The Crosley Service Supplement

No. 5. Supplement to Crosley Broadcaster Jan. 15, 1930

Models 60S, 61S, 62S, 63S

Specifications

Models 60S, 61S, 62S, and 63S utilize the same chassis mounted in different types of cabinets. They are for operation from direct current (D. C.) lighting circuits. Designed primarily for operation from 110 volts D. C., they may be operated on a 220 volt D. C. supply by a simple change in the method of installation, described below.

Installation Notes

Recommended aerial length: 50 to 100 feet for outdoor aerial; 40 to 100 feet for indoor aerial.

This receiver is to be operated with Dynacoil speaker type L. The following tubes are required: 4 type UX 222 (CX 322), 2 type UX 112A (CX 112A), and 2 type UX 171A (CX 371A).

Before connecting this receiver be sure that the electric line supplies 110 or 220 volts **direct current—not alternating current.**

Since direct current is used, this receiver must be connected to the line with proper polarity. To test the polarity, proceed as follows: Make all connections with the exception of that to the light socket or receptacle, and insert the tubes in the proper sockets. Screw a lamp bulb into the fuse socket on the supply cable. For 110 volt lines, use a 110 volt, 40 or 60 watt lamp bulb; and for 220 volt lines, use a 220 volt, 40 watt bulb. Turn on the switch on the receiver. Connect the supply cord to a light socket or baseboard receptacle, and note the brilliance of the lamp bulb. Remove the plug and reinsert it with its prongs reversed, again noting the brilliance of the bulb. The proper connection is that in which the bulb is less brilliant. Never operate the receiver with the plug inserted in the other position.

After the polarity has been determined, the lamp bulb used for testing must be replaced as follows: If the receiver has been connected to a 110 volt line, replace the bulb with the plug fuse supplied with the receiver. If it has been connected to a **220 volt line, replace the bulb with a 40 watt, 110 volt lamp bulb.** This is the only difference in installation and operation for 110 and 220 volts.

Never operate the receiver without a 6 volt, Mazda, miniature-base bulb No. 40 burning in the dial light socket.

Circuit.

The circuit consists of three stages of

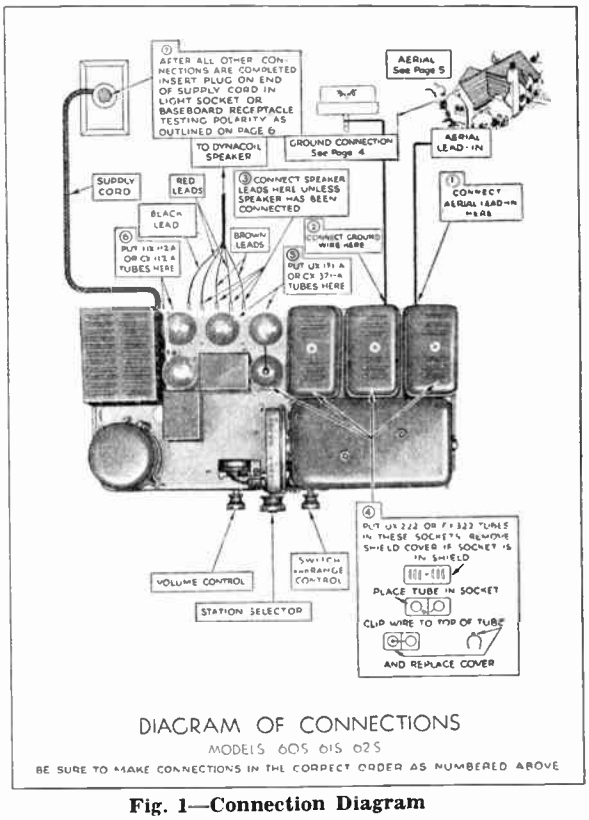


Fig. 1—Connection Diagram
(Page Numbers Above Refer to Instructions)

screen-grid radio-frequency amplification, a screen grid detector (all screen grid stages incorporating 222 type tubes), a first audio stage with two 112A tubes in parallel, and a push-pull output stage using two 171A type tubes.

Tuning is accomplished by three variable condensers in the grid circuits of the radio-frequency stages, operated simultaneously by a single control. The detector is untuned.

The antenna circuit is coupled to the first

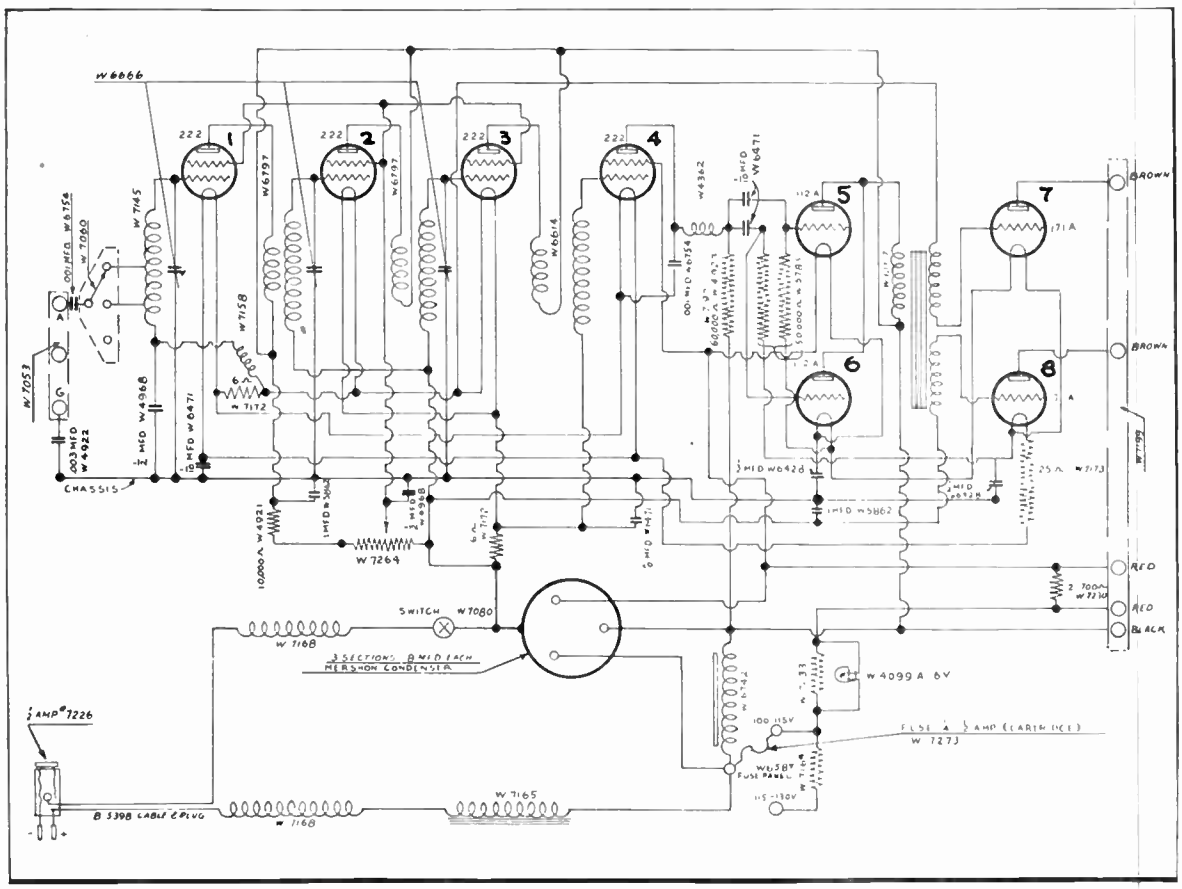


Fig. 2—Circuit Diagram

Voltage Limits

	Volume Control on Full
Filament Voltages	
R. F. and Detector tubes	2.6 to 3.4
All A. F. tubes	4.2 to 5.5
Plate Voltages	
1st R. F. tube	90 to 100
2nd R. F. tube	93 to 103
3rd R. F. tube	95 to 105
Detector tube	64 to 74
A. F. Tube No. 5 (see circuit diagram for this and following tube numbers)	66 to 76
A. F. tube No. 6	72 to 82
Output tube, No. 7	77 to 87
Output tube, No. 8	81 to 91
Control Grid Voltages	
R. F. Tubes	1.4 to 2.3
Detector tube	4.0 to 5.5
112A A. F. tubes (measured to low side of grid resistor)	4.2 to 5.5
Output tubes	14.0 to 19.0
Screen Grid Voltages	
1st R. F. tube	47 to 67
2nd and 3rd R. F. tubes	50 to 70
Detector	14 to 34

The above readings are to be taken with the the receiver in full operating condition, with the volume control on full, and with line voltage of 117½ when fuse is in "High" position or of 107½ when fuse is in "Low" position. Measure plate and grid voltages with a high-resistance D. C. voltmeter (at least 1000 ohms per volt). These voltages are to be measured from the plate or grid socket contacts to the negative filament socket contacts, except as otherwise noted in the table above. These contacts must be reached from the bottom of the receiver with tubes, dial light and speaker in place. Use a low-range D. C. voltmeter to measure the filament voltages.

radio-frequency stage through an auto transformer. The coupling to the second and third radio-frequency stages and to the detector stage is by means of radio-frequency transformers. The detector tube is resistance coupled to the first audio stage, and the latter is coupled through an audio-frequency transformer to the push-pull output stage. The output transformer for the push-pull stage is built into the speaker.

The range control, which is the three-point switch at the extreme left of the circuit diagram, controls the amount of energy trans-

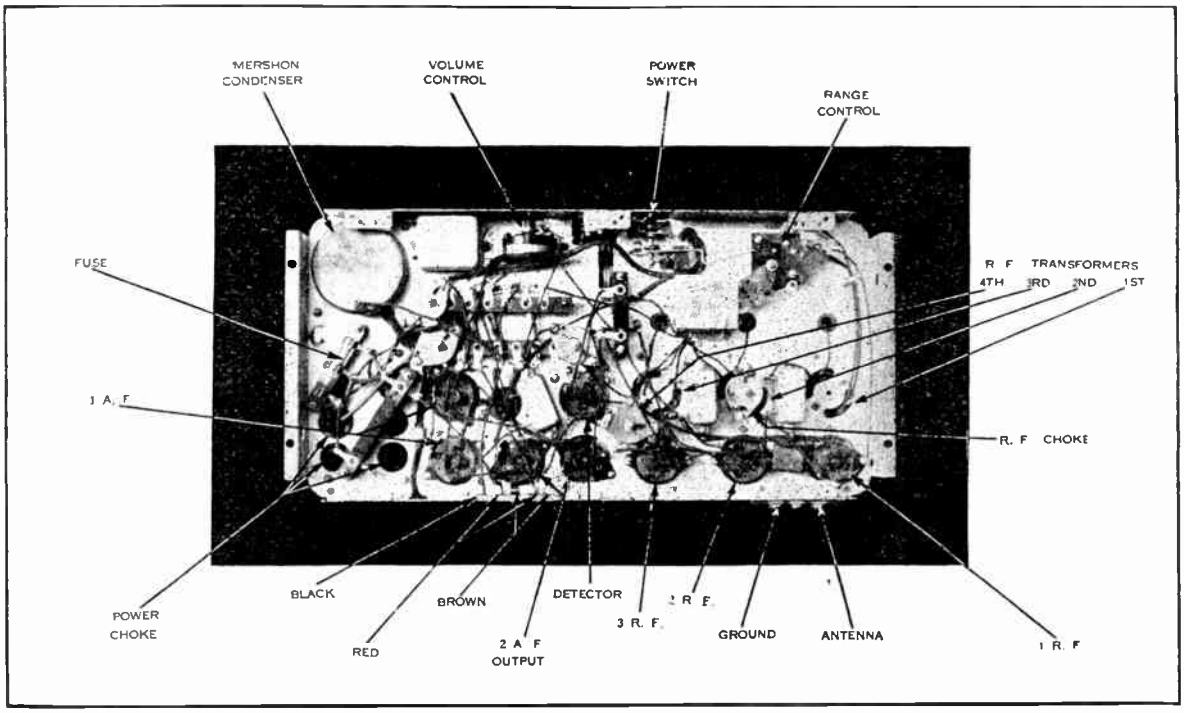


Fig. 3—Bottom View of Chassis

Continuity Tests

NOTE: In order to make the test procedure as simple as possible, tests have been omitted which are taken care of by voltage limits on the preceding page.

Circuit	Remarks	Correct Test	Incorrect Test Indicates
A. Using 50 Volt D. C. Voltmeter In Series With New 45 Volt "B" Battery			
Control Grids 1st R. F. and Output Tube No. 7 to Positive Filament Contact 3rd R. F. Socket	Tubes Removed	Practically Full Scale (About 45 Volts)	Open transformer, or faulty connection.
Control Grids 2nd and 3rd R. F. Tubes, Detector and Output Tube No. 8 to Negative Filament contact 3rd R. F. Socket	Tubes Removed	Practically Full Scale	Open r. f. or a. f. transformer secondary, open resistor, or faulty connections.
Plates all Tubes but Detector to "Black" Speaker Terminal	Tubes Removed Speaker Connected	Practically Full Scale	Open transformer primary or faulty connections.
Plate Detector to "Black" Speaker Terminal		Part Scale	Open transformer primary or faulty connections.
B. Using 45 Volt "B" Battery Connected to Two Contact Points			
All Condensers 0.1 m. f. or Greater Capacity, except Mershon	Mershon is Checked by Voltage Readings on Opposite Page.	Disconnect condenser. Connect "B" Battery across terminals for a few moments. Disconnect battery. After a minute or more, short condenser terminals, watching for spark when terminals are shorted.	If no spark is noted when terminals are shorted, **defective condenser** is indicated.

ferred from the antenna circuit to the first radio-frequency stage.

The volume control is in the screen grid circuit of the radio-frequency tubes, and controls the potential applied to the screen elements of these tubes.

The filaments are for the most part wired in series. The exceptions are the first radio-frequency and detector tubes, the filaments of which are wired in parallel, and the second and third radio-frequency tubes, the filaments of which are also in parallel. Note carefully this wiring arrangements when checking circuits.

The filament voltage drop is utilized for "C" bias.

The receiver is connected to a Dynacoil speaker, type L, the field coil of which is in series with the filament circuit. The plate supply for the output stage is furnished through the black speaker lead, which is connected to a mid tap on the output transformer (built into the Dynacoil).

A Mershon condenser and a group of choke coils serve as a filter system to smooth out the power supply.

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, and description of part, and serial number of set on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer Orders. Prices are subject to the usual trade discounts.

Qty.	Part No.	Description	List Price Each	Doz.
		Chassis Assembly		
1	D-6606	Chassis	$4.00	
6	W-5538	Sockets	.35	
2	W-5544	Sockets	.35	
1	W-5253	Mershon Condenser (3 Sec. SMFD. Each)	6.30	
1	W-7405	Mershon Condenser Cap	.30	
1	W-7406	Mershon Condenser Screw	.05	
1	W-4741	4-36 Sq. Nut	.05	
1	W-4794-A	1-4 in. Sq. Stiffened Sleeving	.05	
2	W-6762	Mounting Clamp	.15	
1	W-7165	Filter Choke	9.00	
1	W-5654	Gromet	.05	
1	W-7496	Shield	.90	
1	W-6742	Filter Choke	3.00	
1	W-5654	Gromet	.05	
1	W-7167	Push Pull Trans.	6.00	
1	W-5654	Gromet	.05	
1	W-7199	Speaker Terminal Assembly	.50	
1	W-6610	Dial Light Support	.20	
1	W-5750-A	Dial Light Socket	.15	
1	W-7145	Antenna Coupler Assembly	1.50	
2	W-6797	R. F. Trans. Assembly	1.50	
	W-7272-A	Tube Terminal Connection	.25	
3	W-6436	Shields	1.00	
3	B-6473	Shield Cover	.30	
3	W-6474	Shield Cover Nut	.05	
1	W-7215-A	Tube Terminal Connection	.25	
1	W-7053	A & G Terminal Board	.35	
		Condenser Gang		
1	W-6666	Complete 3 Gang Variable Condenser Assembly (Including Drum Dial)	20.00	
1	B-6674-A	Dial Indicator Strip	.25	
		Parts On Gang Condenser Sold Separately		
	W-6683	Drive Pulley Sub Assembly	1.00	
	W-6667	Stirrup Assembly	.50	
	W-6671	Drive Pulley	.25	
	W-5596	Set Screw	.05	
	W-6672	Pulley Bracket	.15	
	H-5536	Hex Head Screw	.05	.10
	C-6673-B	Dial Drum	1.25	
	W-6017	Set Screw	.05	
	W-5985-B	Tension Spring	.25	
	W-5749	Drive Rope	.50	
	W-5719	Dial Drum Stop	.15	
	W-6874	Frame Cover	.50	
	W-5726-A	Rotor Thrust Collar	.20	
	W-5596	8-32 Set Screw	.05	
	W-4907	Spring Washer	.05	.25
	W-6966	Contact Springs	.10	

Qty.	Part No.	Description	List Price Each	Doz.
		Parts Under Chassis		
1	W-6587	Fuse Panel Assembly	.50	
1	W-7273	1-2 Amp. Fuse	.10	
1	W-7253	Fixed Resistance (45 ohms)	.30	
1	W-7169	Fixed Resistance (45 ohm)..	.30	
2	W-7230	Fixed Resistance (700 ohm)	.30	
2	W-7168	Line Chokes	.50	
1	B-5298	Cable & Plug	1.75	
1	7226	Fuse 1-2 Amp	.15	
1	W-4751-B	Cable Clamp	.15	
1	W-7190	Resistance block assembly complete (4 Resistors)	3.50	
2	W-6583	Terminal Strip Assembly	.25	
2	W-5735	Fixed Resistance (150,000 ohms)	.60	
1	W-4921	Fixed Resistance (10,000 ohms)	.60	
1	W-4923	Fixed Resistance (60,000 ohms)	.60	
1	W-4362	Plate Choke	.50	
1	W-6754	Fixed Condenser (.001 Mfd.)	.40	
1	W-6428	Fixed Condenser (2 1-2 Mfd.)	1.75	
1	W-7204-B	Volume Control	1.75	
2	W-6471	Fixed Condenser (1-10 Mfd.)	1.00	
1	W-7173	Fixed Resistance (25 Ohm)..	.30	
2	W-7172	Fixed Resistance (6 Ohm)....	.30	
1	W-6614	R. F. Coupling Choke.....	.80	
1	W-4968	Fixed Condenser (1-2 Mfd.)	1.20	
1	W-6471	Fixed Condenser (1-10 Mfd.)	1.00	
1	W-7158	R. F. Choke	.50	
1	W-4968	Fixed Condenser (1-2 Mfd.)	1.20	
1	W-6471	Fixed Condenser (1-10 Mfd.)	1.00	
1	W-4922	Fixed Condenser (.003 Mfd.)	.40	
1	W-5862	Fixed Condenser (2-1 Mfd.)	1.75	
1	W-7080	Switch Assembly	1.25	
	W-7059	Switch Only	.80	
	W-7078	Bracket Sub Assembly	.10	
	W-7079-A	Shaft Sub Assembly	.25	
1	W-7171	Connecting Link	.10	
1	W-7060-A	Antenna Tap Switch Assembly	.75	
	W-7075-A	Contact Sub Assembly	.25	
	W-7071-A	Base Sub Assembly	.50	
1	W-6754	Fixed Condenser (.001 Mfd.)	.40	
3	W-4681	Gromets	.05	
1	C-6949-B	Bottom	.75	
6	W-6579	Bottom Double Nut	.05	
1	W-6950-A	Fuse Cover	.05	

The Crosley Service Supplement

No. 6 Supplement to Crosley Broadcaster Jan. 15, 1930

Models 20, 21, 22

Specifications

These three receivers differ only in the type of case or cabinet. They all use a six tube, screen grid, battery-type chassis, with tubes requiring a six volt filament supply.

