first and second radio tubes through the 800 ohm potentiometer by varying the potential of the cathode with respect to ground. A fixed resistance of 170 ohms is connected in series with the 800 ohm potentiometer to secure a minimum grid bias on the first two tubes of approximately 1.5 volts.

The grid circuit of the linear power detector is biased by a 15,000 ohm resistor in series with the cathode. A 1 microfarad condenser is connected in parallel with this 15,000 ohm resistor to by-pass both radio and audio frequencies.

Note that a .00025 microfarad condenser and a 2 megohm grid leak are connected in parallel and in series with the grid. They have no effect on the detector action however, but are used to prevent the secondary of radio transformer from affecting the operation of the phonograph pick-up.

The model 641 is designed for use with either a magnetic speaker or a dynamic speaker. Either Stromberg-Carlson No. 14 or No. 16 magnetic speakers are recommended while if a dynamic speaker is used, Stromberg-Carlson No. 25 is designed to give satisfactory operation.

The receiver is designed for use with an antenna and ground. A good average length of antenna for this receiver is 85 feet unless located near powerful stations which are impossible to tune out. Then, an antenna from 20 to 55 feet in length will give better results.

Stromberg-Carlson Model 846

In the model 846 receiver, there are three stages of tuned radio frequency amplification, employing -24 screen grid tubes, detector and two stages of audio frequency amplification. In addition there is a -27 tube employed as an automatic volume control. The detector and first audio tube are also of the -27 type while in the second audio stage, two -45 tubes are connected in push-pull. In the power supply, an -80 full wave rectifier provides direct current for the receiver.

As it will be seen from Fig. 8, the field of the dynamic speaker is supplied with direct current by a -80 rectifier and a power transformer entirely separate from the power transformer and rectifier supplying the remaining parts of the receiver. The 110 volt line connects directly to the speaker field supply transformer which has two secondaries. One of these secondaries supplies the filament of the -80 tube, while the other supplies voltage which is rectified for the field of the speaker.

The primary of the antenna coupler is shunted with a 20,000 ohm potentiometer in series with a 10 ohm fixed resistor. This point of the potentiometer is grounded. The purpose of this potentiometer is to vary the sensitivity by reducing the input to the antenna coupler.

The automatic volume control tube is connected so as to vary the grid bias on the first and second R. F. tubes and thus maintain practically the same volume for all stations. The output of the third R. F. tube is connected both to the detector and to the volume control. When the strength of the carrier wave of an incoming signal increases, the volume control circuit tends to increase the grid bias on the first and second R. F. tubes. Increasing the grid bias reduces the amplification so the volume remains practically constant for all stations with the exception of very weak ones. By changing the sensitivity control, the volume may be set to many desired values.

The visual tuning meter in series with the cathode of the second R. F. tube provides a visual indication, showing when the receiver is tuned to exact resonance with a station.

When a station is tuned in strong enough to operate the automatic control, the pointer of the meter swings to the right, the amount of swing depending upon the station signal. The receiver should be adjusted so the pointer swings as far to the right as possible. When the tuning control is set in such a position that the pointer has the greatest swing to the right, the receiver is tuned to exact resonance with the station.

The meter which is mounted on the panel directly above the station selector dial is a milliammeter connected between the 390 ohm resistor in series with the cathode of the second R. F. tube and ground so that it measures the plate current.

When the receiver is tuned to exact resonance with a station, the plate current is less than it is when the receiver is not tuned to resonance, so the pointer swings further to right at resonance than at other points. When the receiver is tuned to a very strong signal, the grid bias will of course be high, as already explained and the plate current will be correspondingly less, so the greatest swing to the right will occur when a strong station is tuned exactly to resonance.

Correct heater voltage for the -24 and -27 tubes also for the -45 power tubes is about 2.4 volts and for the filament of the -80 rectifier tube about 4.7 volts.

Plate voltage for the R. F. tubes should be approximately 145 volts with 235 volts on the plate of the -27 detector and 125 volts on the plate of the first audio amplifier. Correct plate voltage for the power tubes is about 250 volts. Correct C-bias for the first and second radio amplifier is from 1 to 1.5 volts. For the third R. F. tube it should be 1.5 volts with a grid bias of 7 volts on the detector, 7 volts on the first audio tube and 48 volts on the power tubes.

Correct plate voltage for the automatic control tube is 45 volts with a C-bias of 9 volts.

If trouble is experienced with the automatic volume control, the volume control tube should be replaced with another tube which is known to be in good condition. Either high or low emission of the volume control tube will cause unsatisfactory operation of the control. If the emission is too great, the grid bias on the first two R. F. tubes will be higher than it should be,

resulting in volume lower than normal, while if the emission is low the pointer of the meter on the dial will not swing quickly to the right when a station is tuned to resonance and will be sluggish and slow in operation and the tube should be replaced.

