is clamped to the ground post. The antenna and ground posts are mounted on a small bracket that is screwed inside the back of the cabinet.

Inspect the volume control carefully. If the resistance unit is damaged, replace with resistance unit No. 9788. Bend the slider so it will make firm contact with the resistance wire. Clean off the contact end of the slider and see that the top edge of the resistance unit is free from dirt. If resistance unit is of old style with two sizes of wire, replace with new style (same part number) having one size of wire with increased spacing at one end. Also see that slider is of latest style.

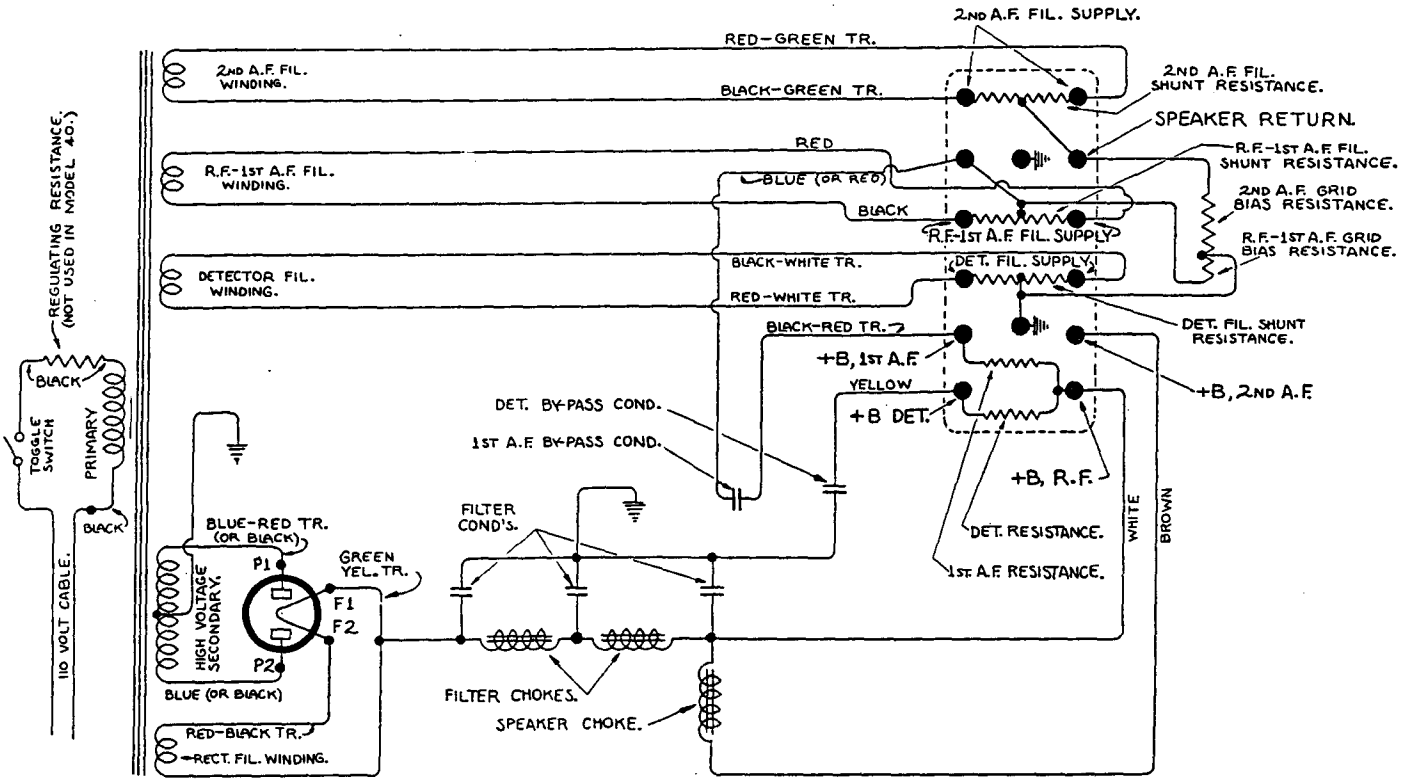

FIG. 63-A. SCHEMATIC DIAGRAM OF POWER UNIT IN MODELS 40, 42, 44, AND 52. SEE PAGE 69 FOR DESCRIPTION OF THIS UNIT. SOME EARLY UNITS OF THIS TYPE HAVE COLOR SCHEME SIMILAR TO UNIT IN MODEL 38 SET. NOTE THAT COLORS AS NOW STANDARDIZED CORRESPOND WITH THE COLORS OF SET-CABLE LEADS.