Installation And Operation Notes

Recommended aerial length: 50 to 100 feet for outdoor aerial; 40 to 100 feet for indoor aerial.

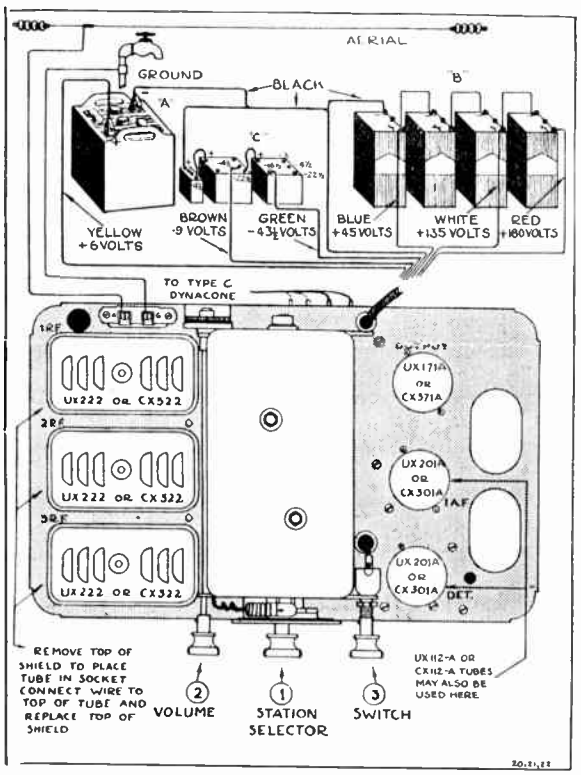


Fig. 1—Connection Diagram

Chasses having four speaker terminals are for use with Dynacone speaker Type C. Those with two speaker terminals are for use with Dynacone type E.

The following tubes are required: three 222 type screen grid tubes; two 201A or 112A type tubes; and one 171A type tube.

The filament supply requires a 6 volt storage battery, 80 to 120 ampere hour capacity. For the "B" supply four 45 volt "B" batteries (heavy duty type recommended) are required. The "C" supply requires two 22 1-2 volt and one 4 1-2 volt battery.

A battery cable with colored leads is used to facilitate making connections. The color code, and the normal operating voltages that should be applied to the various leads are as follows:

Red	B+	+ 180	volts
White	B+	+ 135	volts
Blue	B+	+ 45	volts
Yellow	A+	+ 6	volts
Black	A—, B—, C+	0	volts
Brown	C—	— 9	volts
Green	C—	—43½	volts

The connection diagram from the instruction sheets is reproduced herewith. As shown, the four "B" batteries are simply connected in series. The "C" batteries, however, present more of a problem, on account of the fact that batteries of different makes have

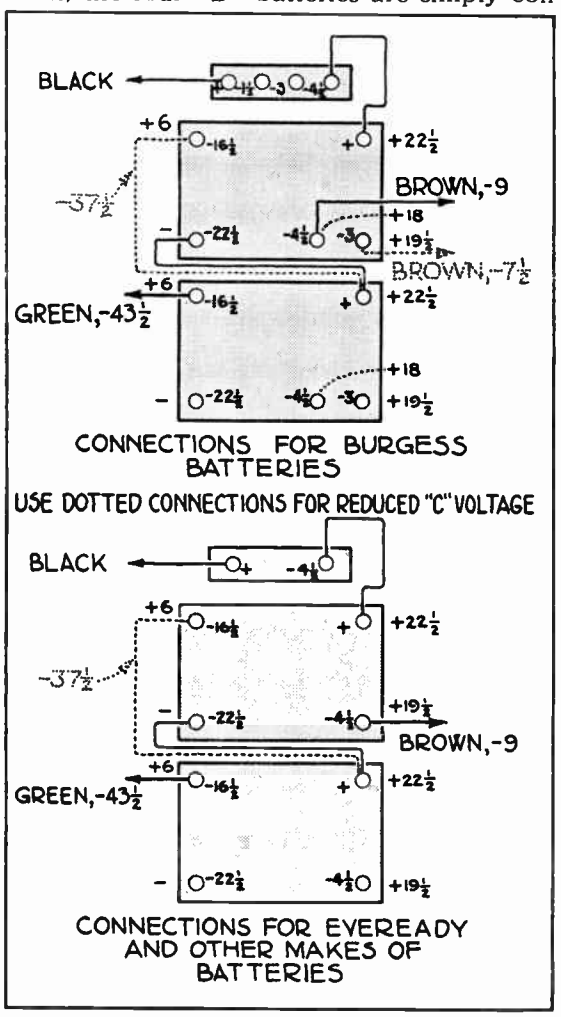


Fig. 2—"C" Battery Connections

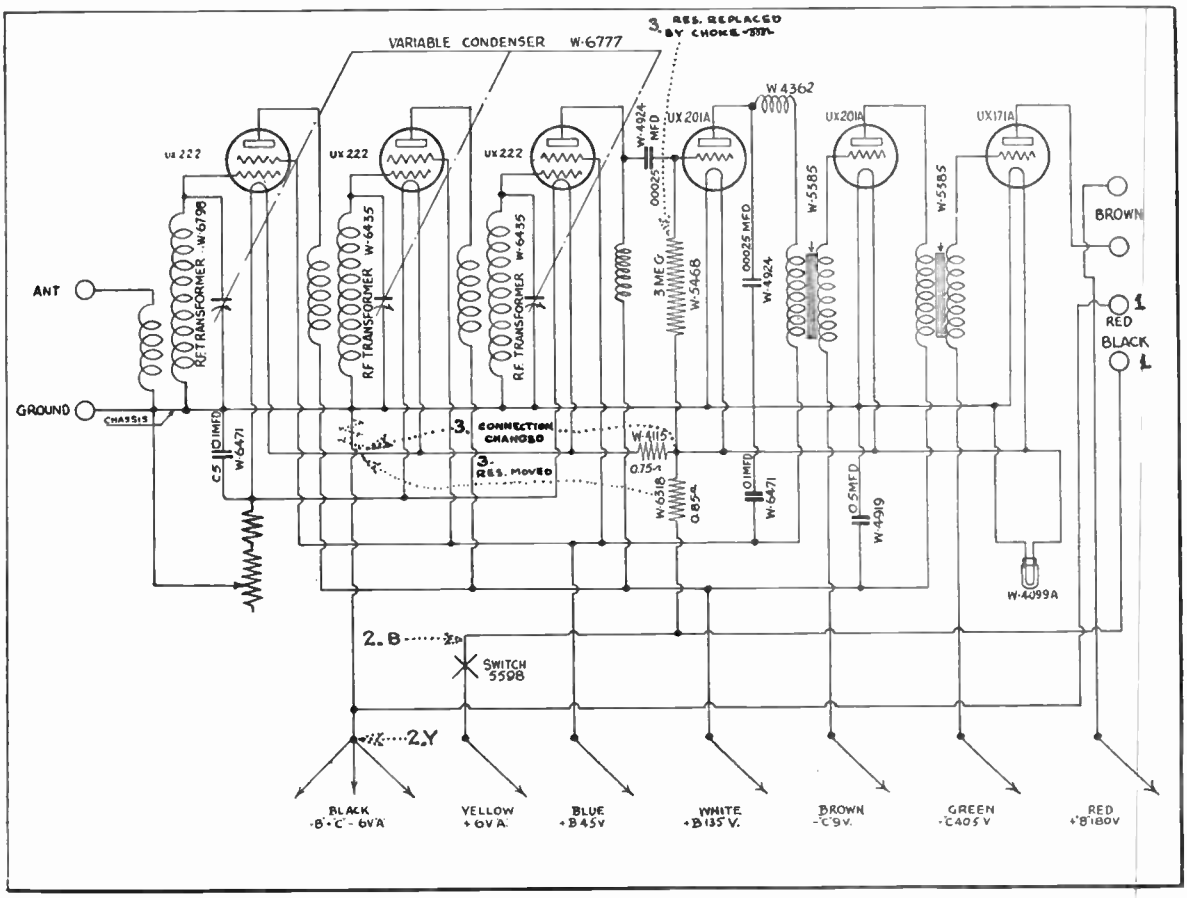


Fig. 3—Circuit Diagram

somewhat different terminals and terminal markings. For your convenience in connecting the "C" batteries, a diagram is reproduced on page 1 showing the proper connections for several well known makes of batteries. Note that on certain of the batteries the "C" markings are printed on cards which are fixed over the top of a "B" battery, the markings in the wax battery top being the regular "B" battery markings. In such instances, the accompanying diagrams show both the card markings and the wax battery top markings.

As mentioned in the instruction sheets, decrease in voltage of the "B" batteries through prolonged use may be partially compensated by reducing the "C" voltages as follows:

Brown .....reduce to —7½ volts if this can be done with batteries used; otherwise do not change.
Green .....reduce to —37½ volts.

If it is desired to use but three "B" batteries this may be done with reduced volume, by using the following voltages:

Red .....+135 volts instead of + 180 volts.
Green .....— 28 volts instead of —43½ volts.

Changes

The following changes of importance to Dealers and Distributors have been made in these chassis since their introduction:

1. The original chasses were built for use with Type E Dynacone. When the type C Dynacone (with separately excited field coils) was introduced, two terminals (Red and Black) were added to the chassis for supplying the field of the "C" type speaker with current direct from the storage battery, or "A" supply.

2. For a short time the yellow and black filament terminals were connected to the points shown by the dotted lines marked "2Y" and "2B" on the circuit diagram.

3. In recent chasses the 3 megohm resistor W5468 in the detector grid circuit is replaced by an A-2 radio-frequency choke, the 0.85 ohm resistor is moved to the negative filament lead, and the detector grid return is connected to the negative side of the 0.85 ohm resistor. See the changes marked "3" on the circuit diagram.

Circuit

There are three radio-frequency stages

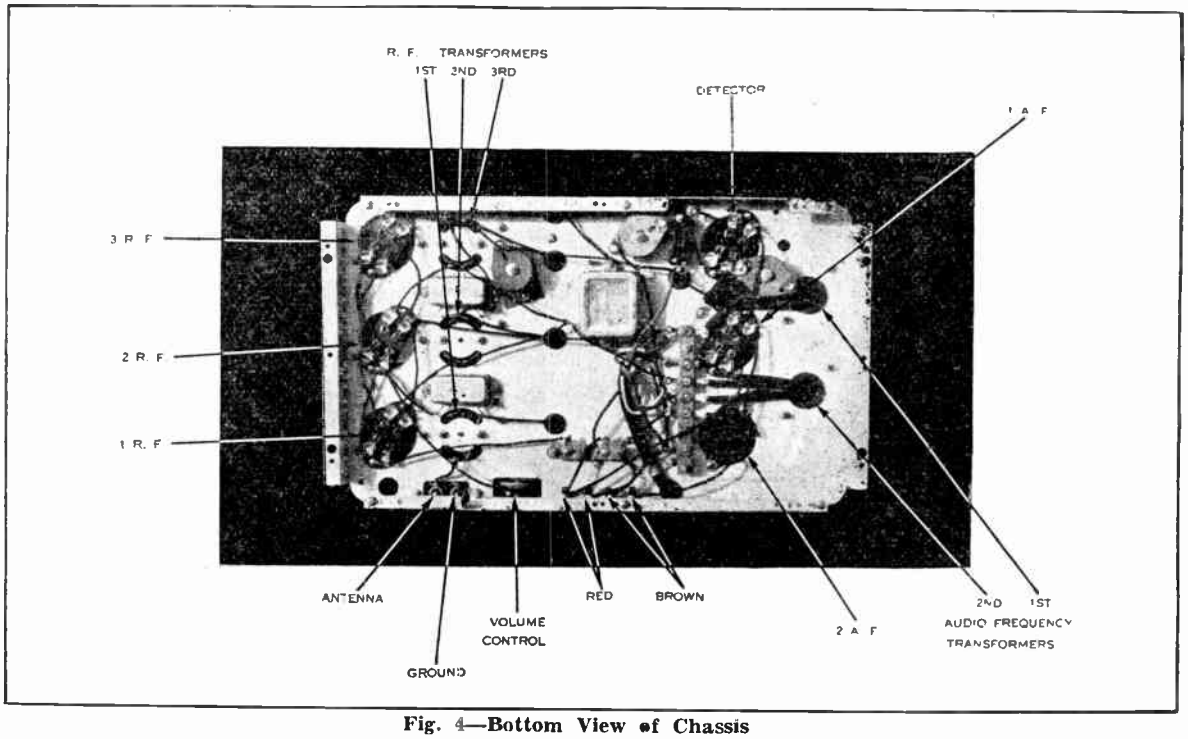


Fig. 4—Bottom View of Chassis

Continuity Tests

NOTE: In order to make the test procedure as simple as possible, certain tests are omitted which are taken care of by voltage limits on following page.

Circuit	Remarks	Correct Test	Incorrect Test Indicates
A. Using 50 Volt D. C. Voltmeter in Series With 45 Volt "B" Battery			
Antenna to Ground (Chassis)		Full Scale (i. e., about 45 volts).	Open Primary Antenna Transformer or Faulty Connections.
Operating Grids R. F. Sockets to Ground (Chassis)		Full Scale	Open Secondary r. f. Transformer, or Faulty Connections.
Operating Grid Detector Socket to Yellow Cord	Switch On	Part Scale on sets having resistor, Full Scale on sets having Choke.	Open Resistor or Choke or Faulty Connections.
Red to Black Speaker Terminals	Switch Off Speaker Connected	Part Scale.	Open Speaker Field or Faulty Connections.

To check condensers, disconnect them, and test capacity with a bridge; or in the case of condensers of 0.1 m. f. capacity or greater, connect momentarily to 45 volt "B" battery, disconnect battery, and shunt condenser, watching for spark. If spark is observed, condenser is in satisfactory condition.

A better test for small condensers is to use a buzzer in conjunction with headphones, as follows: Connect the buzzer in series with a dry cell and a key or switch. Connect one side of headphones to a terminal on the buzzer. Connect a length of wire to the other buzzer terminal. To test a condenser, connect the free wire from the buzzer and the free headphones lead to the condenser terminals, close the battery switch and note loudness of sound in the headphones. Repeat with a standard condenser of the same size and kind. If the condenser tested is perfect, the sound produced with it in the circuit should be as loud as that produced with the standard in the circuit.

using 222 type tubes, a detector and first audio stage using 201A or 112A type tubes in either or both sockets, and an output stage using a 171A type power tube.

The radio-frequency stages are tuned by variable condensers operated by a single station selector. The detector is untuned.

The radio-frequency and audio-frequency

stages are transformer coupled. The detector is choke coupled to the third radio-frequency stage. In earlier models a grid leak type detector was used. In later models a "C bias" type detector is used, commonly known as a "power detector," with a choke instead of a resistor in the detector grid circuit.

The volume control consists of a rheostat in series with a fixed resistor, the volume being regulated by varying the filament supply and "C" bias of the radio-frequency tubes.

A dial light (6 volt, Mazda, miniature base No. 40) is shunted across the filament leads ,and a switch is provided in the A plus lead for turning on or off the power.

Socket Voltages

The voltages at the sockets should be practically the same as those applied to the battery cable, provided that all tubes are removed so that there is no load on the batteries. Leave the speaker connected.

The filament voltages should be measured between the two contacts of each socket. All other voltages should be measured between the plate or grid contact and the negative filament contact of the socket. Use a D. C. voltmeter having a resistance of at least 1000 ohms per volt.

	Voltages Should Be Practically the Same As
Filament Voltages	
All tubes (with volume control on full)	Yellow to Black
Plate Voltages	
R. F. and 1st Audio Tubes	White to Black
Detector	Blue to Black
Output Socket	Red to Black
Control Grid Voltages	
1st Audio Socket	Brown to Black
Output Socket	Green to Black
Screen Grid Voltages	
R. F. Sockets	Blue to Black

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, and description of part, and serial number of set on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer Orders. Prices are subject to the usual trade discounts.