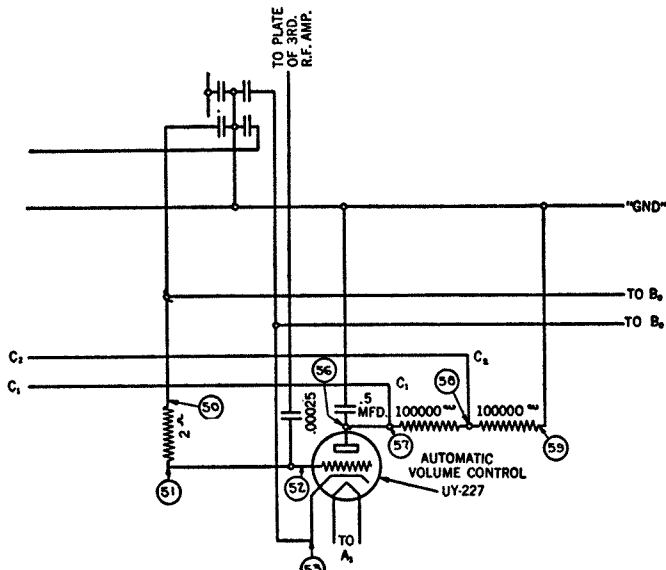


Fig. 9

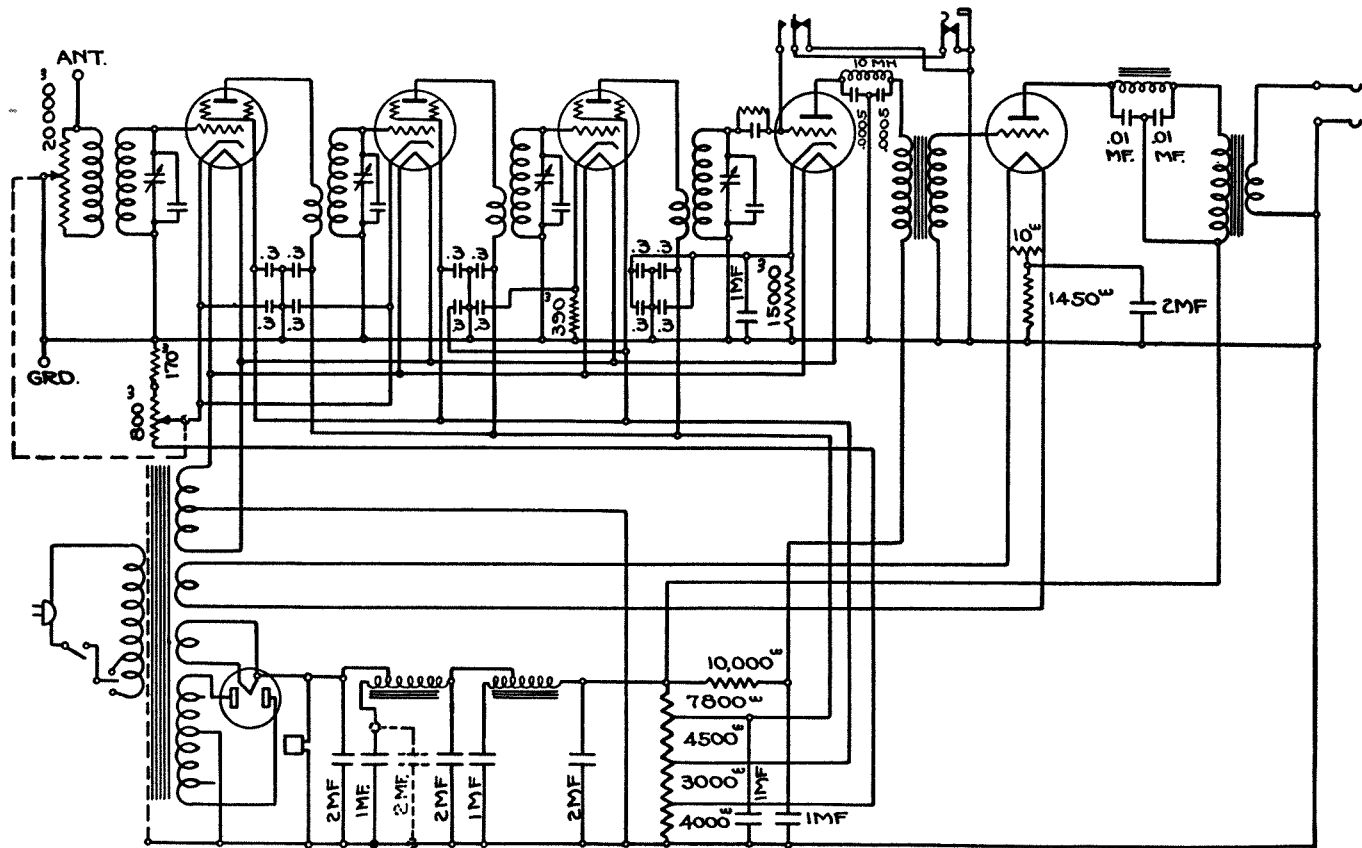


Fig. 10

Stromberg-Carlson Model 642

The three stages of radio frequency amplification in the model 642 employ -24 screen grid tubes. The output of the third stage of radio frequency amplification passes to a -27 detector of the grid bias type. There is only a single stage of audio frequency amplification, a -45 power tube transformer coupled to the output of the detector. The circuit is shown in Fig. 10.

A double type of volume control is employed which operates by varying the input from the antenna to the first radio frequency transformer and also the grid bias of the first two RF tubes. Both controls are operated by a single knob, but the grid bias control does not begin to operate until the volume is partially reduced by the antenna control.