Power Units in Models 37 and 38 Sets

General Description

Power units in Models 37 and 38 receiving sets are mounted inside the metal cabinet of the set. The units are encased in a metal cover which has an opening in the left hand end of the top for insertion of the rectifier tube.

The power unit is designed for operation on 110 volt, alternating current, and furnishes complete filament, plate and grid voltages to the set.

The unit has two metal containers, one for the power transformer and one for the condensers and chokes.

Information about Atwater Kent power units is given in the Section I of this Manual.

Removing Unit from Cabinet

Remove the cover and cable connection panel from the power unit and remove the set itself from the cabinet. (See instructions for removing 37 set chassis from cabinet). Then remove the A. C. toggle switch by loosening the hexagonal nut with an open-end wrench, unscrewing the front knurled lock-nut with the fingers. Never use a wrench or pliers on the knurled nut, as it will scratch up the nut and probably mar the finish of the cabinet. Note that the toggle switch leads come from the right hand side of the cabinet; arrange the switch in the same way when replacing so it will be "on" when the button is pushed to the right.

The power unit is held to the cabinet by three screws at each end, two of the six screws being the two rear

(Continued on page 62.)

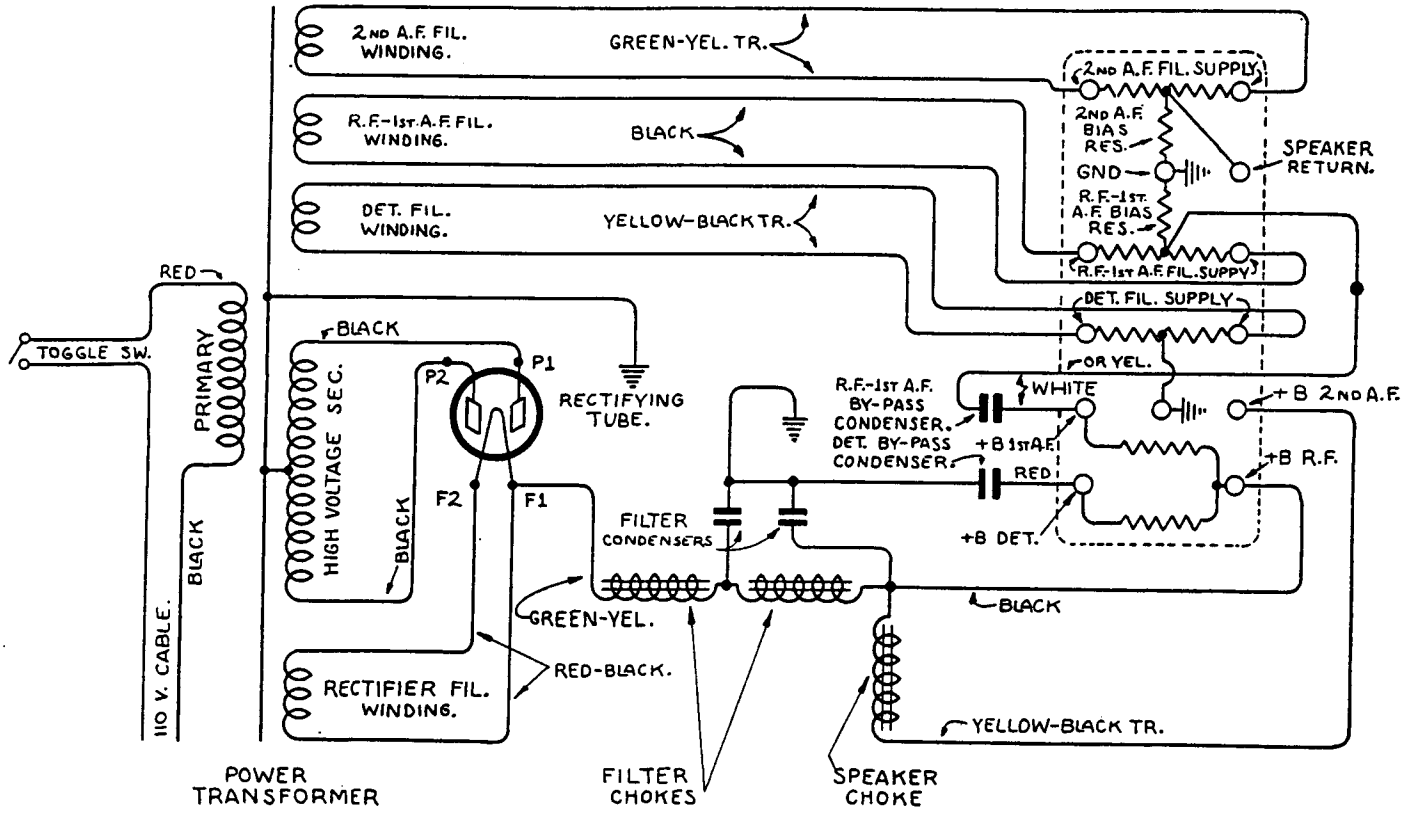

FIG. 64. DIAGRAM OF POWER UNIT IN MODELS 37 AND 38

The diagram of the power unit in Models 40, 42, 44 and 52 is similar to that shown above with the following exceptions: A regulating resistance is connected in series with the primary circuit in Models 42, 44 and 52. A filter condenser is connected between F1 and ground. The junction point of the bias resistance is connected to the lower instead of the upper ground eyelet. The color scheme is different and is shown in Fig. 77.

Continuity Test Table and Chart—Power Unit for Models 37 and 38

For Following Tests Remove Cable Panel from Power Unit