Qty.	Part No.	Description	List Price Each	List Price Doz.
		CHASSIS ASSEMBLY		
1	D-6437-C	Chassis	3.50	
5	W-5538	Socket	.35	
1	W-5544	Socket	.35	
1	M-19	.120x3-16 Tubular Rivet	.05	.10
2	W-6435	R. F. Transformer Assembly	1.50	
1	W-6798	R. F. Transformer Assembly	1.50	
	W-6084-B	Tube Terminal Assembly	.25	
3	W-6436	Shield Assembly	1.00	
3	B-6473	Shield Cover	.30	
3	W-6474	Shield Cover Nut	.05	
1	W-5371	Terminal Board Assembly (A. and G.)	.25	
1	W-6254	Volume Control Rheostat	.60	
1	W-6777	Complete 3 Gang Variable Condenser	18.00	
5	W-4681	Grommet (3-8")	.10	
	B-4879	Frame Cover	.50	
	W-4894	6-32 Acorn Nut	.05	.20
	W-4891	Dial Spider	.30	
	W-3544	Set Screw	.05	.15
	W-5353	Dial Gear with W-5354-B Indicator	.50	
	W-5354-B	Indicator Only	.25	
	W-4899	Pinion	.35	
	W-4907	Pinion Washer	.05	.25
	W-2326	6-32x5-16 Set Screw	.05	.10
	W-4892	Pinion Stirrup	.15	
	W-4883-C	Dial Light Assembly (without lamp)	.50	
	W-4893	Rheostat Bracket	.10	
1	5598	Switch	.75	
2	W-4534-B	Switch Nut	.05	.20
1	W-5385	Audio Transformer	3.25	
2	W-5654	Grommet (3-4")	.10	
		PARTS UNDER CHASSIS		
2	W-6471	Condenser (.1 M. F. 2 Paper)	1.00	
2	W-4562	Shakeproof Lug	.05	.15
1	W-6862	R. F. Choke Assembly	.80	
1	W-4476	Spacer	.05	.15
1	W-4919	Condenser (.5 M. F. 3 paper)	1.20	
1	W-4562	Shakeproof Lug	.05	.15
1	W-4115	Fixed Resistance (Short)	.40	
2	W-3547	Spacer	.05	.15
1	W-4562	Shakeproof Lug	.05	.15
1	W-6818	Terminal Board Assembly (Speaker)	.50	
1	B-4107-B	Cable	2.00	
1	W-4681	Grommet (3-8")	.10	
1	W-4751-A	Cable Clamp	.15	
1	W-6318	Fixed Resistance (Long)	.50	
2	W-3547	Spacer	.05	.15
1	W-4924	Grid Condenser (.00025MF.)	.35	
1	W-4562	Shakeproof Lug	.05	.15
1	W-4362	Plate Choke	.50	
1	W-635-C	Spacer	.05	.15
1	W-5713	Terminal Strip	.25	
2	W-5051	Spacer	.05	.15
1	W-5468	Resistance (3 megohms)	.50	
1	W-5382	Bypass Cond. (.00025 M. F.)	.40	
1	C-5888-B	Bottom	.50	
6	W-5718-A	Bottom Double Nut	.05	
6	6819	Eyelet	.05	.10
		MODEL 21		
1	D-6361	Cabinet Shell with four B-6366 Corners Assembled	4.00	
4	W-6376	Felt Foot	.10	
1	6374-A	Cabinet Cover	1.50	
1	W-6328	Escutcheon	.50	
2	W-6379	Escutcheon Mtg. Screw	.05	.10
1	W-6390	Main Tuning Knob	.25	
2	W-6389	Knob	.15	
		MODEL 22		
1	D-6513-A	C24 B Wood Cabinet	33.00	
4	W-6134-A	Square Head Bolt	.05	.25
4	W-6849	Washer	.05	.20
4	W-6260-A	Square Nut	.05	.15
1	W-6333	Main Tuning Knob	.35	
1	W-5836	Pinion Shaft	.05	
2	W-6332	Knob	.30	
2	W-5837	Shaft Extension	.10	
2	W-2326	Set Screw	.05	.10
1	W-6328	Escutcheon	.50	
1	W-5815	Model 227 Type E Dynacone Speaker	13.00	

The Crosley Service Supplement

No. 7 Supplement to Crosley Broadcaster March 15, 1930

Alignment of Tuning Condensers

This service sheet outlines the proper procedure for aligning the tuning condensers of all Crosley models which have been introduced from the Bandbox series to the latest models of the present date.

The older Crosley models, such as the Bandbox, and early Jewelbox, are equipped with a single aligning condenser, shunted across the detector-stage tuning condenser. The other stages are aligned when tuning, by means of

Table I—Chart of Tuning Condenser Alignment For Various Crosley Models

Models	Circuits Which Are Adjustable	Method of Adjusting	For Proper Procedure	For Views of Chasses
Bandbox, Jr., Models 401, 401-A	Detector stage only; others are controlled by acuminators	By means of aligning condenser on chassis	See Section I	See Crosley Service Manual Pages 6, 8
Bandbox, Model 601	Detector stage only; others are controlled by acuminators	By means of aligning condenser on chassis	See Section I	See Crosley Service Manual, Page 10
Gembox, Model 608	Detector stage only	By means of aligning condenser on top of condenser frame	See Section II	See Crosley Service Manual, Page 12
Gemchest, Model 609; Gembox, Model 610	All tuned stages	Tracking adjustable by split end plates on stators	See Section III	See Crosley Service Manual, Page 24
Bandbox, Model 602; Jewelbox, Models 704, 704-A, 704-B	Detector stage only; others are controlled by acuminators	By means of aligning condenser on chassis	See Section I	See Crosley Service Manual, Pages 14, 16, 18
Showbox and Showchest, Models 705, 706, 708	All tuned stages	Alignment adjusted by detector stage aligning condenser. Tracking adjusted by split end plates on rotors	See Section IV	See Crosley Service Manual, Pages 20, 22
Jewelbox, Model 804	All tuned stages	Same as Showbox (above)	See Section IV	See Crosley Service Manual, Page 26
Models 41-A and 42	All tuned stages	Same as Showbox (above)	See Section IV	See Crosley Service Manual, Page 25
Models 20, 21, 22	All tuned stages	No aligning condensers. Tracking and alignment adjusted by split end plates on rotors	See Section V	See Crosley Service Supplement No. 6
Models 30S, 31S, 33S, 34S, early production	All tuned stages	Padding condensers permanently aligned at factory. Tracking adjustable by split end plates on rotors	See Section VI	See Crosley Service Supplement No. 4
Models 30S, 31S, 33S, 34S, later production	All tuned stages	Padding condensers adjustable from outside of condenser frame. Tracking adjusted by split end plates on rotors	See Section VII	See Crosley Service Supplement No. 4
Models 40S, 41S, 42S, 82S	All tuned stages	No aligning condensers. Tracking and alignment adjusted by split end plates on rotors	See Section V	See Crosley Service Supplement No. 2
Models 60S, 61S, 62S, 63S	All tuned stages	Same as 40-S series (above)	See Section V	See Crosley Service Supplement No. 5

manual controls called "acuminators".

Recent chasses are equipped with tuning condensers mounted together as gangs in metal frames. On most of these chasses one or more small adjustable aligning condensers, called "padding condensers", are provided, mounted on the condenser frames. All of these chasses have tuning condensers with split end plates on either the rotors or stators for use in adjusting the condensers so that they track together—that is, so that they tune together throughout the entire range of the station selector dial.

See the accompanying chart to determine the method of aligning any particular chassis. Then refer to the section indicated on the chart.

I. Bandbox, Jr., Models 401, 401-A; Bandbox, Models 601 and 602; Jewelbox, Models 704, 704-A, 704-B.

These receivers are equipped with "acuminators", which are small, adjustable aligning condensers across the first and second tuning condensers. The acuminators are used as auxiliary tuning controls, being adjusted by small levers on the front of the receiver. The detector stage tuning condenser is aligned by means of a small adjustable aligning condenser (not operated as a tuning control) mounted on the chassis. This condenser should be so adjusted that all three condensers may be brought into sharp resonance, with the aid of the acuminators, at all settings of the station selector.

Proceed as follows to adjust the aligning condenser:

1. Set acuminators at approximately their middle positions.
2. Tune carefully to a weak signal of 1000 to 1500 kilocycles frequency, from a broadcasting station or local modulated oscillator.
3. If necessary, reduce volume by means of volume control or filament rheostat, retuning carefully to middle of signal band (maximum signal with retarded volume control).
4. Adjust aligning condenser by means of a balancing wrench or No. 4 socket wrench until signal is loudest **with wrench removed** (since capacity of wrench may change tuning).
5. Retune slightly if this improves volume; then readjust aligning condenser.
6. Tune to signals at various dial settings to see whether it is possible to tune sharply with acuminators to signals at all frequencies. If not possible, realign, as above.

II. Gembox, Model 608

This receiver has no acuminators or other aligning condensers across the first two tuning condensers, but has an adjustable aligning condenser across the detector-stage tuning condenser. The aligning condenser is mounted on top of the condenser frame.

To align, proceed as follows:

1. Tune carefully to a signal of moderate strength of 1000 to 1500 kilocycles frequency, from a broadcasting station or local modulated oscillator. If necessary, reduce volume by means of volume control. Be sure to tune to middle of signal band (loudest signal with retarded volume control).
2. Adjust aligning condenser by means of a balancing wrench or No. 4 socket wrench until signal is loudest with wrench removed (since capacity of wrench may change tuning).
3. Retune slightly if this improves volume, and readjust aligning condenser. Continue re-tuning and realigning until no further improvement is noted.

III. Gemchest, Model 609; Gembox, Model 610

These receivers have no aligning condensers. The tuning condensers have four-section split end plates on the stators, which are used for adjusting the tuning condensers so that they track together. In order to make this adjustment, a beat-frequency oscillator should be used. See section VIII-B.

IV. Showbox and Showchest, Models 705, 706, 708; Jewelbox, Model 804; Models 41-A and 42

These receivers have aligning condensers across their detector-stage tuning condensers. In addition, the rotors of the tuning condensers have seven-section split end plates for adjusting so that the condensers track together. The aligning condenser on Jewelbox, Model 804 is mounted on the chassis, to the rear of the condenser gang, and is adjustable by means of a balancing wrench or No. 4 socket wrench. The aligning condenser on each of the other models is mounted inside the condenser frame, and is adjustable by means of a square head screw extending through the condenser frame just above the power switch.

A. Adjusting Rotor End Plates For Tracking.

A beat-frequency oscillator should be used for this purpose. See section VIII-A.

B. Adjusting Detector Stage Aligning Condenser.

Proceed as follows:

1. Tune to a signal of moderate strength of 1000 to 1500 kilocycles frequency (dial setting about 5 to 15) from a broadcast station or local modulated oscillator. Tune to middle of signal band (loudest signal with retarded volume control) reducing volume by means of volume control if necessary.
2. Adjust aligning condenser until signal is loudest. Retune slightly if this improves volume, and readjust aligning condenser.
3. Continue retuning and readjusting aligning condenser until no further improvement is noted.

V. Models 20, 21, 22, 40S, 41S, 42S, 82S, 60S, 61S, 62S, 63S.

These receivers are not equipped with aligning or padding condensers. The rotors of the tuning condensers have seven-section split end plates, for adjusting the condensers so that they track together. As explained below, these may also be adjusted on the chassis for aligning the three stages.

A. Adjusting Rotor End Plates for Tracking.

To adjust the condensers so that they track together, a beat-frequency oscillator should be used. See section VIII-A.

B. Aligning Tuning Condensers on Chassis.

Proceed as follows:

1. IMPORTANT! Cover the caps and clips on the tops of the screen grid tubes with tape, so that no metal is exposed.
2. Tune to a signal of moderate strength between 1200 and 1500 kilocycles (dial setting 5 to 15) from a broadcast station or local modulated oscillator. Carefully adjust station selector to middle of signal band (loudest signal with retarded volume control).
3. Procure a strip of copper or brass just narrow enough to slip easily into the louvres (ventilator openings) on the covers over the screen grid tubes.

Slide this piece of metal through one of the louvres toward the first-stage screen grid tube cap, keeping the metal grounded against the shield. Note whether the loudness increases or decreases. Try this for each screen grid tube.

4. If the volume increases in every case, or decreases in every case, the receiver is not tuned sharply. Retune and check again.

5. If the volume increases in some cases but not in others, more capacity is needed in those stages showing increased volume. If the volume decreases in some stages but not in others, less capacity is needed in the stages exhibiting decreased volume. Note which condenser needs adjusting worst, and whether it requires increased or decreased capacity.

6. Remove shield cover from condenser frame and adjust interleaved split end plate of condenser out of alignment. Bend split sector slightly toward adjacent stator plate to increase capacity, or slightly away from it to decrease capacity.

7. Retune and recheck as above.

8. Repeat until metal strip test fails to show lack of alignment.

VI. Models 30S, 31S, 33S, 34S—Early Production, Not Equipped With Padding Condensers Adjustable From Outside of Condenser Frames.

These receivers have aligning or padding condensers for each tuned stage, but these condensers are not adjustable from outside the tuning-condenser frame. They are adjusted permanently with a special tool at the factory, and should not be changed. If realignment is necessary, this may be taken care of by adjusting the tracking with a beat-frequency oscillator as explained in section VIII-A. The rotors of the tuning condensers are equipped with seven-sector split end plates for this purpose.

VII. Models 30S, 31S, 33S, 34S—Late Production, Equipped With Padding Condensers Adjustable From Outside Condenser Frame.

These receivers are equipped with small adjustable padding or aligning condensers for two tuned stages, adjustable from outside the tuning condenser frames by means of screws extending through the frames. The rotors of the tuning condensers have seven-sector split end plates, for adjusting them so that they track together.

A. Adjusting Rotor End Plates For Tracking.

This should be done by means of a beat-frequency oscillator. See section VIII-A.

B. Adjusting Padding Condensers With Outside Station Signals.

Proceed as follows:

1. Tune to a weak signal between 1200 and 1500 kilocycles (dial setting 5 to 15). Carefully tune to middle of signal band (maximum signal with retarded volume control), reducing volume by means of volume control if necessary.

2. Loosen locknut with three-eights inch end wrench and adjust padding condenser toward rear of chassis until signal is loudest. Retune slightly if this improves volume, and readjust padding condenser. Repeat until no improvement is noted; then tighten locknut without permitting adjusting screw to turn.

3. Adjust the other padding condenser as in "2".

4. If when aligning signal becomes too strong to allow of accurate adjustment, tune to a weaker signal and repeat above procedure.

C. Adjusting Padding Condensers With Local Oscillator.

Follow above procedure, except:

1. Instead of adjusting for maximum signal loudness, adjustment may be made for maximum reading on a 250 volt D. C. voltmeter, having a resistance of about 250,000 ohms, connected across the detector grid bias resistance, from emitter to chassis. A small punched strip may be used to make the connection to the emitter prong of the tube, or this may be reached by removing the bottom of the chassis. The speaker must remain connected.

2. It is advisable to check the alignment for oscillator signals at two frequencies—at about 10 and 40 on the station selector dial.

VIII. Aligning Condensers for Tracking With Beat-Frequency Oscillator

The following procedure is for the purpose of adjusting the tuning condensers so that they "track together"; that is, so that they each change capacity by the same amount when the station selector is rotated. This insures uniform tuning throughout the entire range of the station selector, but does not align the condenser so that all circuits are tuned to the same frequency. The latter is accomplished by means of the aligning or padding condensers. The proper procedure, then, is: first, adjust condensers for tracking by means of beat-frequency oscillator; second, replace condenser gang on chassis and align circuits by means of padding condensers.

A. Condensers Having Seven Sector Split End Plates on Rotors.

Proceed as follows:

1. Take off cover from condenser frame. Unsolder leads and remove frame from chassis. Hold gang directly in front of you, with rotors entirely interleaved between stators, and note whether rotor plates of each condenser are centered between corresponding stators. If any require centering, loosen set screws and slide along shaft until properly centered. Then tighten set screws. When you are satisfied that all rotors are properly centered, tighten all set screws holding rotors to shaft.

Table II—Allowable Variation in Capacity at Different Settings—Seven-Sector Rotor Plates

Number of Split Sectors Entered Into Stator	Allowable Difference Between Any Two Condensers of Gang
1	1.5 mmf.
2	1.5 mmf.
3	2.0 mmf.
4	2.0 mmf.
5	2.5 mmf.
6	2.5 mmf.
7	2.5 mmf.

2. Place frame in jig on top of beat-frequency oscillator. Turn station-selector knob so that there is no interleaving of rotors and stators—that is, so that condensers are set for minimum capacity.

3. Check the capacity of each condenser. If there is a variation in capacity, adjust the compensators C1, C2, and C3 on the beat frequency oscillator so that the same reading is obtained with each condenser.

4. Turn station selector knob so that first sector of each split end plate is entered into stator. Check capacity of each condenser. If there is a variation

greater than that given in Table 1, note which condenser is farthest out. Then rotate station selector until first split end plate of this condenser may be adjusted. Spring this sector slightly toward adjacent stator plate to increase capacity or slightly away from adjacent stator plate to decrease capacity. Adjust station selector so that first split sectors are again interleaved with stators, and recheck capacities. If there is too much variation, readjust as above. Repeat until variation of capacity is within the limits given in Table I.

5. Rotate station selector until first two split sectors are entered into stators. Check capacity variation as above. If variation is greater than allowable limits given in Table I, adjust condenser farthest out by springing second split end plate sector of that condenser toward adjacent stator plate to increase capacity or away from adjacent stator plate to decrease capacity. Recheck and readjust until variation is within allowable limits of Table I, as outlined in "4".

6. Repeat above procedure with three, four, five, six, and seven sectors entered into stators. Remember that the sector to be adjusted in each case is the last one entered into the stators prior to checking. Thus, to compensate for variation found when five sectors are interleaving stators, the fifth sector should be adjusted, etc.

7. After completing adjustment, recheck in each position and readjust as necessary.

8. Replace frame on chassis, and align padding condensers.

B. Condensers Having Four Sector Split End Plates on Stators.

Follow the above procedure, except adjust the split stator sectors instead of rotor sectors, referring to Table III for allowable limits of variation.

Table III—Allowable Capacity Variation at Different Settings—Four Sector Stator Plates

Number of Split Stator Sectors Interleaved by Rotors	Allowable Difference Between Any Two Condensers of Gang
1	2.0 mmf.
2	2.0 mmf.
3	2.5 mmf.
4	2.5 mmf.

SERVICE SUPPLEMENTS SOON TO BE ISSUED

No. 9. How to Build a Local Modulated Oscillator.

No. 10. How to Build and Use a Beat-Frequency Oscillator for Adjusting Tracking of Tuning Condensers.

No. 11. Service Information Regarding Crosley Receivers Buddy and Chum

The Crosley Service Supplement

No. 9. Supplement to Crosley Broadcaster July 15, 1930

Eliminating Interference from Automobile and Motorboat Electrical Systems

The instruction book describing the installation of the ROAMIO, outlines, briefly, the general methods to follow in eliminating interference from the automobile electrical system. The information given in that booklet is sufficiently detailed to cover the average automobile installation. There are exceptional cases, however, which require special methods of interference elimination. It is advisable, therefore, for the service man to be familiar with every possible cause of interference in order that he may be able to cope adequately with any situation which may arise.

Every automobile incorporates numerous electrical circuits. There is an extensive system of wiring for the lights. There are low tension leads to the ignition coil, ammeter, starter, horn, windshield wiper (if of the electric type) etc. There are high tension leads from the ignition coil to the distributor and from the distributor to the plugs. Each part of this electrical system is a possible source of interference, although some parts are much more liable to cause interference than others.

Causes of Interference

When a current of electricity flows through a conductor the space about the conductor becomes a magnetic field. If the strength of current in the conductor changes, the strength of the magnetic field changes. Suppose a second conductor is placed in the neighborhood of the first one. As long as the current flowing in the first conductor remains constant, and the magnetic field surrounding it remains constant, no current will be induced in the second conductor. If the current in the first conductor changes or fluctuates, however, so as to change the magnetic field, a current will be induced in the second conductor. Thus, a changing current results in a changing magnetic field, which induces currents in conductors in the neighborhood.

The radio electrical system must necessarily be in the neighborhood of the automobile electrical system. Thus, if changing currents flow in the automobile electrical system, and no provision is made to shield the two systems from each other, interfering currents will be induced in the radio electrical system.

Unfortunately, the current flowing throughout the entire automobile electrical system has ordinarily some fluctuating characteristics, when the engine is running. The lights have a direct-current supply, and one might think offhand, that this supply would be free from current fluctuations. Sparking at the generator commutator, opening and closing of cut out relays, and such, cause frequent fluctuations, however.

But the lighting system is the least offender, as far as electrical interference is concerned. The primary current supplied to the ignition system is constantly being switched on and off by the breaker contacts in the distributor, and therefore is of a highly fluctuating character. The high tension current supplied to the spark plugs has even greater interference characteristics.

A spark discharge is of an oscillatory nature, it is an alternating current of very high frequency. Currents of this type are especially effective in radiating energy to be picked up by neighboring conductors.