The antenna volume control is a 20,000 ohm potentiometer bridged across the antenna transformer primary with the ground connected to the variable potentiometer contact. The other section of the volume control consists of an 800 ohm potentiometer in series with the 170 ohm fixed resistor. The purpose of the 170 ohm fixed resistor is to insure a minimum bias of about 1.5 volts on the control grid of the first two RF tubes.

The linear power detector is capable of large outputs and the -27 detector tube operates with a plate potential of approximately 250 volts and a normal bias of approximately 28 volts. The grid is biased by means of a 15,000 ohm resistor in series with the cathode which is bypassed by a capacity of .9 mfd.

A 2 megohm grid leak and a .00025 mfd. grid condenser are connected in parallel and in series with the grid. These have nothing to do with the detector action but are used to prevent the secondary of the radio transformer from interfering with the operation of the phonograph pick-up.

A pick-up switch is provided to connect a phonograph pick-up in the grid circuit of the detector. Throwing the switch to the phonograph position connects one terminal of the pick-up jack to the grid of the detector and the other to ground.

Correct operating voltages for the receiver are given in Table No. 3.

TABLE No. 3

Tube	Filament		Screen	Grid	Plate
	Type	Voltage	Voltage	Bias	Voltage
1st R. F. Amplifier....	-24	2.4	60-65	2-3	135-145
2nd R. F. Amplifier...	-24	2.4	60-65	2-3	135-145
3rd R. F. Amplifier....	-24	2.4	60-65	1.5-2	135-145
Detector.....	-27	2.4	.....	28	250
A. F. Amplifier.....	-45	2.4	.....	46	240
Rectifier.....	-80	4.7	.....	..	345

Model 645

The model 645 has eight tubes consisting of three -24 screen grid RF amplifiers, a -27 detector, two stages of audio frequency resistance coupled amplification employing -27 tubes and two -45 power tubes in the output stage. The receiver is designed for operation from a 105-125 volt DC supply line.

The filaments of all tubes are connected in series as shown in Fig. 11, which shows the complete circuit for the receiver. The negative supply line connects through the switch directly to one filament terminal of one of the -45 power tubes, the filament return to the positive side of the line being made through a resistor which lowers the voltage to a value which is suitable for the filaments.

A double volume control is used, this control being operated from a single knob. One section of the volume control consists of a 2000 ohm potentiometer and varies the input from the antenna to the first RF transformer and the other a potentiometer which varies the grid bias on the first two RF tubes.

A power detector is used, and operates with a plate potential of approximately 30 volts and a bias of 9 volts, the bias voltage being supplied by a 9 volt C battery.

The first two stages of audio amplification are resistance coupled and the third stage which is connected in push-pull is designed to supply a dynamic speaker with a voice coil of 13 ohms impedance.