TEST	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Across 2nd A.F. Filament Supply.	*Full*	None—Open 2nd A.F. fil. winding and open 2nd A.F. filament shunt resistance.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
Across R.F.-1st A.F. Filament Supply.	*Full*	None—Open R.F.-1st A.F. fil. winding and open R.F.-1st A.F. fil. shunt res.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
Across Detector Filament Supply.	*Full*	None—Open det. fil. winding and open detector filament shunt resistance.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
FROM +B R.F. to			
+B 2nd A.F.	*Partial*	None—Open speaker (output) choke.	Full—Shorted speaker choke.
+B 1st A.F.	*Small*	None—Open 1st A.F. plate circuit res.	
+B Detector.	*Very Small*	None—Open detector plate circuit res.	
Ground.	*None*	Shorted filter condenser.	
F1 (on Rectifier Tube Socket.)	*Partial*	None—Open plate supply filter choke.	
FROM GROUND to			
+B Detector.	*None*	Shorted by-pass condenser.	
One Side of 2nd A.F. Filament Supply.	*Partial*	None—Open 2nd A.F. grid bias resistance.	Full—Shorted bias resistance.
One Side of R.F.-1st A.F. Filament Supply.	*Partial*	None—Open R.F.-1st A.F. grid bias resis.	Full—Shorted bias resistance.
One Side of Detector Filament Supply.	*Full*	Open connection to center-tap of detector filament shunt resistance.	Examine connections under panel assembly.
+B 1st A.F.	*None*	Shorted by-pass condenser.	
P1, P2 (on Rectifier Tube Socket.)	*Nearly Full*	None—Open high voltage sec. winding.	
Each Terminal of A.C. Plug.	*None*	Grounded primary of power transformer.	Inspect A.C. cable and switch leads for accidental grounds.
OTHER TESTS			
Across Terminals of A. C. Plug. (Toggle Switch "On.")	*Full*	Open primary of transformer or open cable or switch leads.	
F1 to F2 (on Rectifier Tube Socket.)	*Full*	Open rectifier filament winding or connections.	
One Side of 2nd A.F. Filament Supply to Speaker Return Terminal.	*Full*	Open connection to center-tap of 2nd A.F. filament shunt resistance.	