The older radio telegraph transmitters, for instance, made use of spark discharges for sending radio signals. Each spark plug may be likened to a minature edition of one of these old style spark transmitters, with its high-tension lead acting as an antenna.

Procedure For Eliminating Interference

The object in interference elimination, then, is to reduce to a minimum the fluctuating currents in the automobile electrical system, and to shield the automobile system from the radio system if necessary. Grounded metallic shields effectively prevent the passage of the inductive energy.

Automobiles differ so much in their construction that no absolute rules of interference elimination may be written. In many automobiles the problem is extremely simple, requiring the installation of but a few eliminator and suppressor units. In other automobiles, more elaborate steps must be taken. The logical procedure to follow, therefore, is to take the few simple corrective measures required by all cars first, then to try the reception with the car running, and if this is found to be unsatisfactory to eliminate one by one each of the other possible sources of interference, starting with the most probable causes.

The first thing that an experienced service man usually does is to install an eliminator across the output terminals of the generator.

The eliminator is a small condenser unit, one terminal of which is grounded to the metal frame of the car, the other terminal of which is connected to the high-potential terminal of the device to be corrected. The eliminator acts like a tiny electrical tank, smoothing out the pulsations caused by sparking or circuit breaks.

The eliminator should be mounted as close as possible to the device to which it is to be connected. For connection to the generator, it may be mounted on the output cover. Crosley eliminators have but one lead, the ground return being obtained through the metal case of the condenser. Be sure that the eliminator case makes good electrical contact with metal parts of the car.

After an eliminator has been installed on the generator, reception should be tested. In some cases, reception will be found satisfactory without further elimination. If not satisfactory, the next thing to do is to install an eliminator at the ignition coil.

Mount the coil eliminator as near to the coil as practical. Connect its lead to that primary binding post of the coil which is connected to the switch (not the one connected to the breaker points). After the installation is completed, test reception again, with the engine running.

Installing Suppressors

At this time reception may be found satisfactory in those cars in which the spark plugs and high tension leads are partially or completely shielded by grounded metal coverings. If reception is still unsatisfactory, suppressors should be installed in the spark plug leads and center distributor leads.

The suppressors are small resistance units, which damp out the high-frequency oscillations causing interference from the high-tension leads. Crosley suppressors are of two types, one for installation in spark plug leads, the other for installation in distributor leads. A spark plug suppressor should be mounted in each spark plug lead at the plug, and a distributor suppressor should be mounted in the center lead of each distributor at the distributor. If difficulty is encountered in installing standard suppressors on some cars, special suppressors may be obtained.

The elimination methods described up to this point are sufficient to take care of the average installation. If reception is still unsatisfactory, all other possible causes of interference must be ruled out, carefully, one by one. The following paragraphs outline additional steps, one or more of which may have to be used in certain cases.

Additional Methods For Eliminating Interference

It is sometimes necessary to connect an eliminator to one of the ammeter terminals. Additional eliminators may be required by the electric horn, electric windshield wiper, electric fan, starting motor, etc. These units may be tested, one by one, by placing an eliminator across them temporarily and testing reception with the engine running.

The starting motor will, of course, only interfere with reception when the engine is being started, but the noise through the speaker is sometimes loud enough to be objectionable when the motor is started.

Variation in tube current supplied by the automobile storage battery, due to fluctuations caused by the generator and load on the battery, is a cause of interference in many automobile receivers. Crosley Roamio is designed to eliminate this possibility almost entirely, but in order to insure the best reception it may be advisable in some cases to be sure that the yellow A lead is run direct to the car storage battery rather than to other possible locations for connection to the low-tension current supply.

One particular source of interference pick-up is the antenna lead-in wire at the position where it leaves the windshield post and goes to terminal at the set. This section of the lead-in wire should be run clear of all ignition and other car electrical circuits. A little careful positioning or locating of above wires will obviate trouble from this source.

All low-tension wiring of the car should be placed as far as possible from high tension wiring. If it is not practical to change the location of the wiring, and, if this is believed to be the cause of interference, it is often possible to accomplish the same result by shielding the low-tension cables with grounded metal shields.

If the ignition coil is mounted on the instrument board, it may be necessary to shield the primary and high-tension wires from the coil to the distributor, for the portion from the coil to the metal engine bulkhead. Copper-screen, wrapped around the conductors and well grounded at both ends, may be used for this purpose. In come cases it may be necessary to shield the coil itself.

It is frequently helpful to ground all oil lines, speedometer cables, control rods, etc., which run through the engine bulkhead. They should be grounded to the metal engine bulkhead (or metal covering of the bulkhead) where they pass through it. Some service men make a practice of grounding these units as a regular routine part of every installation.

The Crosley Service Supplement

No. 10 Supplement to Crosley Broadcaster August 1, 1930

Buddy and Chum----1929 Models

Specifications

Crosley Buddy and Chum receivers employ the same chassis, mounted in different types of cabinets. The chassis is for A. C. light-socket operation. Models are supplied for 110 volts, 60 cycles, A. C.; 110 volts, 25 to 50 cycles A. C.; and 220 volts, 25 to 60 cycles, A. C.

Installation Notes

Recommended aerial length: 40 feet or more for either outdoor or indoor aerials. Outdoor aerials should preferably be supported 25 feet or more above the ground.

Plug in speaker before making connections. Never disconnect speaker while the receiver is connected to the light socket.

Two positions of fuse are provided, so that receiver may be adjusted for high or low line voltage. Fuse may be reached from bottom of chassis.

For further information regarding installation, see instruction books accompanying receivers.

Circuit

The Buddy and Chum circuit makes use of a total of six tubes, including the rectifier. Screen grid UY 224 tubes are used in the radio-frequency stages, a UY 227 heater tube in the detector socket, UX 171-A's in the push-pull audio-output stage, and a UX 280 in the rectifier socket.

In order to vary the pick-up, a local-distance adjustment, controlled by a toggle switch, is provided.

The radio-frequency and detector stages are tuned by variable condensers, mounted together as a single gang, and controlled by the station selector. A small aligning condenser is provided across each variable condenser (aligning condensers are not shown in the circuit diagram).

Interstage coupling in the radio-frequency portion of the circuit is accomplished by air-cored transformers so constructed as to introduce a sufficient amount of capacity coupling to equalize the response of the receiver throughout the entire broadcasting range. Audio-frequency coupling, between the detector and push-pull stage, is by means of an audio-frequency transformer.

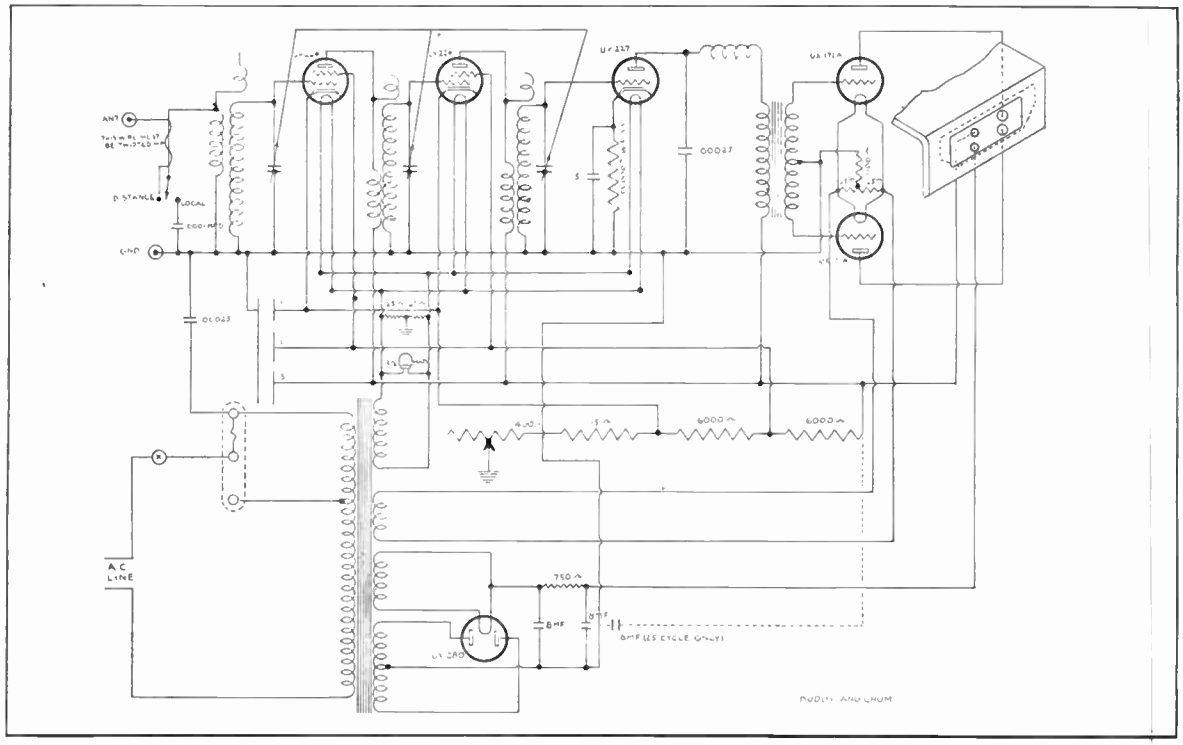
Tube filament current comes from three separate secondaries on the power transformer. One supplies the heaters of the radio frequency and detector tubes, a second supplies the filaments of the push pull tubes, and a third supplies the filament of the rectifier tube.

There is a fourth secondary on the power transformer for the high-voltage B and C supply. The ends of this secondary are connected to the plates of the rectifier tube so as to obtain full-wave rectification. A middle tap of the secondary, representing the negative or low-potential side of the B supply circuit, is grounded to the metal chassis.

The positive or high-potential side of the B supply circuit is connected to the rectifier tube filament. This circuit passes through a 750 ohm resistor to the speaker field. The 750 ohm resistor and two 8 m.f. condensers, together with the speaker field, act as a filter system.

The output tube plates are connected directly to the armature of the Dynacoil speaker, without the use of an output transformer or choke. The armature consists of four coils. Two of these are connected in series in the line from each output plate. After passing through the armature coils, the plate circuits join in a common lead, which connects to the speaker field. The B supply current comes from the speaker field through this common lead, branching at the armature to pass through two of the armature coils to one output plate, and through the other two armature coils to the other output plate.

The armature coils are so arranged that the magnetic effect of the D. C. component of the output plate current cancels out, while the A. C. signal component is effective in moving



Circuit Diagram

the armature. To understand this, assume that the D. C. plate component is flowing through all four armature coils all of the time, while the signal component is only flowing through two armature coils, to one tube plate, at any one time. Thus, by bucking against each other the pairs of armature coils in the two plate leads, the D. C. plate current effect may be cancelled out without decreasing the effect of the signal current.

After it returns from the speaker field to the receiver, the high potential side of the B circuit branches, one branch going to the detector and radio frequency plates, the other going through a 6000 ohm resistor to the screen grids, through a second 6000 ohm resistor to the emitters of the radio-frequency tubes, and finally through a 115 ohm resistor and the volume control rheostat (400 ohms) to ground (chassis).

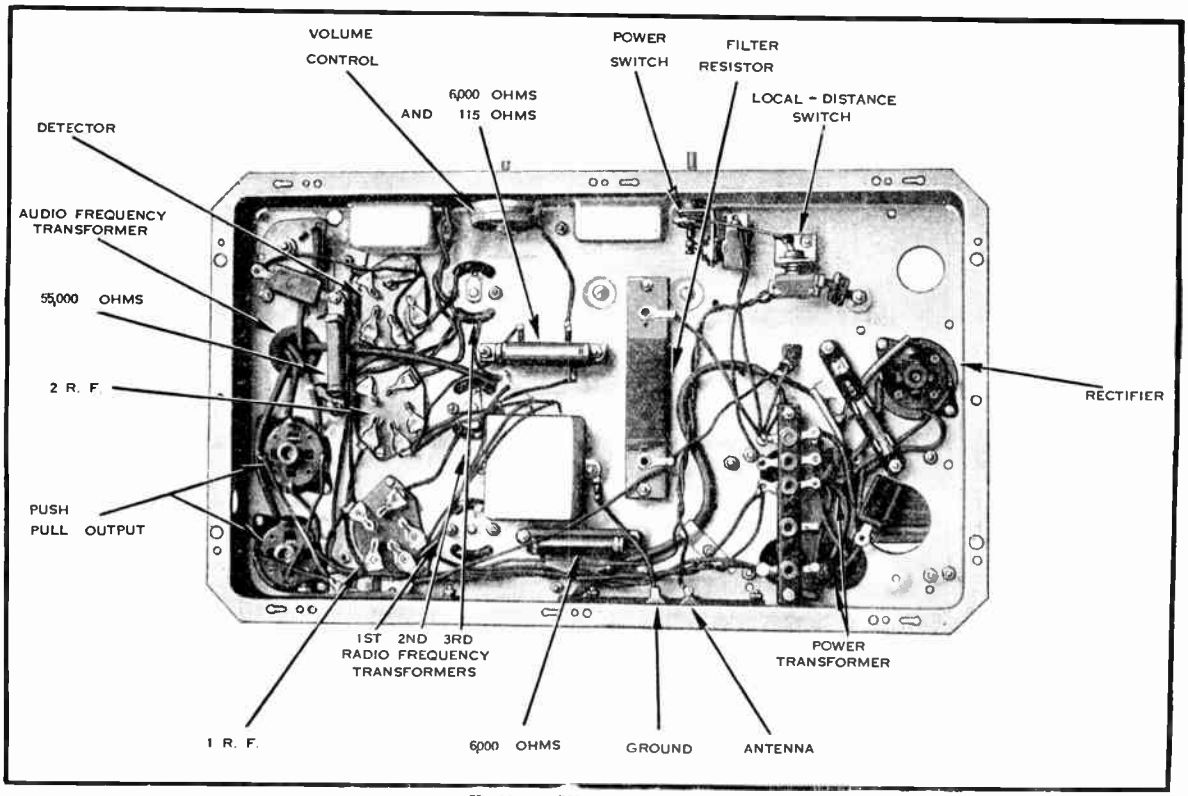
The grids of the radio-frequency tubes are connected through their respective radio-frequency transformer secondaries to ground (chassis). By virtue of the voltage drop in the previously mentioned 115 ohm resistor and volume control rheostat, the radio-frequency

(Continued on Page 4)

VOLTAGE LIMITS

	Volume Control On Full
Filament Voltages	
R. F. and Detector tubes	2.4
A. F. and Rectifier tubes	4.8
Plate Voltages	
All tubes but Rectifier	170
Rectifier tube	250 each
Control Grid Voltages	
R. F. tubes	2.8
Detector tube	12.0 16.0
A. F. tubes	38.0
Screen Grid Voltages	
R. F. tubes	85.0

The above readings are to be taken with the receiver in full operating condition, with the volume control on full, and with a line voltage of 117.5 when the fuse is in the "High" position or of 107.5 when the fuse is on the "Low" position. In the case of 220 volt receivers, the line voltages should be respectively 235 and 215. Measure plate and grid voltages with a high-resistance D. C. voltmeter (at least 800 ohms per volt.) These voltages are to be measured from the plate or grid socket contact to the emitter contact or negative filament contact, unless otherwise noted in the table. The contacts must be reached from the bottom of the receiver (unless a set tester is used) with tubes, dial light, and speaker in place. Use a low-range A. C. voltmeter to measure the filament voltages.



Bottom View of Receiver

CONTINUITY TESTS

NOTE: In order to make the test procedure as simple as possible, certain tests are omitted which are taken care of by voltage limits on preceding page.

Circuit	Remarks	Correct Test	Incorrect Test Indicates
Antenna to Ground.	This test and tests below to be made with circuit tester, described in previous service articles.	Full Scale	Open primary antenna transformer or faulty connections.
Operating Grid Contacts R. F. and Detector Sockets to Ground.		Full Scale	Open R. F. transformer secondary or faulty connections.
R. F. Emitter Socket Contacts to Ground.	Readings should vary with adjustment of volume control.	Part Scale	Faulty connection or open circuit in line, 115 ohm resistor, or volume control rheostat if no reading; short if full scale reading.
Detector Emitter Socket Contact to Ground		Part Scale	Faulty connection or open circuit if no reading; short if full scale reading.
Push Pull Filament Socket Contacts to Ground.	Test at each filament contact (2 on each socket).	Part Scale	Faulty connection or open circuit in line, 50 ohm potentiometer, or 1100 ohm resistor if no reading; short if full scale reading.

Condensers may be disconnected and checked with a capacity bridge.

Simpler tests, which serve adequately, may be made as follows: If condenser is 0.1 m. f. or greater capacity, disconnect it, connect a 45 volt B battery across its terminals for a few moments, disconnect

battery, and shunt condenser with a piece of wire or metal, watching for a spark as contact is made. A spark upon making contact indicates that the condenser is in satisfactory condition.

For condensers smaller than 0.1 m. f. it is better to use a buzzer test. A pair of headphones, a buzzer, a dry cell, and a key or switch are required. Connect the buzzer in series with the dry cell and key switch. Connect one headphones lead to one of the buzzer terminals. Connect a length of wire to the other buzzer terminal. To test a condenser, disconnect it from the circuit. Connect the free wire from the buzzer and the free headphones lead to the condenser terminals. Close the battery switch and note loudness of sound in the headphones. Repeat with a standard condenser of the same size and kind. If the test condenser is perfect, the sound produced with it in the circuit should be as loud as that produced with the standard in the circuit.

(Continued from Page 2)

grids are biased with a negative potential with respect to the emitters of these tubes. The amount of bias is regulated by the volume control rheostat.

The grids of the output tubes are biased by the voltage drop in a 1100 ohm resistor, carrying the return plate current from the middle of a 50 ohm potentiometer (shunted across these filaments) to the chassis.

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, description of part, and serial number of receiver on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer orders. Prices are subject to the usual trade discounts.