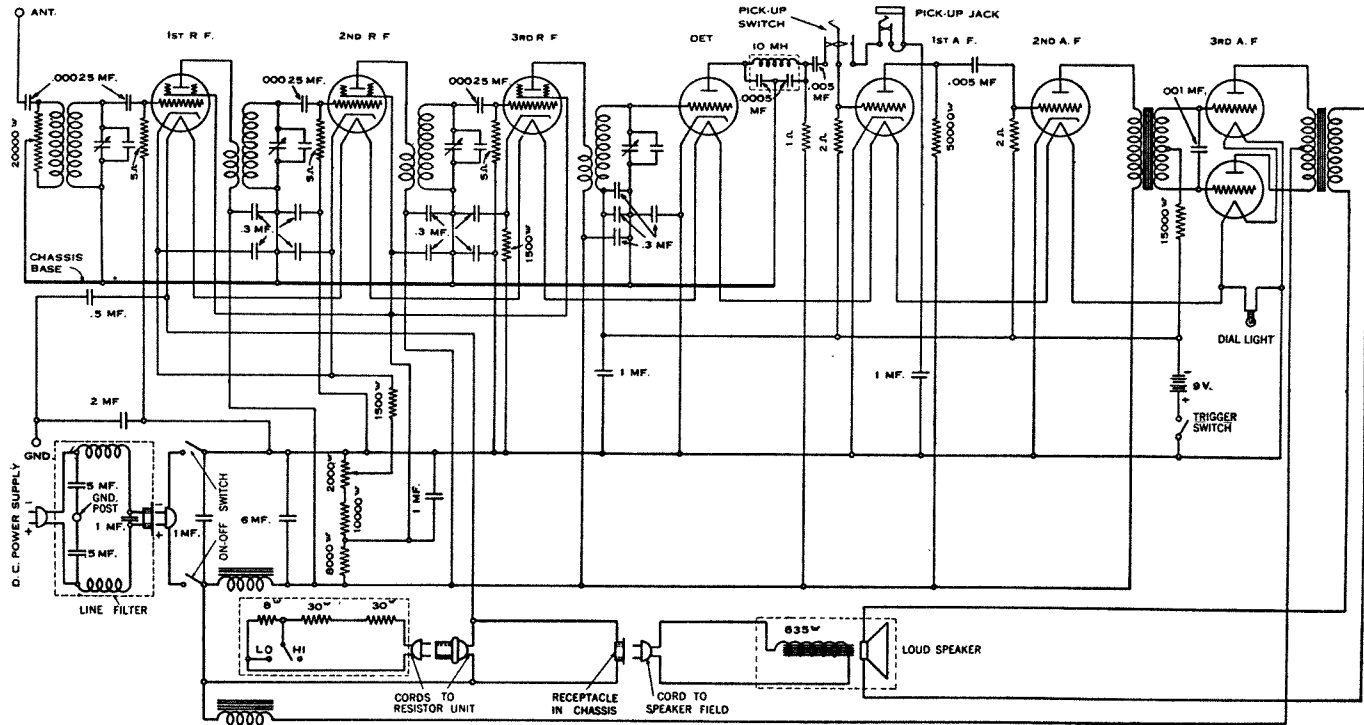


Fig. 11

Since the -45 tube filaments require only 1½ amperes of current while all other tubes require 1.75 amperes, a Mazda No. 31 pilot lamp is shunted across the filaments of the -45 tubes. If the receiver is operated without the pilot lamp, the lives of the -45 power tubes will be shortened. If any one of the tubes burns out or is removed, the filament of the remaining tubes will not light. When a tube is to be removed from a socket, the receiver should always be turned off on account of the fact that an arc will form at the filament contact and may burn the prong or the socket.

Correct operating voltages for the filament, heater, grid and plate circuits of the various tubes are given in Table No. 4.

TABLE No. 4

Tube	Type	Filament Voltage	Screen Voltage	Grid Bias	Plate Voltage	Normal Plate M.A.
R. F. Amplifier.....	-24	2.1	56	.5	107	1.0
Detector.....	-27	2.3	..	7.	13	.05
1st A. F. Amplifier..	-27	2.2	..	.5	79	1.10
2nd A. F. Amplifier..	-27	2.2	..	.5	105	1.5
Power.....	-45	2.2	..	9.	96	23

Models 10 and 11

Models 10 and 11 employ the same circuit, the only difference being that the No. 11 receiver is mounted in a console cabinet in which a phonograph panel assembly may be added, making a combination radio and phonograph.

Three stages of radio frequency amplification are employed, using -24 screen grid tubes. There is a total of five tuned circuits in the radio frequency amplifiers, also a broad band inter-stage coupling transformer.

Fig. 12 shows a complete schematic diagram of the circuit employed in the models 10 and 11. As will be noticed, the output of the third radio frequency amplifier supplies the grid of a -24 detector, the output of the detector supplies a pair of 45 power tubes in push-pull.

The phonograph pick-up jack and the pick-up switch are connected in the grid circuit of the detector so that when a phonograph pick-up is connected to the jack and the switch thrown to the phonograph position, the detector acts as an amplifier thus giving two stages of amplification for phonograph records.

The antenna is capacitively coupled to the first tuned circuit. There is a pin jack arrangement by which it is possible to connect either of two capacitors in series with the antenna circuit to compensate for the antenna length.

The range control is provided to reduce the signal input from the antenna to the RF amplifier when extremely strong signals are received. When the range control is thrown to the local position, it shunts a .015 mfd. condenser between the antenna and ground.

The volume is controlled by means of the 1000 ohm potentiometer marked R6 in Fig. 12. Changing the setting of this potentiometer varies the grid bias applied to the first and second RF tubes, the variations being from 3 to 15 volts.

A switch is connected in the primary of the power transformer to compensate for variations in the line voltage. The secondary of the power transformer has four windings, one of which supplies the heaters of the detector and RF tubes, another supplies the filament of the power tubes, the third supplies filament voltage for the -80 full wave rectifier tube and the fourth is the high voltage winding which provides plate and grid voltages for the receiver.

The values of all fixed resistors and fixed condensers are given on Fig. 12 and the normal voltage reading for each tube and circuit are given in Table No. 5.