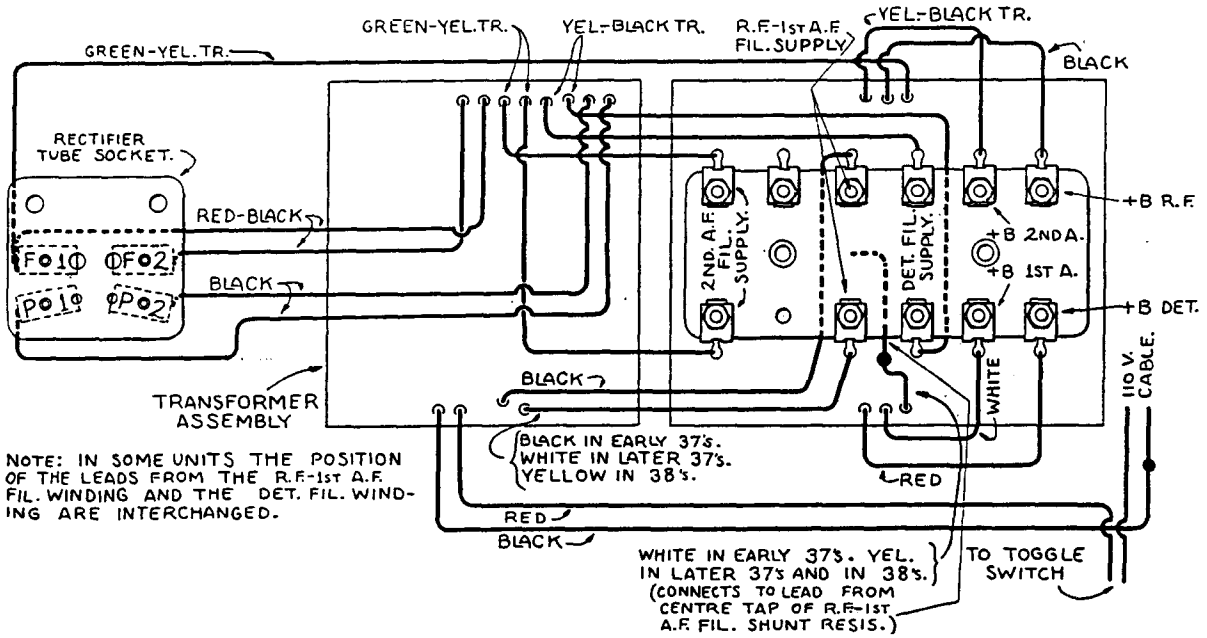

FIG. 65. SHOWING CONNECTIONS FROM TRANSFORMER AND CONDENSER-CHOKE ASSEMBLIES TO PANEL ASSEMBLY

This view shows the approximate position of leads from the metal containers. In replacement condenser-choke assemblies for Model 38 the lead to +B first A. F. terminal is sometimes black-red tracer instead of white.

felt-headed feet of the cabinet. The transformer and condenser-choke sections are held to the base of the power unit by three long bolts and a single heavy metal strap. The panel assembly is fastened to the metal strap by two screws and nuts—one the ground terminal and the other at the center toward the opposite end of the panel assembly.

Note that a bare braided wire comes from each metal container and that these wires are soldered to lugs which are fastened to two of the long bolts.

Testing

Apply the continuity tests given in the table. If the tests indicate that one section of the unit is defective, replace that section, connecting it exactly as the original.

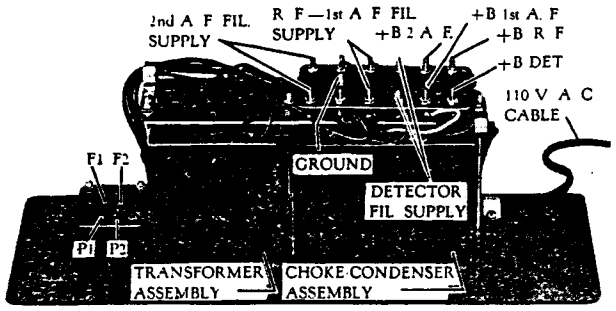

FIG. 66. POWER UNIT IN MODELS 37 AND 38. COVER REMOVED

The unit illustrated is for a Console 37 and the two terminals on either side of the ground terminal are used for toggle switch connection in the 110 volt line.