Qty.	Part No.	Description	List Price Each	List Price Doz.
1	B-7991	Chassis	$3.75	
1	W-7854	Cover (socket)	.10	
1	W-6590	Push-pull transformer	6.00	
3	W-7020	Socket (4 prong)	.25	
2	W-7291	Socket Guide (171-A)	.10	
1	W-7057	Socket Guide (280)	.10	
3	W-7021	Socket (5 prong)	.30	
3	W-7125	Socket Guide	.10	
12	M-20	.120 x 7-32 tubular rivet	.05	.10
1	W-7740	R. F. transformer (antenna)	1.75	
2	W-7741	R. F. Transformer (interstage)	1.75	
2	W-7272-A	Tube Connections	.30	
6	L-6	No. 6 Lockwashers	.05	.10
6	N-5062	6-32 Hex. Nuts	.05	.10
1	B-7278-A	R. F. Coil Shield (Detector)	.50	
2	B-7279-A	R. F. Coil Shield	.50	
1	W-7072	R. F. Shield Assem. (large)	2.50	
1	W-5916-A	Dial Light Clip	.10	
1	B-7074	Shield Cover	.75	
2	W-6474	Shield cover nut	.05	.20
1	W-5750-B	Dial Light socket (without lamp)	.15	
1	W-7704	Grommet	.10	
1	W-7083	Variable Condenser gang assembly complete	18.00	
1	W-7154	Dial Gear	.25	
1	W-5354-D	Dial Indicator	.25	
1	W-7153	Dial Spider	.30	
1	W-7870	3-32 x 5-8 Groove Pin	.05	.10
1	W-5442	Pinion (Set Screw W-2326)	.35	
1	W-5495	Pinion Washer	.05	.25
1	W-7157-A	Pinion Spring	.10	
1	W-7155	Pinion Bracket	.15	
1	W-7156-B	Stop Bracket	.10	
1	W-4907	Spring washer	.05	.25
1	W-5726-A	Rotor thrust collar	.20	
1	W-5596	8-32 S. H. Set Screw	.05	
2	W-6966-B	Springs (Rotors)	.10	
1	W-4943-A	Mershon Condenser	5.15	
	W-5253	Mershon Condenser (in 25 cycle units)	6.30	
1	W-4946-E	Condenser Cap	.25	
1	W-4794	1-4" Stiffened sleeving (5 3-4" long)	.10	
2	W-5033	Mounting clamps	.15	
1	W-7751	Power Transformer 110 v. 60 cycle	14.00	
	7768	110 v. 25 cycle	14.00	
	7769	220 v. 25 cycle	14.00	
1	W-7496	Transformer shield	.90	

Qty.	Part No.	Description	List Price Each	List Price Doz.
		PARTS UNDER CHASSIS		
1	W-4362-D	Plate Choke Assembly	.50	
1	W-4076	Spacer	.05	.15
1	W-4924	.00025 M. F. Fixed Condenser	.35	
1	W-5753	55000 ohm resistance	.60	
1	W-5713	Terminal Strip	.25	
2	W-2478	Spacers	.05	.15
1	W-4968	1-2 mfd. 2 paper fixed condenser	1.20	
1	W-4562	No. 6 Shakeproof Lug	.05	.15
1	W-7424	Speaker terminal	.35	
1	W-7430	Terminal Guide	.10	
1	W-7640	Volume Control (400 Ohms)	.75	
1	W-6703	6000 Ohm Resistance	.75	
1	W-5713	Terminal Strip	.25	
1	W-7752	115 Ohm Resistance	.30	
2	W-3547	Spacers	.05	.15
1	W-7753-A	.1 - .5 - .1 Mfd. Fixed Condenser	2.00	
1	W-6703	6000 Ohm Resistance	.75	
1	W-5713	Terminal Strip	.25	
1	W-20149	750 Ohm Fixed Resistance (Armored)	.80	
1	W-7746	750 Ohm Fixed Resistance (used in first series)	.75	
1	W-7876	1100 Ohm Fixed Resistance	.35	
2	W-5864	Spacers	.05	.15
1	W-7838	Terminal Board (Aerial & Ground)	.25	
1	W-7059	Switch (Power)	.80	
1	W-7079-E	Shaft Assembly	.25	
1	W-7078-C	Bracket	.10	
1	W-7192	Spacer	.05	
1	W-7857-A	Switch (L-D)	.80	
1	W-7865	Switch Bracket	.10	
1	W-7866	Connecting Link	.10	
1	W-7847	.0001 Mfd. Fixed Condenser	.35	
2	W-5669	25-25 Ohm Fixed Potentiometer	.50	
2	W-4476	Spacers (5-32)	.05	.15
2	W-5864	Spacers (15-32)	.05	.15
1	W-6587	Fuse panel	.50	
1	W-7612	Fuse (1 amp.)	.10	
1	W-4924	.00025 M. F. Fixed Condenser	.35	
1	B-6867	Cable	1.50	
1	W-7704	Grommet	.10	
1	W-4751-B	Cable Clamp	.15	
1	W-5063	Rubber Tubing 1-2" long	.05	
3	W-5654	Grommet (3-4")	.10	
1	W-20653	Chassis Bottom	.75	
6	W-5718-A	Bottom Double Nut	.05	

The Crosley Service Supplement

No. 11 Supplement to Crosley Broadcaster August 1, 1930

Roamio Receiver

Specifications

Crosley Roamio is a receiver for installation in automobiles or motorboats. It obtains its power from a storage "A" battery and dry "B" and "C" batteries.

Installation Notes

For information regarding how to install the Roamio, refer to the instruction books accompanying the receivers, and to Service Supplement No. 9.

Circuit

In many respects the circuit of the Roamio is similar to those of other Crosley battery models, but there are certain special features which make it particularly adapted to automobile and motorboat use.

The Roamio has two stages of radio-frequency amplification, a detector, and two stages of audio-frequency amplification. Screen grid tubes of the 224 type are used in the radio-frequency stages, a 227 heater type tube is used in the detector stage, and 112-A power tubes are used in the audio-frequency stages.

The grid circuits of the radio-frequency and detector stages are tuned. A three-gang condenser with single control is used for this purpose. There are three aligning condensers mounted on the gang—one for each tuning condenser.

The antenna coupling coil and the interstage radio-frequency coupling coils are wound so as to provide a slight amount of extra capacity coupling, in order to make the response of the receiver more uniform throughout the entire broadcasting range. This feature has been described in more detail in service information covering the 30S series of receivers.

The detector stage acts both as a detector and as an automatic volume control, keeping the level of reproduction as constant as practicable while the automobile moves through areas in which the signal strength varies.

This automatic control of volume is accomplished by a circuit arrangement which increases the negative bias on the radio-frequency and detector grids as the signal becomes stronger, and decreases this bias as the signal becomes weaker. The necessary biasing voltage is obtained from the voltage drop in the 60,000 ohm resistor in the —D lead. With increased signal, more current flows through the detector plate circuit, increasing the drop in this resistance, and thereby increasing the biasing voltage applied to the grids of the first three tubes. This results in a reduction of radio-frequency amplification, tending to maintain the signal, as finally delivered from the audio system, at a comparatively constant level.

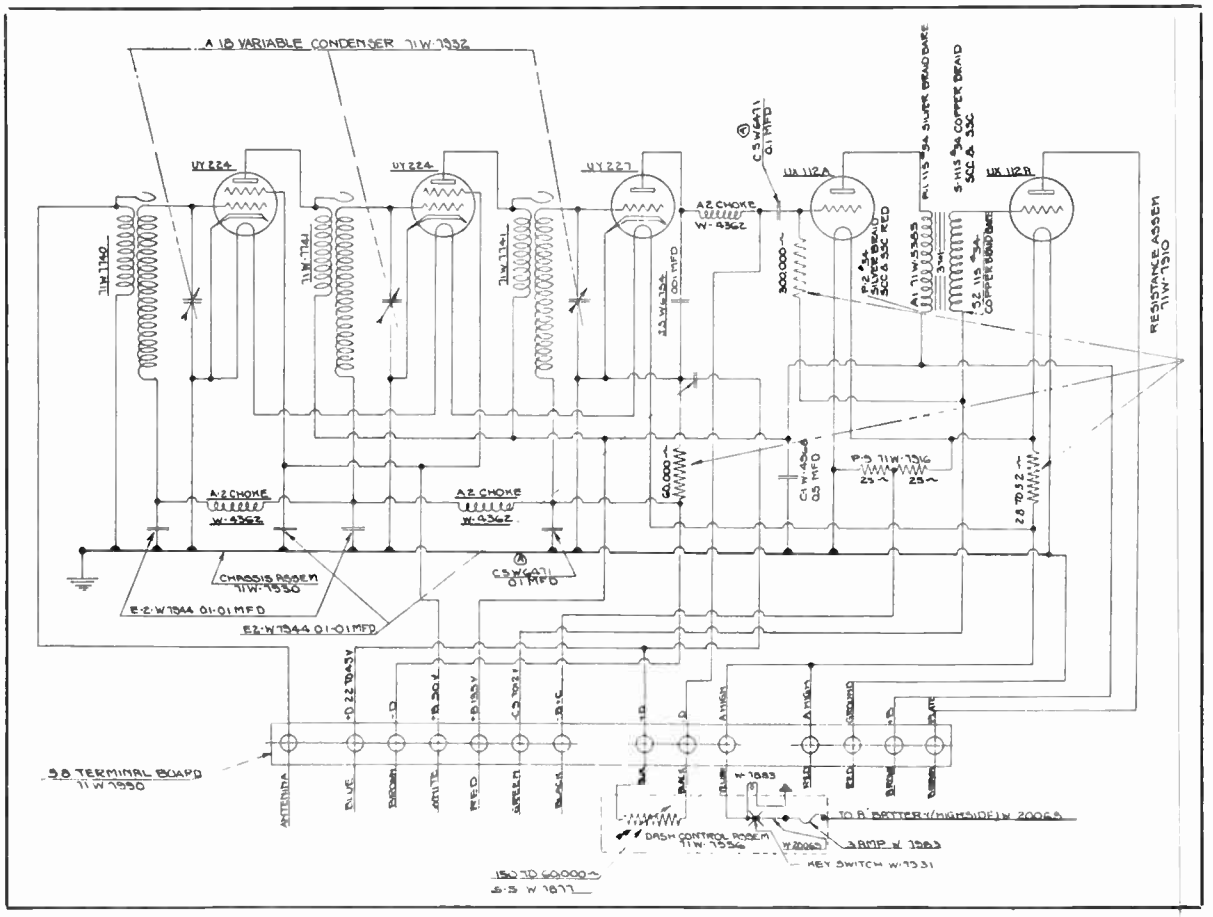
In addition to the biasing resistor, for automatic volume control in the detector plate circuit, there is a variable resistor, operated by a knob on the control panel, for manually controlling the volume.

The detector is resistance coupled to the first audio stage. An audio-frequency transformer is used between the first and second audio stages.

The A and B supply is by means of batteries. The plates of all tubes but the detector are connected to the Red plus B lead, to which a positive potential of 135 volts is applied by the B battery. A separate plate battery known as the D battery, is used for the detector. It applies 22½ volts to the detector plate circuit through the Blue lead.

The positive voltage for the screen grids of the screen grid tubes is applied through the White lead, connected to the plus 90 volt terminal of the B battery. The radio-frequency and detector tubes are biased by the voltage drop in a resistance, as previously described. The audio-frequency tubes are biased by a C battery, which applies minus 12 volts to the Green lead.

The filaments of the radio-frequency and detector tubes are connected in series. Since



Circuit Diagram

the terminal voltage of the car storage battery, supplying these tube filaments, may vary between 6.0 and 7.5 while the car is running, this means that between 2.0 and 2.5 volts will be applied to each of these tube filaments.

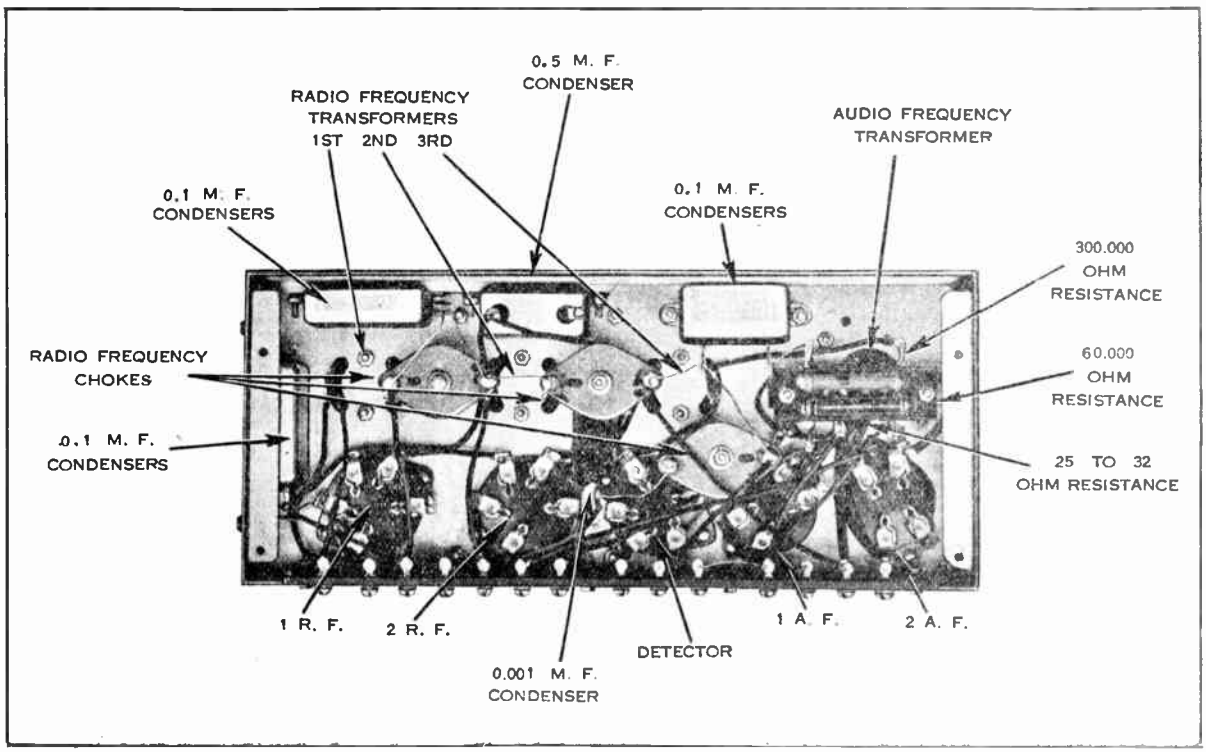
The filaments of the audio-frequency tubes are connected in parallel. A ballast resistor is used in series with these filaments. The return filament circuit is through the chassis, grounded to the metal frame of the car.

The minus B and plus C leads are connected to the middle of a 50 ohm potentiometer shunted across these filament leads, so that the polarity of the A supply does not affect the grid or plate voltage of these tubes. This method of connection is necessary because in some automobiles the negative side of the storage battery is grounded while in others the positive side of the battery is grounded.

Voltage Limits

	For Rated Battery Voltages
Filament Voltages	
R. F. and Detector Tubes	2.0
A. F. Tubes	4.7
Plate Voltages	
All Tubes but Detector	135
Detector Tube	22½
Control Grid Voltages	
R. F. Tubes	2.5
Detector Tube	3.0
A. F. Tubes	12.0
Screen Grid Voltages	
R. F. Tubes	90

The above voltages are to be measured with the speaker connected and the tubes in place. For plate and grid voltages use a high-resistance (800 ohms or more per volt) D. C. voltmeter. Measure plate and grid voltages from plate or grid socket contact to negative filament contact.



Bottom of Chassis

Continuity Tests

NOTE—In order to make the test procedure as simple as possible, certain tests are omitted which are taken care of by the voltage limits in the accompanying table.

Circuit	Remarks	Correct Test	Incorrect Test
Using 50 Volt D. C. Voltmeter in Series With 45 Volt "B" Battery			
Antenna to Ground (Chassis)	-	Practically Full Scale (about 45 volts)	Open antenna transformer primary or faulty connections
Emitters to Chassis R. F. and Detector Stages	Tubes Removed	Practically Full Scale	Faulty connection or open circuit
Operating Grids R. F. and Detector Stages to Brown Battery Lead	Tubes Removed	Practically Full Scale	Faulty connections or open R. F. transformer secondary or R. F. choke
Operating Grids A. F. Stages to Green Battery Lead	Tubes Removed	Part Scale	Faulty connections or open resistor or A. F. transformer secondary
Screen Grids R. F. stages to White Battery Lead	Tubes Removed	Practically Full Scale	Faulty connections
Plates R. F. Stages to Red Battery Lead	Tubes Removed	Practically Full Scale	Faulty connections or open R. F. transformer primary
Plate Detector Stage to Black Lead	Tubes Removed	Part Scale	Faulty connections or open choke
Plate First Audio Stage to Plate Second Audio Stage	Tubes Removed and Speaker Connected	Practically Full Scale	Faulty connections or open A. F. transformer primary or open speaker armature coils

For methods of testing condensers, see Service Supplement No. 10, Page 3.

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, description of part, and serial number of receiver on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer orders. Prices are subject to the usual trade discounts.