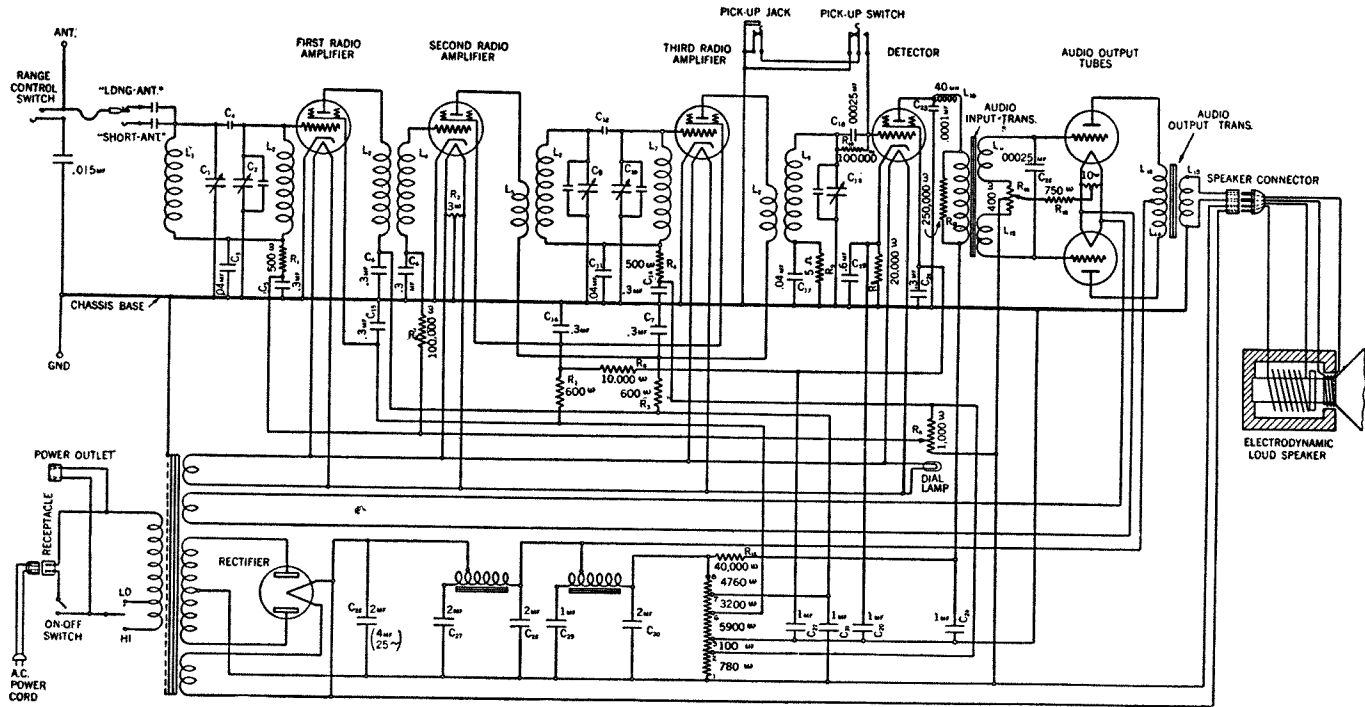


Fig. 12

TABLE No. 5

Tube	Filament Type	Plate Voltage	Grid Bias	Screen Grid	
R. F. Amplifiers.....	-24	2.4	135	2.5	80
DETECTOR.....	-24	2.4	200	...	75
A. F. Amplifier.....	-45	2.4	235	...	45
RECTIFIER.....	-80	4.8	...	...	..

Models 12 and 14

The same chassis and speaker are employed in the models 12 and 14. The No. 14, however, is equipped with a multiple record phonograph with an automatic record changer. Both are adapted for attachment of No. 1 Stromberg-Carlson remote control equipment.

Three -24 screen grid RF amplifiers and five tuned circuits are employed. Two of the tuned circuits are incorporated in a bi-resonator which serves to couple the antenna to the first radio amplifier tube. A broad band transformer couples the first and second tubes together with a second bi-resonator circuit between the second and third RF amplifiers and a single tuned RF transformer between the last radio frequency amplifier and the -24 screen grid detector.

The antenna is coupled to the first tuned circuit, the same as in the models 10 and 11 receivers previously described.

A -27 automatic volume control tube is connected in the circuit. Its function is to maintain practically constant volume by regulating the grid bias of the first two radio frequency amplifiers. The grid circuit of the volume control tube is supplied with signal energy from the third radio frequency amplifier. Strong signals cause the automatic volume control tube to increase the bias on the first and second RF amplifiers, thus decreasing the volume. The visual tuning arrangement which is shown in Fig. 13 consists of a milliammeter connected between the cathode of the second RF amplifier tube and ground. It

reads the plate current in that tube. This plate current is of course varied by the control grid bias and when the bias is greater, due to a strong signal, the plate current will be correspondingly less, the least reading being when the receiver is tuned exactly to resonance with a station.

A pick-up jack and a pick-up switch are provided and connected as shown in Fig. 13, so the audio amplifier of the receiver may be used for phonograph reproduction. A manual volume control is also provided. It consists of a potentiometer connected across the secondary of the first audio transformer with a movable contact connected to ground.

As shown, there are two stages of audio amplification, the first employing a -27 heater tube and the second a pair of -45 power tubes in push-pull.

Table No. 6 gives the normal operating voltages for each tube and circuit. The values found when testing a receiver with a high grade analyzer should agree approximately with the values given in the table.

TABLE No. 6

Tube	Filament Type	Plate Voltage	Grid Bias	Screen Grid	
R. F. Amplifiers.....	-24	2.4	135	3.0	85
Detector.....	-27	2.4	195	...	25
1st A. F. Amplifier....	-27	2.4	115	...	4.5
2nd A. F. Amplifier...	-45	2.4	245	...	45

Model 16 Receiver

The model 16 is designed for operation from a D. C. power line. It employs three -24 screen grid radio frequency amplifiers, and five tuned circuits, the same as in the models 10, 11, 12 and 14. The detector is a -27 tube and its output is transformer coupled to a -27 first audio amplifier which in turn supplies a pair of -45 output power tubes connected in push-pull.