Qty.	Part No.	Description	List Price Each	Doz.
		CABINET		
1	D-7884-C	Housing	2.00	
1	C-7885-C	Cover	.50	
6	P-155	8-32 x 3-8 Fil. Hd. Mach. Screw	.05	.10
4	W-20001	Cover Felt	.05	
1	W-20014	Speaker Mounting Bracket	.05	
1	C-7886	Bottom	.25	
1	W-20005	Housing Sub cover	.10	
1	W-20006	Housing Sub cover gasket	.05	
2	W-20132	Cable Gromet	.10	
1	W-20031	Name Plate	.15	
2	M-78	.008 x 1-8 tubular rivet	.05	.10
1	W-20000	Condenser Drive Assembly Complete	3.50	
1	C-7887	Gear Bracket	.50	
1	W-7995	Worm Gear Shaft	.10	
1	W-7892	Worm Gear	.50	
2	W-6017	8-32 set screw	.05	.15
1	W-7893	Worm	1.25	
2	W-20122	8-32 x 1-4" Cup Point set screw	.05	.15
1	W-7996	Worm Shaft	.10	
1	W-7945	Worm Bracket Assembly	.15	
1	W-20158	Worm Shaft bushing	.15	
1	W-7891	Adjusting screw	.05	.20
1	B-7888	Gear Bracket Cover	.20	
1	W-7989	Coupling Assembly	.50	
1	W-7932	Variable Condenser Assem.	12.00	
2	W-7272-A	Tube Connection Assembly (S. G.)	.10	
1	C-7913	Chassis	.75	
3	W-7873	Socket (5 prong)	.35	
3	W-7874	Socket Guides	.10	
2	W-7871	Socket (4 prong)	.30	
2	W-7872	Socket Guides	.10	
1	W-5385	A. F. Transformer	3.25	
1	W-5654	Gromet 1"	.10	
1	W-20054	R. F. Transformer	1.65	
2	W-20055	R. F. Transformer	1.75	
3	B-7922	R. F. Shields	.40	
3	W-7704	Gromets	.10	
2	B-20096	Interstage Tube shields	.15	
1	W-7990	Terminal board assembly	.80	
1	W-7916	Fixed resistance (25 -25 ohms)	.40	
1	W-7910	3 ohm resistance strip	.40	
1	W-4923	60,000 ohm resistor (blue)	.60	
1	W-6704	300,000 ohm resistor (yellow)	.60	
2	W-3547	L spacer	.05	.15
2	W-2478	S spacer	.05	.10
3	W-4362	Plate chokes	.50	
3	W-5129	Spacer	.05	.10
2	W-6471	.1 mfd. fixed condenser	1.00	
2	W-5864	Spacer	.05	.15
1	W-6754	.001 mfd. fixed condenser (Aerovox)	.40	
1	W-4968	.5 mfd. fixed condenser	1.20	
2	W-7944	.1 - .1 mfd. fixed condenser	1.00	

Qty.	Part No.	Description	List Price Each	Doz.
		DASH CONTROL ASSEMBLY, ETC.		
1	B-7928	Escutcheon	.80	
2	W-7919	Knobs	.20	
1	W-7931	Key Switch	1.25	
1	W-20057	Key Switch Insulator Sleeve	.05	
1	W-7877	Volume Control	1.75	
1	W-7958	Pinion shaft	.15	
1	W-7907	Pinion	.20	
1	W-5596	8-32 x 7-32 Cup Point Set Screw	.05	.10
1	W-7926	Dial & Gear	.50	
1	W-7912	Dial Bushing	.10	
1	W-7914	Escutcheon Screw 6-32 x 1-2 Hex. Hd.	.05	.10
2	W-5495	Washer	.05	.20
1	W-4907	Spring	.05	.25
1	W-7959	Mounting Plate	.80	
2	W-7880	Clamps	.05	
1	W-7946	Fuse Panel Assembly	.35	
2	W-4476	Spacers	.05	.15
1	W-7983	Fuse	.10	
1	W-7882	Dial Light Receptacle	.15	
1	W-7963	Dash Control Cable Assem.	1.25	
	B-7986-A	Cable Only	1.00	
	W-7987	Terminal Strip	.25	
1	W-4751	Cable Clamp	.05	
2	W-7997	Universal Joint Assembly	1.50	
1	W-7941	Drive shaft	.10	
1	W-7998	Adapter shaft	.10	
1	B-7896	Battery box	2.00	
1	B-7897	Battery box cover	.75	
1	W-7960	Battery cable	4.00	
	B-7951-A	Cable only	3.40	
	W-7952	Terminal strip	.60	
1	W-20008	Box Cable	1.50	
3	W-20058	Box Sleeve Clamp	.10	
1	W-20117	Ferrule	.05	
1	W-20059	Box Sleeve fitting	.05	
1	W-20094	B battery fuse unit	.50	
1	W-7949	Antenna connectors	.25	
		SPEAKER ASSEMBLY		
1	C-7834	Unit Holder	.45	
1	W-20047	Type C. Dynacone motor assembly	8.00	
1	W-7719	Felt	.10	
1	W-5198	Felt liner	.10	
	W-7025	Cone	2.00	
2	W-6776	Cone Clamp	.05	
1	W-5874	Inner cone nut	.05	.15
1	W-5786	Inner cone nut	.05	.15
1	C-7822	Frame	.60	
3	W-7848	Spring	.05	
1	W-7211	Name Plate	.50	
1	W-7962	Speaker Cable Assembly	1.60	
	B-7984-A	Cable only	1.20	
	W-7985	Terminal strip	.40	
1	W-4681	Cable Gromet	.10	

The Crosley Service Supplement

No. 13 Supplement To Crosley Broadcaster Sept. 1, 1930

Model 84

Specifications

These receivers are for operation from A. C., electric house-lighting circuits. They are supplied in a number of different models, all incorporating the same chassis. Chasses may be obtained for operation from 110 volts, 25 cycles; 110 volts, 60 cycles; and 220 volts, 25 to 60 cycles.

Installation Notes

Recommended aeiral length, 50 feet or more for outdoor installations; 20 feet or more for indoor installations.

Terminals are provided for phonograph pick-up devices. When such a device is connected, the wire between terminals "P" and "C" must be cut. If the pick-up device is afterwards disconnected, a wire must be connected between "P" and "C" before the receiver may be operated.

To connect a phonograph pick-up a double-throw, single-pole switch must be used. Connect the middle pole of the switch to terminal "C" and the end poles to terminals "P" and "S". Connect the pick-up to the switch poles which are connected to "P" and "C", and cut the wire between "P" and "C", as described above. Throw switch toward "P" pole for radio reproduction or toward "S" pole for phonograph reproduction.

For further information regarding the installation and operation of the receiver, see the instruction book accompanying the receiver.

Circuit

These receivers utilize eight tubes—three screen-grid radio-frequency tubes, a screen grid detector, a -27 type first audio tube, two -45 type power output tubes, and a -80 type rectifier.

Radio-frequency transformers are used for linking the aerial circuit and the first radio-frequency stage, and for linking the radio-frequency and detector stages together. A certain amount of capacity coupling is introduced in these radio-frequency transformers in order to insure practically uniform response to signals of all frequencies throughout the broadcasting range.

The screen grid detector is resistance coupled to the first audio stage. The latter is coupled to the push-pull output stage by an audio-frequency transformer.

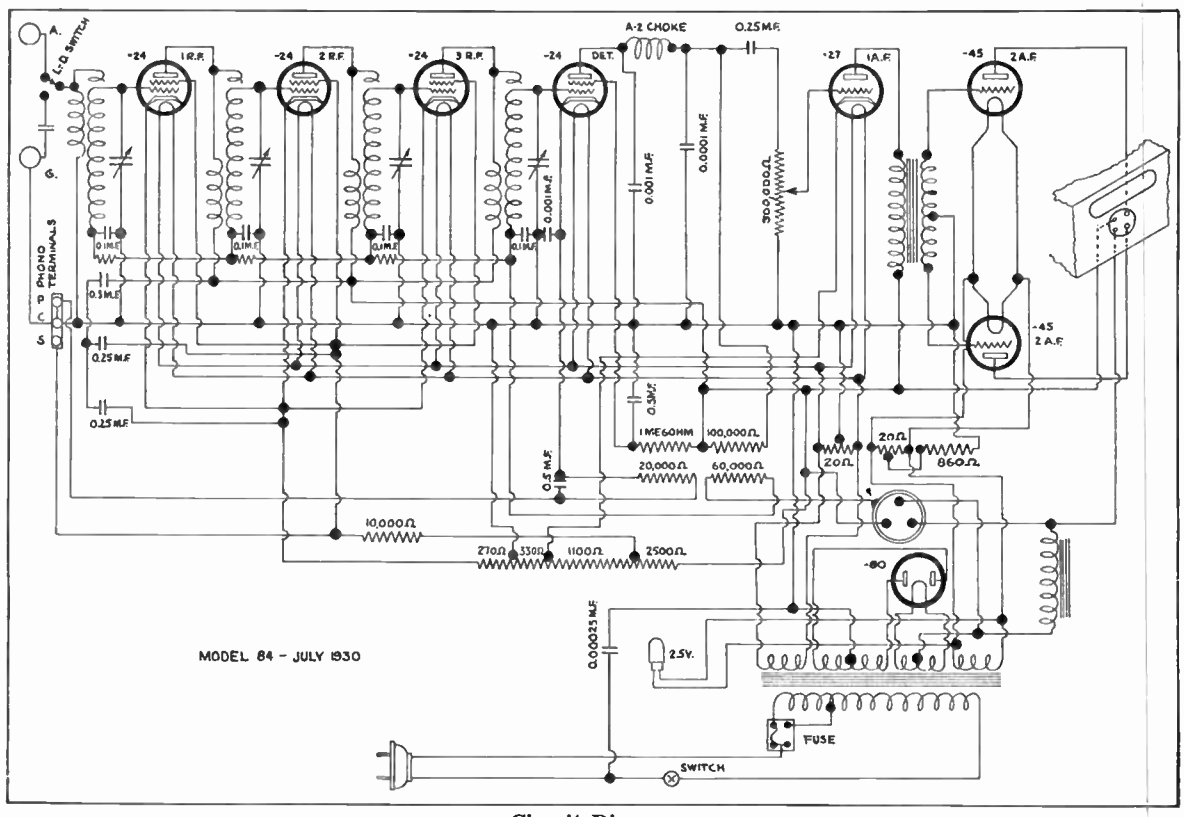
A power transformer, with a voltage adjustment on the primary, supplies the power for operating the tubes. The voltage adjustment is made by inserting the line fuse in either of two sets of clips. In the position marked "Low" the fuse connects only a part of the transformer primary in the circuit, thus providing a higher step-up ratio in the transformer and adapting the receiver to operation from lighting circuits of low voltage (100 to 115 for 110 volt receivers or 200 to 230 for 220 volt receivers). In the position marked "High" the fuse connects the entire transformer primary in the circuit, reducing the step-up ratio, and adapting the receiver to operation from lines of higher voltage (115 to 130 for 110 volt receivers, or 220 to 250 for 220 volt receivers).

There are three secondaries on the power transformer for supplying power to the filaments, or heaters, of the various tubes—one for the heaters of the -24 and -27 tubes, one for the filaments of the -45 tubes, and one for the filaments of the -80 tubes. A fourth, high-voltage secondary supplies the plate current.

The ends of the high-voltage secondary are connected to the plates of the rectifier tube. A middle tap of this secondary is grounded to the chassis. This represents the low-potential, or negative, side of the plate or "B" circuit. The high-potential, or positive, side of the plate circuit is connected to a middle tap of the transformer secondary supplying the rectifier filament. From this point, the high-potential circuit continues through a filter system consisting of a Mershon condenser and choke coil to the field coil of the loudspeaker. Part of the plate current passes through the speaker field coil and returns to the receiver through the second field lead; the remainder flows through a branch circuit inside the speaker to a middle tap on the primary of an output transformer built into the speaker, and thence to the plates of the output tubes.

An examination of the circuit diagram will show that the return plate circuit from the loudspeaker field is connected directly to the radio-frequency and first audio plates and through a 100,000 ohm resistor to the detector plate. Thus, practically the same voltage is applied to the radio-frequency and first audio plates, while a somewhat lower voltage is applied to the detector plate.

The appropriate positive voltage for the



Circuit Diagram

screen grid of the detector tube is applied through a 1 megohm resistor connected to the positive plate circuit returning from the speaker field.

Below the first audio tube on the circuit diagram a branch of this positive plate circuit passes down and to the left through a string of resistors—2500 ohms, 1100 ohms, 330 ohms —and thence to ground (chassis). These resistors are for the purpose of applying the proper potentials to the radio-frequency screen grids and the first audio emitter. The circuit to the radio-frequency screen grids runs from the junction of the 2500 ohm and 1100 ohm resistors through a 10,000 ohm resistor to the tubes. This circuit applies a positive potential to the screen elements with regard to chassis. The emitter of the first audio tube is connected to the junction between the 330 ohm and 1100 ohm resistors. A somewhat less positive potential is thus applied to this emitter.

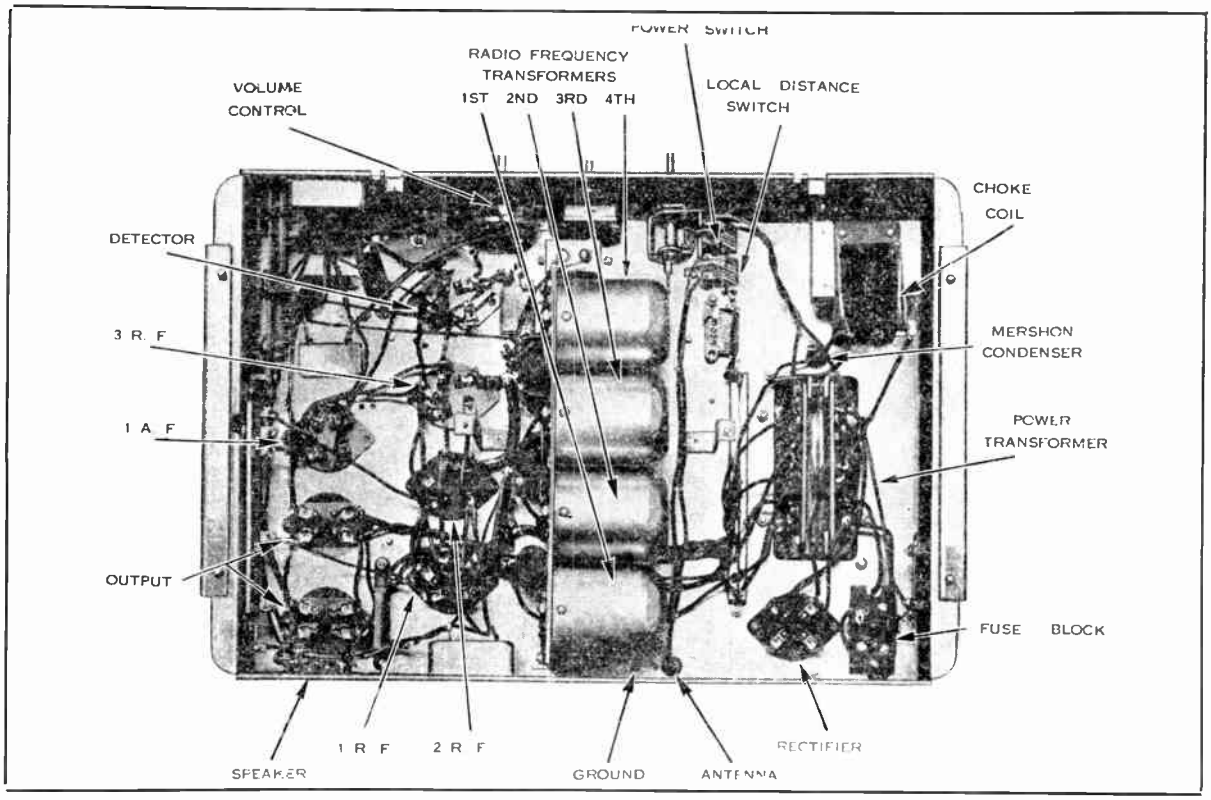
The emitters of the radio-frequency tubes are grounded to the chassis through a 270 ohm resistor. The voltage drop in this resistor keeps the emitters at a positive potential with regard to the chassis. Similarly, the emitter of the detector tube is kept positive with regard to the chassis by a 20,000 ohm resistor.

(Continued on Page 4)

Voltage Limits

Filament Voltages	
All tubes but rectifier	2.3 to 2.6
Rectifier tube	4.6 to 5.2
Plate Voltages	
R. F. tubes	170 to 190
Detector tube	95 to 105
1st Audio tube	130 to 150
Output tubes	220 to 250
Rectifier tube (A. C. voltage)	250 to 280 each plate
Control Grid Voltages	
R. F. tubes	2.5 to 3.5
Detector tube	4.0 to 7.0
1st Audio tube	8.0 to 11.0
Output tubes	40.0 to 50.0
Screen Grid Voltages	
R. F. tubes	60 to 75
Detector tube	35 to 55

To be measured with speaker connected and line voltage of 117½ (235 for 220 volt receivers) with fuse in "High" position or of 107½ (215 for 220 volt receivers) with fuse in "Low" position. Measure plate and grid voltages with a high-resistance, D. C. voltmeter (600 ohms or more per volt) from plate or grid tube contact to emitter contact, except in the case of the grid voltage of the first audio tube, which should be measured from the emitter to the chassis.



Bottom of Chassis

Continuity Tests

Circuit	Remarks	Correct Test	Incorrect Test Indicates
The following tests are to be made with a circuit tester consisting of a 45 volt "B" battery in series with a 50 volt high-resistance voltmeter, a 1½ volt battery in series with a milliammeter of 1 m. a. range and a 1500 ohm resistor, or a similar arrangement.			
Antenna to Ground (Chassis)	Local-distance Switch in Distance position.	Practically full scale	Open circuit in r. f. transformer primary, leads, or connections
Grids R. F. and Detector Stages to Ground (Chassis)		Slight deflection	No deflection indicates open circuit in resistors, r. f. transformer secondary, leads, or connections. Full-scale deflection indicates short circuit
Grid 1st Audio Stage to Ground (Chassis)	Adjust volume control while taking reading	Deflection should depend upon setting of volume control	Full scale at all settings of volume control indicates short. No deflection indicates open circuit.
Grids Output Stage to Ground (Chasis)		Practically full scale	Open circuit in r. f. transformer secondary, etc.
Plates Output Stage to High Potential Speaker Field Terminal	Speaker connected	Practically full scale	No deflection indicates open circuit in output transformer primary, leads, speaker field, etc.
Plate 1st A. F. Stage to Speaker Field Return Terminal	Speaker disconnected	Practically full scale	Open circuit in a. f. transformer primary, leads, or connections
Plates R. F. and Detector Stages to Speaker Field Return Terminal	Speaker disconnected	Part scale	No reading indicates open circuit. Full scale reading indicates short circuit

For methods of testing condensers, see Service Supplement No. 10, Page 3.

The filaments of the output and rectifier tubes serve as the emitters, while the other tubes have heaters and separate emitters. Measure filament voltages with a low-range, A. C. voltmeter.

(Continued from Page 2)

The control grids of the output tubes are biased by means of an 860 ohm resistor in the lead from the chassis to the middle of the resistor shunted across the output filaments.

The biasing of the first audio tube is accomplished in the same way, by the previously described mode of connection of the emitter which keeps it at a positive potential with regard to the chassis. There is a variable coupling resistor in the grid circuit. This variable resistor is used as a manual volume control. Since it follows the detector in the circuit, it controls the volume both of radio signals and of phonograph reproduction through the phonograph terminals.

The biasing of the radio-frequency and detector tubes is partially accomplished by maintaining the emitters at positive potentials with regard to the chassis, as previously described, and partially, when grid current is flowing, by the drop due to the grid current in the 60,000 ohm resistor in the detector grid circuit. This latter drop, due to grid current, is the basis of automatic volume control, or automatic response control. A signal strong enough to cause grid current to flow in this circuit automatically increases the negative bias of the grids of the radio-frequency and detector tubes. This decreases the amplification in the radio-frequency and detector stages.

In addition to the manual volume control and automatic volume control, a local-distance switch is provided for adapting the receiver to the reception of powerful signals from nearby stations.

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, description of part, and serial number of receiver on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer orders. Prices are subject to the usual trade discounts.

Qty.	Part No.	Description	List Price Each Doz.
1	D-20204-C	Chassis	$4.00
1	W-20173	A. F. Transformer	7.00
5	W-7873	Tube Socket—5 Prong	.30
4	W-7871	Tube Socket—4 Prong (1 for loud speaker)	.25
8	W-7874	Socket guides	.10
1	W-7872	Socket guide (loud speaker)	.10
1	W-20273	Variable Condenser gang assembly	20.00
1	W-20208	Inner bracket	.15
1	W-20209	Outer bracket	.10
1	W-20434	Dial Stop	.05
1	W-20435	Spring Washer	.05
1	W-20431	Drive Pulley	.25
1	W-20436	Dial Assembly	2.75
1	W-5749	Drive rope	.50
1	W-20376	Shadow box escutcheon assembly	1.00
4	W-7272-A	Screen Grid connections	.25
1	C-20206	Condenser & tube shield assembly	1.25
1	C-20363	Condenser & tube shield cover	2.00
1	W-20341	Mershon Condenser (9-9-18)	7.50
1	W-6764	Mershon Condenser cap	.30
1	W-4742	Jar Cap Screw	.05
1	W-4741	4-36 Square Nut	.05
2	W-6762	Mounting Clamp	.15
1	W-20150	Power Transformer (110 v. 60 c.)	14.00
	W-20469	Power Transformer (110 v. 25 c.)	14.00
	W-20470	Power Transformer (220 v. 25 c.)	14.00
1	W-7496	Transformer shield	.90
1	W-20171	Fuse Panel Assembly	.30
1	W-7983	Fuse (3 amp.)	.10
1	W-20321	Fuse guard	.35
1	W-20322	Fuse guard insulator	.05
1	W-20175	A & G terminal	.50
1	W-20266	Phone pick-up terminal	.50
		Miscellaneous	
	W-20178	Grommets	.10
	W-7578	Spaghetti Tubing	.05 ft.
	W-20485	Knob, Large	.40
	W-20474	Knob, Small (set screw type)	.35
	W-20486	Knob, Small (spring type)	.35

Qty.	Part No.	Description	List Price Each Doz.
		PARTS UNDER CHASSIS	
2	W-4313	.5 mfd fixed Condenser	1.20
1	W-4362	R. F. Plate Choke	.50
1	W-7847	.0001 mfd fixed Condenser	.35
1	W-20187	.25 mfd fixed Condenser	1.00
1	W-20622	Mounted Resistor Assembly	3.00
	W-20099	Terminal Strip Assembly	.30
	W-20464	1 meg. fixed resistance (brown, green dot)	.60
	W-5469	100,000 ohm fixed resistance (brown, yellow dot)	.60
	W-5370	20,000 ohm fixed resistance (red, orange dot)	.60
	W-4923	60,000 ohm fixed resistance (blue, orange dot)	.60
1	W-20452	Candohm fixed resistance (5 taps)	1.00
1	W-5370	20,000 ohm fixed resistance	.60
1	W-5713	Terminal Strip	.25
1	W-20185	Volume Control	1.75
2	W-6754	.001 mfd Condenser	.40
1	W-20186	.25-.3-.25 mfd Condenser	2.25
3	W-4923	60,000 fixed resistance	.60
3	W-5098	Rubber Tubing	.05
4	W-20188	.1 mfd fixed condenser	.60
1	B-20330	Coil Mounting Strip	.50
1	W-20374	Antenna R. F. Transformer Assembly	2.00
3	W-20375	R. F. Transformer Assem.	2.00
4	W-20339	R. F. Coil Shield	.50
4	W-20491	Rubber Washer	.05
1	W-21012	On, Off, and Tap Switch Assembly	2.00
		Power Switch only	.75
		Tap Switch only	.80
1	W-20499	.00025 mfd fixed Condenser	.35
1	W-20176	Candohm fixed resistance (8 taps)	1.00
1	W-20172	Filter Choke	3.00
1	W-20499	.00025 mfd fixed Condenser	.35
1	B-6867	Cable and Plug	1.50
1	C-20205	Chassis Bottom	.75
2	W-20177	Brackets for Bottom	.05

The Crosley Service Supplement

No. 14 Supplement to Crosley Broadcaster Sept. 1, 1930

Model 77

Specifications

Model 77 is supplied in a number of different cabinets, all utilizing the same chassis. This receiver is for operation from alternating current house-lighting circuits. Chasses are supplied for operation from 110 volts 60 cycles, 110 volts 25 to 50 cycles, and 220 volts 25 to 60 cycles.

Installation Notes

Recommended aerial length: 50 feet or more for outdoor aerial, 20 to 50 feet for indoor aerial.

There are three terminals at the rear of the chassis, marked "P", "C", and "S", for phonograph pick up devices. Instructions for connecting these in Crosley phono-radio combinations will be found in the instruction books accompanying the receivers. To connect other types of phonograph pick up, a single-pole double-throw switch is required. Cut the wire between terminals "P" and "C". Connect the center pole of the switch to terminal "C". Connect the end poles of the switch to terminals "P" and "S". Connect the two leads from the phonograph pick up to the switch poles which are connected to "P" and "C" (terminal "C" is grounded to the chassis). For phonograph reproduction, throw the switch so that the terminals "C" and "S" are connected together. For radio reproduction, throw the switch so that the terminals "P" and "C" are connected together. The volume of phonograph reproduction may be controlled by the volume control on the radio receiver.

If the phonograph attachment is disconnected from the receiver at any time and it is desired to obtain radio reception, it will be necessary to connect a wire from "P" to "C."

For further information regarding installation, see the instruction books accompanying the receivers.

Circuit

These receivers utilize seven tubes, including the rectifier, as follows: two -24 type screen-grid tubes in the radio-frequency stages, a -24 type screen grid detector, a 27 type tube in the first audio stage, two -45 type power tubes in the push-pull output stage, and a -80 type rectifier.

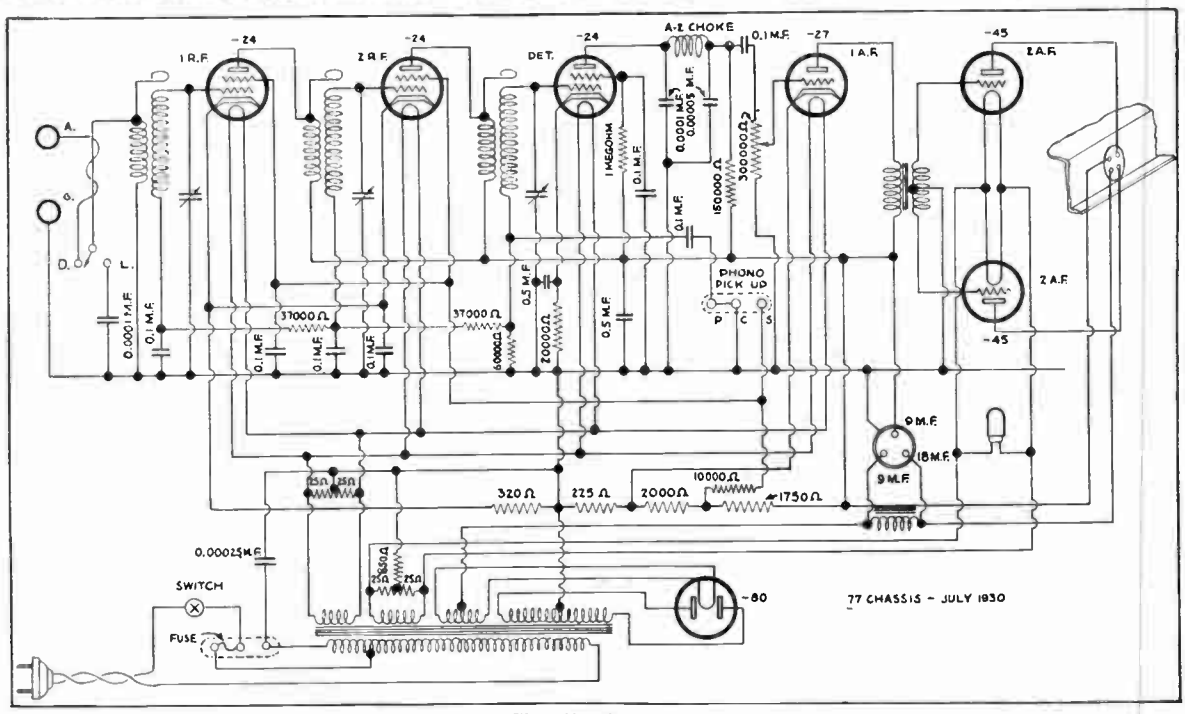
Air-core radio-frequency transformers are used for coupling the antenna stage to the first radio-frequency stage, the first r. f. stage to the second r. f. stage, and the second r. f. stage to the detector. These transformers are of special design, as described in previous bulletins, so that they introduce sufficient capacity coupling as well as inductive coupling to insure uniform amplification of signals of various frequencies throughout the broadcasting range. The detector stage is resistance coupled to the first audio stage. The first audio stage is coupled to the output stage by an audio-frequency transformer.

A local-distance switch in the antenna circuit provides a means of adjusting the energy transfer from the antenna circuit to the radio-frequency stages, so that the receiver may be compensated for the great variation in strength of signals from different stations. This switch is marked "L" for the local position and "D" for the distance position on the circuit diagram.

There is a power switch and a fuse in the primary circuit of the power transformer. The fuse also serves as a means of adjusting the receiver to high or low line voltages. It is shown in the "Low" position on the circuit diagram. In this position it connects only a portion of the transformer primary in the circuit, so that the step up ratio of the transformer is increased. In the "High" position it connects the entire transformer primary in the circuit, reducing the step-up ratio of the transformer. With the fuse in the "Low" position, the receiver is adapted to operation from lighting circuits of 100 to 115 volts for 110 volt receivers, or 200 to 230 volts for 220 volt receivers.. With the fuse in the "High" position, the receiver is adapted to operation from circuits of 115 to 130 volts for 110 volt receivers, or 220 to 250 volts for 220 volt receivers.

There are four secondaries on the power transformer for supplying the filament and plate circuits of the various tubes. One of these is connected to the filament of the rectifier tube. A second is connected to the paralleled filaments of the power output tubes. The dial light is shunted across the leads from this secondary. A third is connected to the paralleled heaters of the radio-frequency, detector, and first audio-frequency tubes. The fourth secondary, connected to the plates of the rectifier tube, is the high-voltage secondary for the plate supply.

A middle tap on the high-voltage secondary represents the negative, or low-voltage,



Circuit Diagram

side of the plate supply circuit. It is grounded to the chassis. The middle tap of the rectifier filament secondary represents the positive, or high-voltage, side of the plate supply circuit. From this point the high-voltage plate supply circuit passes through a filter system consisting of a Mershon condenser and choke coil to the field coil of the loud speaker.

Inside the speaker the plate circuit branches. One branch goes direct to a middle tap on the primary of an output transformer built into the speaker and thence to the plates of the output tubes. The other branch continues through the speaker field coil, and thence back to the receiver, to the other tubes. The speaker field thus carries the plate current of the radio-frequency, detector, and first audio tubes, but not that of the output tubes.

Returning to the chassis after passing through the speaker field, the plate supply circuit is connected directly to the plate of the first audio tube (through the primary of the audio-frequency transformer), to the plates of the radio-frequency tubes (through the primaries of the interstage radio-frequency transformers) and to the plates of the detector (through the 150,000 ohm plate coupling resistor and A-2 choke).

The screen grid of the detector tube is connected to the plate supply circuit through a 1 megohm resistor, which reduces the voltage

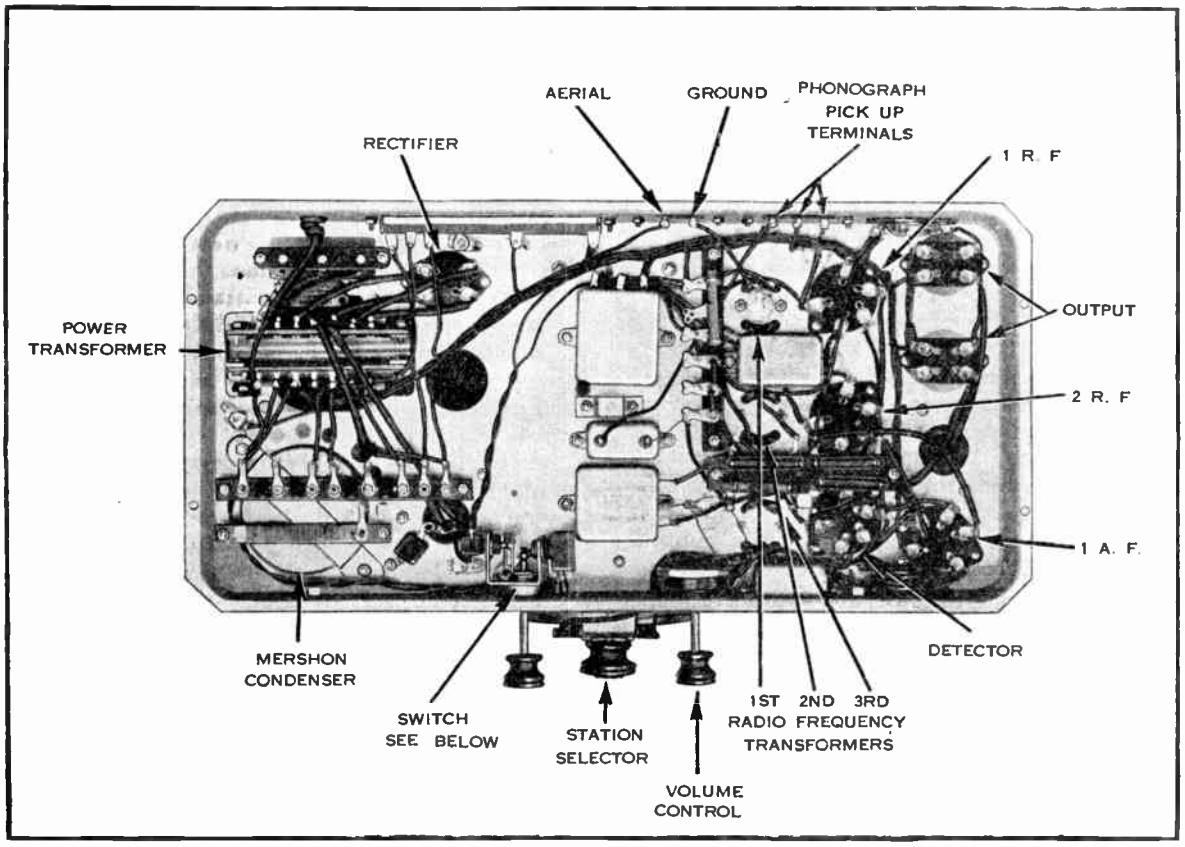
(Continued On Page 4)

Voltage Limits

Filament Voltages	
All tubes but rectifier	2.3 to 2.6
Rectifier tube	4.6 to 5.2
Plate Voltages	
R. F. tubes	140 to 160
Detector tube	85 to 110
1st Audio tubes	125 to 150
Output tubes	230 to 260
Rectifier tube (A. C. Voltage)	250 to 280 each plate
Control Grid Voltages	
R. F. tubes	1.6 to 3.2
Detector tube	2.0 to 3.2
1st Audio tube	8.0 to 10.0
Output tubes	45. to 65.
Screen Grid Voltages	
R. F. tubes	75 to 90
Detector tube	35 to 55

To be measured with speaker connected and line voltage of 117½ (235 for 220 volt receivers) with fuse in "High" position or of 107½ (215 for 220 volt receivers) with fuse in "Low" position. Measure plate and grid voltages with a high-resistance, D. C. voltmeter (600 ohms or more per volt) from plate or grid tube contact to emitter contact, except in the case of the grid voltage of the first audio tube, which should be measured from the emitter to the chassis. The filaments of the output and rectifier tubes serve as the emitters, while the other tubes have heaters and separate emitters. Measure filament voltages with a low-range, A. C. voltmeter.

All voltage readings are to be taken with the speaker connected and the tubes in place.



Bottom of Chassis

Continuity Tests

Circuit	Remarks	Correct Test	Incorrect Test Indicates
The following tests are to be made with a circuit tester consisting of a 45 volt "B" battery in series with a 50 volt, high-resistance voltmeter, a 1½ volt battery in series with a milliammeter of 1 m. a. range and a 1500 ohm resistor, or a similar arrangement.			
Antenna to Ground (Chassis)	Local-distance Switch in Distance Position	Practically full scale	Open circuit in r. f. transformer primary, leads, or connections
Grids R. F. and Detector Stages to Ground (Chassis)		Slight deflection	No deflection indicates open circuit in resistors, r. f. transformer secondary, leads, or connections. Full-scale deflection indicates short circuit
Grid 1st Audio Stage to Ground (Chassis)	Adjust volume control while taking reading	Deflection should depend upon setting of volume control	Full scale at all settings of volume control indicates short. No deflection indicates open circuit
Grids Output Stage to Ground (Chassis)		Part scale	Open circuit in a. f. transformer secondary, etc.
Plates Output Stage to Speaker Field Return	Speaker connected	Practically full scale	No deflection indicates open circuit in output transformer primary, leads, speaker field, etc.
Plates R. F. and 1st A. F. Stages to Speaker Field Return	Speaker disconnected	Practically full scale	Open circuit in transformer primary, leads, etc.
Plate Detector Stage to Speaker Field Return	Speaker disconnected	Part scale	No reading indicates open. Full scale indicates short.

For methods of testing condensers, see Service Supplement No. 10, Page 3.

(Continued From Page 2)

to the proper value. The screen grids of the radio-frequency stages are connected to the plate supply circuit through 10,000 ohm and 1750 ohm resistors, shown on the circuit diagram just at the left of the filter system. After passing through the 1750 ohm resistor, the plate supply circuit is grounded through a 2000 ohm resistor and a 225 ohm resistor, connected in series.

The emitter of the first audio tube is connected to the junction of the 2000 ohm and 225 ohm resistors in the bleeder circuit. Thus the flow of plate current and bleeder current through the 225 ohm resistor serves to maintain the emitter of this tube at a positive potential with regard to the chassis, supplying the bias for this stage. The manual volume control on the receiver operates by adjusting the 300,000 ohm variable coupling resistor connected to the grid of this tube.

The normal bias of the radio frequency and detector tubes is obtained by means of a 320 ohm biasing resistor in the radio-frequency emitter circuit, and a 20,000 ohm biasing resistor in the detector emitter circuit. These resistors maintain the emitters at positive potentials with regard to the chassis, so that the grids of the tubes are negative with respect to the emitters.

In addition to the above mentioned biasing resistors in the radio frequency and detector circuits, there are three resistors in the grid circuits of these tubes. Two of these, marked 37,000 ohm resistance on the circuit diagram, have a value of 60,000 ohms in later chasses. The third is a 60,000 ohm resistor connecting all three grid circuits to the chassis. This third, 60,000 ohm resistor acts as an automatic volume or response control, reducing the amplification of the receiver for signals of strength greater than a given value. If a signal is received of sufficient strength to cause grid current to flow in the detector circuit, the resulting voltage drop in this resistor increases the negative bias of the radio-frequency and detector tubes, decreasing the amplification in these stages.

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, description of part, and serial number of receiver on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer orders. Prices are subject to the usual trade discounts.