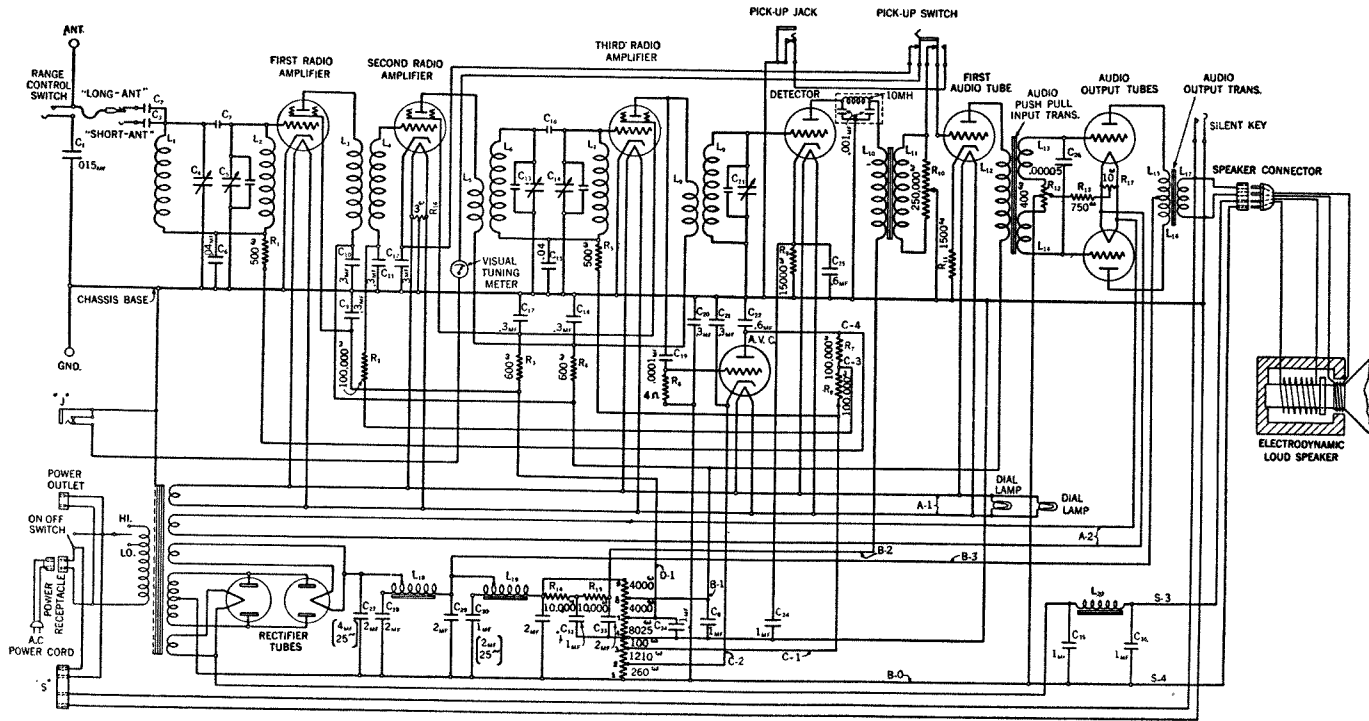


Fig. 13

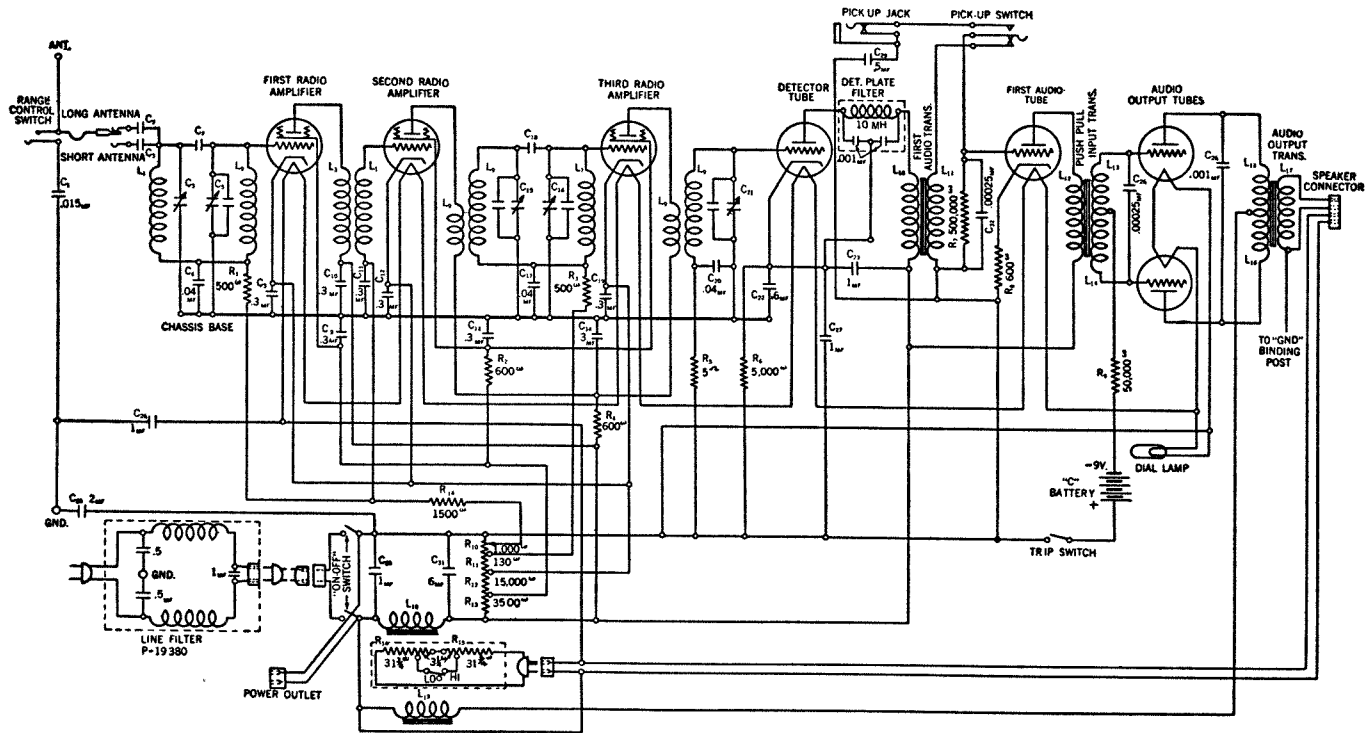


Fig. 14

The heaters of the -24 RF amplifier and of the detector and first audio amplifier, also the filament of the power tubes are all connected in series as shown.

Since the power tubes require less filament current than the heaters of the remaining tubes, a dial lamp is connected in parallel with the power tube filaments. The receiver should never be operated without the dial lamp, because the filament of the power tubes will be overloaded and their lives correspondingly shortened.

As in other models of Stromberg-Carlson receivers, a phonograph pick-up jack and pick-up switch are provided, the connections being as shown in Fig. 14, which is a complete schematic diagram of the receiver.

In Fig. 14, the values of all fixed condensers and resistors are given as an aid in making tests.

All voltages for the receiver are supplied from the power line with the exception of the C bias for the output power tube. This bias is provided by a 9 volt C battery.

The following table gives the normal voltage readings for the receiver. The DC meters used to make these measurements should have a resistance of approximately 1000 ohms per volt. These readings correspond to a line voltage of 120 volts on the high position of the Hi-Lo switch of the voltage divider. The voltages found upon actual test may not agree exactly with the figures given in the table, but they should be approximately the same.

TABLE No. 7

Tube	Filament		Screen Voltage	Grid Bias	Plate Voltage
	Type	Voltage			
R. F. Amplifiers.	-24	2.4	60-65	2-2.5	95-100
Detector.	-27	2.4	.....	.....	95-100
Power.	-45	2.4	.....	9.0	100-105
1st A. F.	-27	2.4	.....	.....	95-100

Stromberg-Carlson Models 19 and 20

The same chassis is employed in the models 19 and 20. A total of nine tubes are required, the connections being as shown in Fig. No. 15.

Correct operating voltages are given in Table No. 8, also a list of the tubes employed throughout the receiver.

TABLE No. 8

Type	Position	A Volts	B Volts	C Volts	Screen Grid Volts
35	1st R. F.	2.4	150—170	3	
35	1st Detector	2.4	150—170	10—12	80—90
27	Oscillator	2.4	85—90	10—15	80—90
35	1st I. F.	2.4	150—170	3	
35	2nd I. F.	2.4	150—170	3	80—90
27	2nd Detector	2.4	190—215	20—25	80—90
45	Audio	2.4	250	45—50	