Qty.	Part No.	Description	List Price Each
1	D-20329	Chassis	$2.50
1	W-20380	A. F. Transformer	5.50
4	W-7873	Sockets (5 prong)	.30
4	W-7871	Sockets (4 prong)	.25
5	W-7874	Socket Guide (5 prong)	.10
3	W-7872	Socket Guide	.10
1	W-20444	Antenna R. F. Transformer	2.50
2	W-20445	Interstage R. F. Transformer	2.50
3	W-7272-A	Screen Grid Connections	.25
3	B-7558	R. F. Coil Shield	.50
1	W-20439	Variable Condenser Gang Complete	25.00
	W-20456	Dial Assembly	2.25
	W-20443	Inner Bracket	.15
	W-20209	Outer Bracket	.10
	W-20431	Drive Pulley	.25
	W-20435	Spring Washer	.05
	W-5749	Drive Rope	.50
	W-20434	Dial Stop	.05
	W-20376	Shadow Box	1.00
1	C-20455	R. F. Shield Assembly	3.00
1	W-20381	Filter Choke	3.25
1	W-20341	Mershon Condenser (18-9-9)	7.50
1	W-4794	Stiffened Sleeving (5 3-4 in. long)	.10
2	W-6762	Mounting Clamp	.15
1	W-20453	Condenser Bottom Support	.15
1	W-20150	Power Transformer (110 v. 60 c.)	14.00
	W-20469	Power Transformer (220 v.) 25 c.)	14.00
	W-20470	Power Transformer (110 v. 25 c.)	14.00
1	W-20496	Fuse Panel	.30
1	W-4639	Fuse (2 amp.)	.10
1	C-20451	Power Unit Shield	2.50
		PARTS UNDER CHASSIS	
1	W-4362-D	Plate Choke	.50
1	W-7847	.0001 Mfd. Fixed Condenser	.35
1	W-20389	.00005 Mfd. Fixed Condenser	.35
1	W-20447	.1 Mfd. 3 Paper Fixed Condenser	1.10
1	W-20454	Mounted Resistor Assembly	3.00
	W-20099	Mounting Strip	.30
	W-20464	1 megohm Resistor (Brown green spot	.60
	W-5735	150000 ohm Resistor (Brown, yellow spot)	.60
	W-4923	60000 ohm Resistor (Blue, orange spot)	.60
	W-5370	20000 ohm Resistor (Red, orange spot)	.60
1	W-20361	Mounted Resistor Assembly	2.50
	W-20467	Mounting Strip	.30
	(2) W-7287	37000 ohm Resistor (Orange, violet)	.60
	W-4921	10000 ohm Resistor (Brown, Orange spot)	.60
1	W-7944	.1-.1 Mfd. Fixed Condenser	1.10
1	W-20266	Terminal Strip (P. C. S.)	.50
1	W-20304	Volume Control	1.75
1	W-20449	.1-.5 Mfd. Fixed Condenser	1.25
1	W-20448	.1 Mfd. 2 Paper Fixed Condenser	1.00
1	W-20179	Support Bracket	.10
1	W-20446	.1-.5-.1 Mfd. Fixed Condenser	2.25
1	W-20264	Terminal (A & G)	.30
1	W-20452	Fixed Resistance (Candohms)	1.00
1	W-21009	On. off & tap Switch Assembly	2.00
		On, off Switch only	.75
		Tap Switch Only	.80
1	W-7847	.0001 Mfd. Fixed Condenser	.35
1	W-7084	850 ohm Fixed Resistor	.35
1	W-20390	Fixed Resistance Assembly (8 lugs)	.90
1	W-4924	.00025 Mfd. Fixed Condenser	.35
1	B-6867	Cable & Plug	1.50
7	W-20458	Spring Clips	.05
1	C-20180	Bottom	.75
1	W-20167	Knob (large)	.40
2	W-20482	Knob (small)	.35

The Crosley Service Supplement

Supplement to Crosley Broadcaster

Model 26

Specifications

Model 26 is a battery operated chassis, which is supplied in a number of different cabinets. It is used with a 6 volt storage "A" battery, and a "B" battery totalling 180 volts. No "C" battery is required.

Installation Notes

Recommended aerial length: 50 feet or more for outdoor installations; 25 feet or more for indoor installations. The battery cable is coded as follows:

Yellow—plus **A** 6 volts (to plus terminal of storage battery).

Black with Yellow Tracer—minus **A** (to minus terminal of storage battery).

Black with Red Tracer—minus **B** (to minus terminal of **B** battery).

Red—plus **B** 180 volts (to plus terminal of fourth **B** battery, all four 45 volt **B** batteries being connected in series).

To install this receiver connect the "B" batteries in series, connect the coded cable wires as outlined above, insert the speaker plug in the socket on the chassis, insert the tubes, and connect the aerial and ground. Further information will be found in the instruction books accompanying the receivers.

Circuit

The circuit includes three stages of radio-frequency amplification, utilizing -22 type screen grid tubes, a detector utilizing a -01-A or -12-A type tube, a first audio stage utilizing a -01-A or -12-A tube, and a push-pull output stage utilizing two -12-A type tubes. The grid circuits of the first three tubes are tuned by variable condensers, operated by a single station selector.

The radio-frequency and detector stages are coupled to one another by air-core radio-frequency transformers. The antenna circuit is coupled to the first radio-frequency stage by an air-core auto-transformer. Tuning is accomplished by three variable condensers, in the grid circuits of the three radio-frequency stages. These three condensers are operated simultaneously by the station selector. Each tuning condenser is equipped with a small aligning or "padding" condenser which may be used to align the circuits so that they tune together.

There is a local-distance switch in the antenna circuit which controls the amount of energy fed into the first radio-frequency stage. When in the "distance" position the switch connects the antenna direct to the antenna coupling coil. When in the "Local" position the connection of the antenna to the antenna coupling coil is through capacity coupling only.

The detector is of the grid-condenser, grid-leak type.

The detector stage is resistance coupled to the first audio stage, and the first audio stage is coupled to the output stage by an iron-core, audio-frequency transformer.

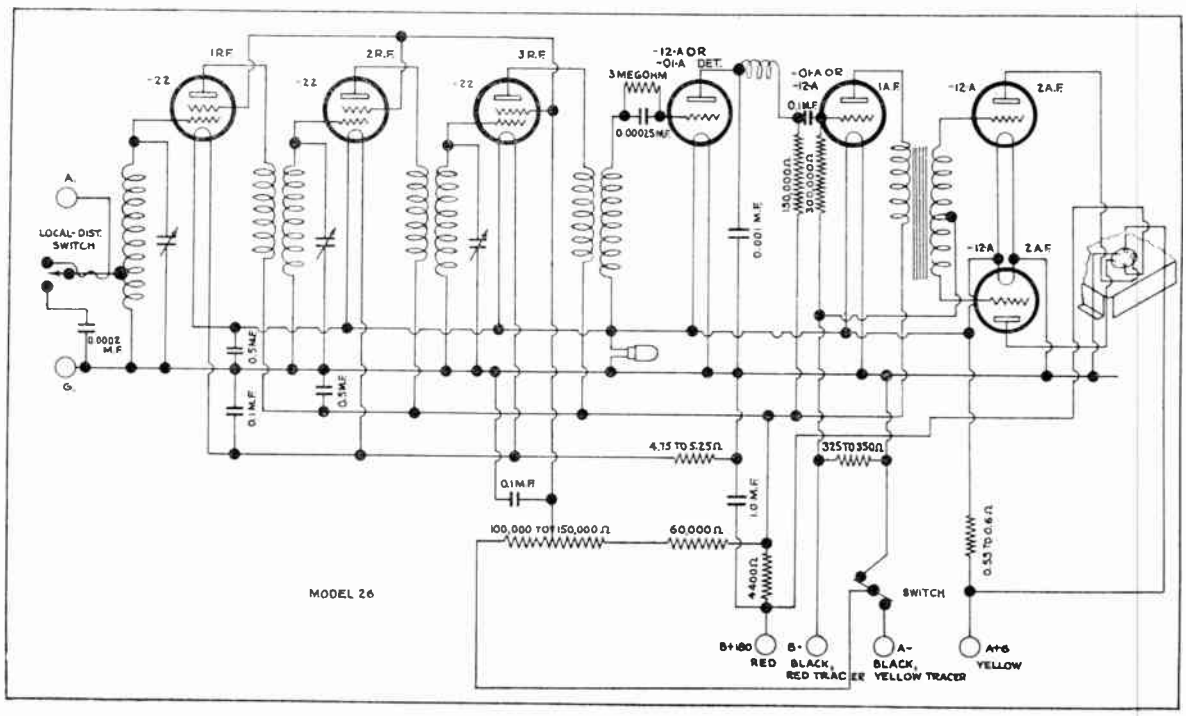
There are two resistors in the "A" battery circuit, a ballast resistor of 0.55 to 0.60 ohms in the plus "A" circuit, preventing overload of the various tube filaments, and a resistor of 4.75 to 5.25 ohms in the negative filament lead from the radio frequency tubes, for the purpose of reducing the voltage applied across the screen-grid filaments to about 3.3. The power switch is in the negative "A" circuit.

Since but one "B" voltage is applied to the receiver terminals, 180 volts, the requirements of the various tubes as to plate voltages, biasing voltages, and screen grid voltages must be taken care of by resistors connected in the circuit at appropriate positions to adjust the voltages to the desired values.

The negative "B" lead is connected to the chassis through a resistor of 325 to 350 ohms resistance. You will note that the grids of the first audio and output tubes are connected to the negative side of this resistor. The voltage drop in it provides the necessary bias for these tubes. The voltage drop in the previously mentioned 4.75 to 5.25 ohm resistor in the filament circuit supplies the necessary bias of approximately 1½ volts for the radio-frequency tubes, (since it maintains the filaments of these tubes at a positive voltage of that amount with regard to the chassis, while the control grids of the tubes are approximately at chassis potential).

A branch of the positive "B" circuit goes direct to the speaker armature, whence it passes through the speaker armature coils to the plates of the output tubes. The speaker armature coils are so connected that the direct current component of the plate current is balanced out as far as magnetic effect on the armature is concerned, while the signal current is effective in moving the armature.

A second branch of the positive "B" circuit goes through a 4400 ohm resistor and the respective transformer primaries to the plates



Model 26 Circuit

of the radio-frequency and first audio-frequency tubes. This branch of the circuit also connects to the plate of the detector tube, through an additional resistor of approximately 150,000 ohms and a radio-frequency choke.

A third branch of the positive "B" circuit leads from the negative side of the 4400 ohm "B" resistor through a fixed resistor of approximately 60,000 ohms and through the complete resistor unit of the volume control, carrying bleeder current to the chassis. The screen grids of the radio-frequency tubes are connected to the variable contact on the volume control, and are maintained at a positive potential with regard to the chassis by the voltage drop caused by the flow of bleeder current through the volume control resistor. The volume is varied by changing the positive potential applied to these grids.

Current for energizing the speaker field is supplied by the "A" battery, through two of the five speaker socket contacts. The connection of the battery to the speaker field is direct (without the interposition of the ballast resistor) as may be seen by an examination of the circuit diagram.

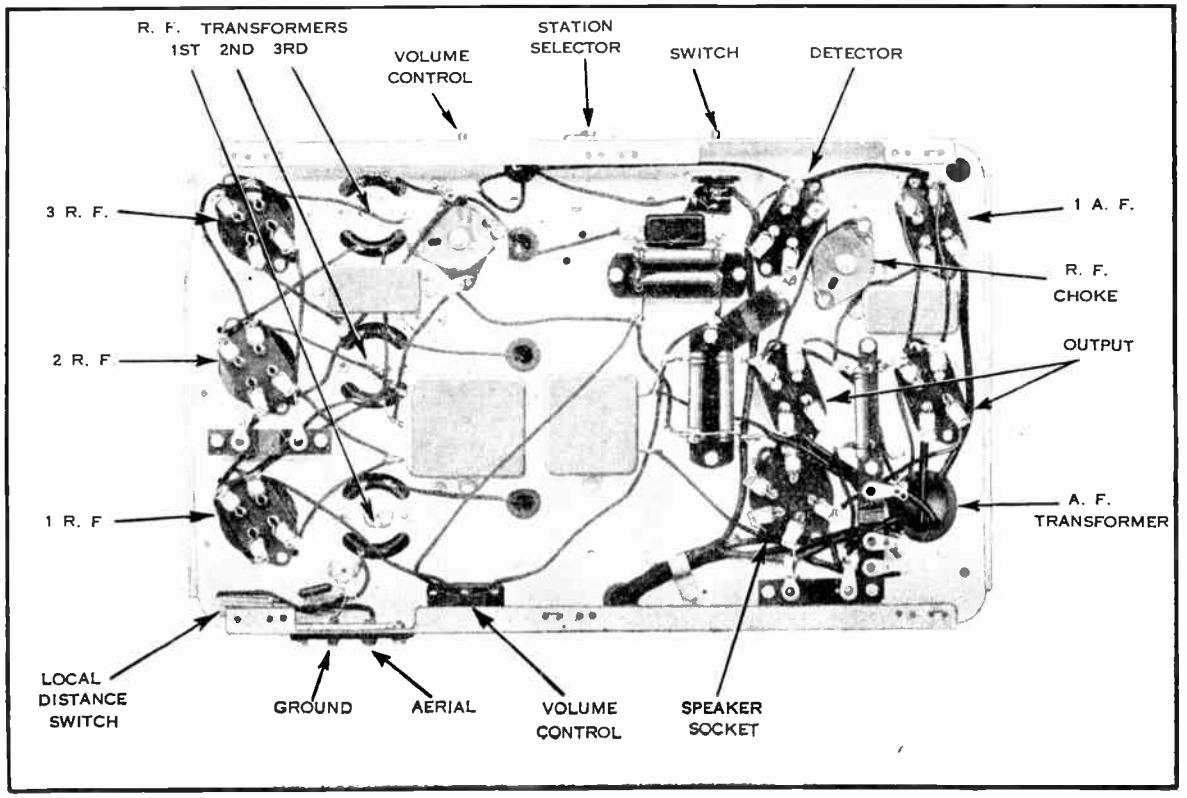
The dial light is shunted across the filament supply circuit of the detector and audio tubes.

Voltage Limits

Voltages at the tubes should be approximately as follows when the receiver is in operating condition with fully-charged and fresh batteries.

Filament Voltages	
R. F. tubes	2.4 to 2.7
Detector, 1st Audio, and Output tubes	4.3 to 4.8
Plate Voltages	
R. F. and 1st Audio tubes	120 to 130
Detector tube	110 to 120
Output tubes	150 to 160
Control Grid Voltages	
R. F. tubes	1.6 to 2.0
Detector tube	4.3 to 4.6
1st Audio and Output Tubes	4.3 to 4.6
Screen Grid Voltages	
R. F. tubes	48 to 55

The above voltages are to be measured with the speaker connected, the tubes in place, and with a fully charged "A" and fresh "B" batteries connected. Measure plate and grid voltages with a high-resistance D. C. voltmeter (600 ohms or more per volt) from plate or grid tube contact to emitter contact. The grid voltage of the 1st audio tube may be assumed to be the same as that measured for the output tubes.



Bottom View, Model 26 Chassis

Continuity Tests

The following simplified continuity tests may be used to supplement the "Voltage Limits" on the opposite page.

Circuit	Remarks	Correct Test	Incorrect Test Indicates
The following tests are to be made with a circuit tester consisting of a 45 volt "B" battery in series with a 50 volt, high-resistance voltmeter, a 1½ volt battery in series with a milliammeter of 1 m. a. range and a 1500 ohm resistor, or a similar arrangement.			
Antenna to Ground (Chassis)	Local-Distance Switch in Distance Position	Practically Full Scale	Open circuit in antenna coil, switch, or connections
Operating Grids R. F. Stages to Ground (Chassis)		Practically Full Scale	Open circuit in r. f. transformer secondaries, antenna coil, or in leads or connections
Grids Output Stage to Black Lead with Red Tracer		Part Scale	Open circuit in a. f. transformer secondary, leads, or connections
Plates All Stages to Red Lead	Speaker Connected	Part Scale	No reading indicates open circuit. Full scale reading indicates short circuit
Screen Grids R. F. Stages to Black Lead with Yellow Tracer	Switch On	Slight Deflection, depending on setting of Volume Control	No reading indicates open circuit. Full scale reading at all volume settings indicates short circuit

For methods of testing condensers, see Service Supplement No. 10, Page 3.

Parts List

INSTRUCTIONS FOR ORDERING—Give part number, description of part, and serial number of receiver on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer orders. Prices are subject to the usual trade discounts and are subject to change without notice.

Qty.	Part No.	Description	List Price Each
1	D-20119-A	Chassis	$2.00
7	W-7871	Socket	.25
7	W-7872	Socket Guide	.10
1	W-7873	Socket (5 prong speaker)	.30
1	W-7874	Socket Guide	.10
2	W-20111	R. F. Transformer	1.50
1	W-20112	R. F. Transformer (antenna)	1.50
3	W-7272	Screen Grid Connectors	.25
3	W-6436	R. F. Shield	1.00
3	W-6473	R. F. Shield Cover	.30
3	W-6474	R. F. Shield Cover Nut	.05
1	W-20148	Toggle Switch (local-dist.)	.80
1	W-20114	Volume Control	1.75
1	W-20264	Terminal Board (A & G)	.30
1	W-20115	Variable Condenser Gang (complete)	18.00
	W-4883	Dial Light Bracket	.50
	W-5352	Dial & Spider	.25
	W-5354	Dial Indicator	.25
	W-4899	Pinion	.35
	W-4907	Pinion Spring	.05
	W-20123	Pinion Stirrup	.25
	B-21057	Gang Cover	.50
	W-6474	Gang Cover Nuts	.05
1	W-20130	Power Switch	.75
1	W-20125	Detector Shield Base	.15
1	W-20124	Detector Shield	.25
1	W-20380	Push Pull A. F. Trans.	5.50
		PARTS UNDER CHASSIS	
1	W-20260	Fixed Resistance (4.75 to 5.25)	.35
1	W-20103	.0002 Mfd. Fixed Condenser	.35
1	W-4968	.5 Mfd. Fixed Condenser (2 paper)	1.20
1	W-6614	R. F. Choke	.80
1	W-7753	.1 - .5 - .1 Mfd. Fixed Cond.	2.00
1	W-4013	1. Mfd. Fixed Condenser	1.35
1	W-20829	Mounting Strip	.30
1	W-4924	.00025 Mfd. Fixed Condenser	.35
1	W-5468	3 Meg. (Grid Leak) Resistor	.50
1	W-4923	60000 Ohm Resistor (Blue, Orange Spot)	.60
1	W-6754	.001 Mfd. Fixed Condenser	.40
1	W-20829	Mounting Strip	.30
1	W-7159	4400 Ohm Resistor (Yellow, Red Spot)	.60
1	W-5735	150000 Ohm Resistor (Brown, Green, Yellow Spot)	.60
1	W-4362	Plate Choke	.50
1	W-6471	.1 Mfd. Fixed Condenser (2 paper)	1.00
1	W-5713	Mounting Strip	.25
1	W-6704	300000 Ohm Resistor, (Brown, Blk., Yellow Spot)	.60
1	W-20090	.55 to .6 Ohm Resistor	.35
1	W-20100	350 Ohm Resistor	.35
1	B-20118	Cable (4 wire)	1.75
1	W-4751	Cable Clamp	.15
5	W-4681	Grommets (3-8")	.10
1	W-5655	Grommets (1")	.10
1	C-5888	Bottom	.50
6	W-5718	Bottom Double Nut	.05
1	W-6161	Knob (large)	.45
2	W-6162	Knob (small)	.30
1	W-6328	Escutcheon	.50
1	B-7030	Front Panel (Wood Cabinet Chassis)	.75

IMPORTANT

Be sure to instruct purchasers of Crosley or Amrad radio-phonograph combinations to put a few drops of oil in the motor oil holes three to four times a year.