45	Audio	2.4	250	45—50	
80	Rectifier	4.8	325—350		

Since these receivers are accurately adjusted at the factory, there are few adjustments necessary after they are installed. In case of necessity, however, these receivers may be aligned and adjusted in the same manner as any other superheterodyne receiver. The equipment necessary in proper aligning, one of these receivers includes the broadcast signal oscillator, inter-

mediate oscillator and output meter. The frequency of the intermediate amplifier is 175 kilocycles.

The following table gives the resistor identification, also the color coding of the resistors used throughout the receiver and will be helpful in service work.

Designation	FUNCTIONS	Value (Ohms)	BODY	COLOR CODING	
				TIP	DOT
R1	Grid Bias Feeder of Radio Amplifier.....	500	Green	Black	Brown
R2	Filter Resistor Plate Circuits of SC Tubes.....	600	Blue	Black	Brown
R3	Filter Resistor Screen Circuits of SG Tubes.....	600	Blue	Black	Brown
R4	Mid-tap Resistor Heater Circuit (at First I. F. Tube).....	3		(Wire-Wound)	
R5	Demodulator Grid Bias Feeder.....	10 megohms	Brown	Black	Blue
R6	Demodulator "Grid Leak".....	100,000	Brown	Black	Green
R7	Grid Biasing Resistor Power Output Tubes.....	750		(Wire-Wound)	
R8	Mid-tap Res. Fil. Circuit Output Tube.....	10		(Wire-Wound)	
R9	Series Grid Resistor of Oscillator.....	500	Green	Black	Brown
R10	Cathode Resistor of Oscillator.....	6,500	Blue	Green	Red
R11	Cathode Resistor of Mixer Tube.....	6,500	Blue	Green	Red
R12	Filter Resistor Demodulator "B" Supply.....	60,000	Blue	Black	Orange
R13	Section of Voltage Divider Resistor.....	1,575		(Wire-Wound)	
R14	Section of Voltage Divider Resistor.....	900		(Wire-Wound)	
R15	Volume Control Potentiometer.....	1,000		(Wire-Wound)	
R16	Section of Voltage Divider Resistor.....	60		(Wire-Wound)	
R17	Cathode Resistor of Demodulator.....	30,000	Orange	Black	Orange
R18	Hum Adjuster Potentiometer.....	400		(Wire-Wound)	
R19	Variable Resistor of Automatic Clarifier Circuit.....	100,000		(Carbon Potentiometer)	

Stromberg-Carlson Model 22

The model 22, like the models 19 and 20, is a superheterodyne. The tubes in it are quite similar to those employed in the 19 and 20 models, except that one additional audio frequency tube is employed, and the receiver is designed with automatic volume control.

A complete circuit diagram is shown in Fig. No. 16. On the diagrams, the values of all fixed condensers and resistors are indicated, while table No. 9 gives the correct operating voltages for the various tubes.

TABLE No. 9

Type	Position	A Volts	B Volts	C Volts	Screen Grid Volts
35	Radio Frequency	2.4	135—155	4	75—90
35	1st Detector	2.4	135—155	9.4	75—90
27	Oscillator	2.4	75—90	18.5—21.0	
35	1st I. F.	2.4	135—155	4.1	75—90
35	2nd I. F.	2.4	220—245	2.8	75—90
27	2nd Detector	2.4		35—40	
27	1st Audio	2.4	135—155	11.6	
45	2nd Audio	2.4	230—260	45—55	
45	2nd Audio	2.4	230—260	45—55	
80	Rectifier	4.8	325—355		

In case it is necessary to adjust or align one of these receivers, a broadcast oscillator and output meter are necessary, together with a 175 kilocycle oscillator for adjusting the intermediate frequency transformer.

The following table gives the values of all fixed resistors together with the color coding as an aid in identifying by color when making service tests.

Designation	FUNCTIONS	Value (Ohms)	BODY	COLOR CODING	
				TIP	DOT
R1	Grid Bias of Feeder of Radio Amplifier.....	100,000	Brown	Black	Yellow
R2	Grid Bias of Feeder of Mixer Tube.....	100,000	Brown	Black	Yellow
R3	Grid Bias of Feeder of First I. F. Amplifier.....	100,000	Brown	Black	Yellow
R4	Filter Resistor Screen Circuits of SG Tubes.....	600	Blue	Black	Brown
R5	Filter Resistor Plate Circuits of SG Tubes.....	600	Blue	Black	Brown
R6	Cathode Res. of R. F. Ampl. and 1st I. F. Ampl. Tubes.....	450		(Wire-Wound)	
R7	Cathode Resistor Second I. F. Amplifier.....	600	Blue	Black	Brown
R8	Filter Resistor Plate Circuit 2nd I. F. Amplifier.....	10,000	Brown	Black	Orange
R9	Demodulator Grid Resistor.....	250,000	Red	Green	Yellow
R10	Demodulator Grid Circuit Filter Resistor.....	100,000	Brown	Black	Yellow
R11	Plate Resistor of Demodulator.....	1 megohm	Brown	Black	Green
R12	Filter Resistor Plate Circuit of Demodulator.....	500,000	Green	Black	Yellow
R13	Filter Resistor Plate Circuit of Demodulator.....	100,000	Brown	Black	Yellow
R14	Volume Control Potentiometer.....	500,000			
R15	Hum Adjuster Potentiometer.....	400		(Wire-Wound)	
R16	Grid Biasing Resistor of Power Output Tubes.....	750		(Wire-Wound)	
R17	Midtap Resistor Filament Circuit of Output Tubes.....	10		(Wire-Wound)	
R18	Series Grid Resistor of Oscillator.....	500	Green	Black	Brown
R19	Cathode Resistor of Mixer Tube.....	6,500	Blue	Green	Red
R20	Cathode Resistor of Oscillator.....	6,500	Blue	Green	Red
R21	Section of Voltage Divider Resistor.....	1,575		(Wire-Wound)	
R22	Section of Voltage Divider Resistor.....	1,220		(Wire-Wound)	
R23	Section of Voltage Divider Resistor.....	144		(Wire-Wound)	
R24	Section of Voltage Divider Resistor.....	520		(Wire-Wound)	
R25	Section of Voltage Divider Resistor.....	285		(Wire-Wound)	
R26	Midtap Resistor Heater Circuit (at 1st I. F. Tube).....	3		(Wire-Wound)	

Stromberg-Carlson Models 25 and 26

Fig. 17 shows the complete circuit connections for the Chassis used in models 25 and 26.

Table No. 10 gives the correct operating voltage for these

receivers. Of course, there may be some variations, but in general the values should be within the limits given on the table.

TABLE No. 10

Type	Position	A Volts	B Volts	C Volts	Screen Grid Volts
24	Radio Frequency	2.4	135—150	2.5	
24	1st Detector	2.4	135—150	2.5	130—150
27	Oscillator	2.4	80—90	13	130—150
24	I. F.	2.4	135—150	2.5	
24	2nd Detector	2.4	190—215	7	130—150
45	Audio	2.4	225—255	40—50	130—150
45	Audio	2.4	225—255	40—50	
80	Rectifier	4.8	320—350		