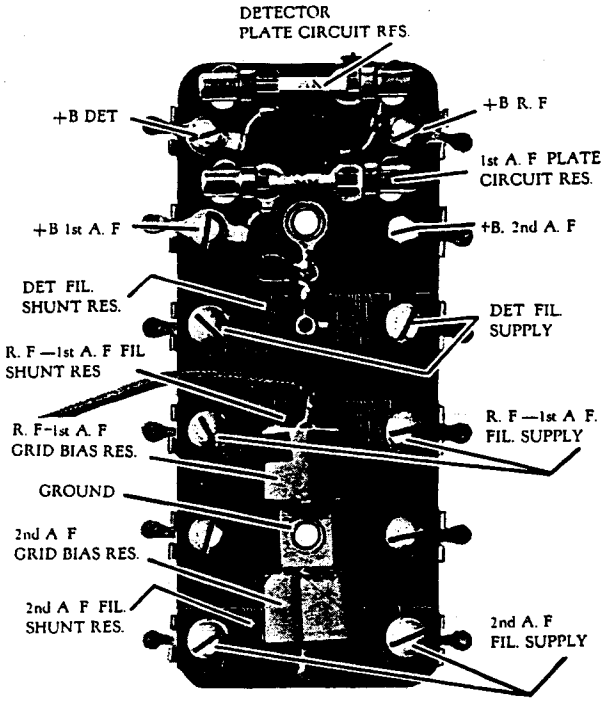

FIG. 67. REAR VIEW OF PANEL ASSEMBLY ON MODELS 37, 38 AND LATER TYPE "Y" POWER UNITS

The terminal on the right hand side of the ground eyelet is used as "speaker-return" terminal on later Models 37 and 38 sets. In Model 37 Console sets, and in later type "Y" power units, the terminals on either side of the ground eyelet are used for toggle switch connection in the 110 volt line.

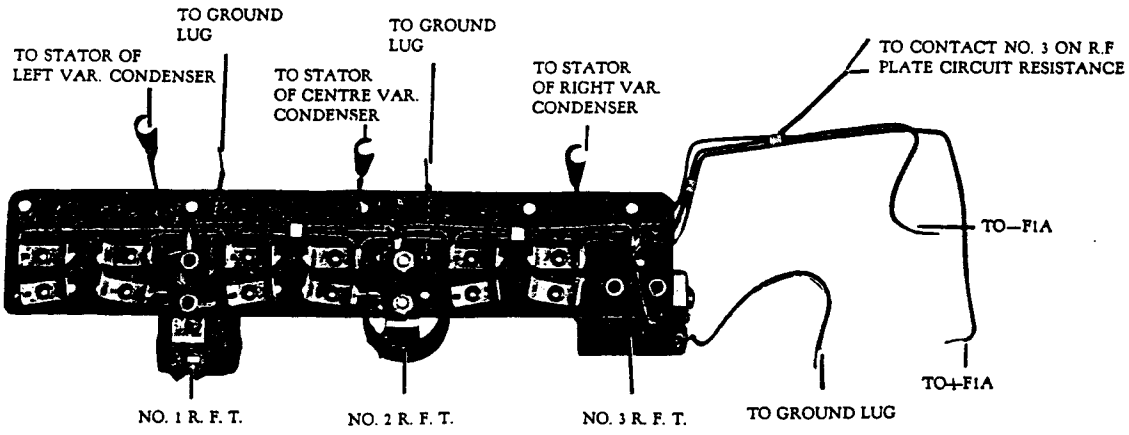

FIG. 68. VIEW OF R. F. AMPLIFIER ASSEMBLY IN MODELS 40, 42 AND 52, SHOWING WHERE EACH LEAD IS TO BE CONNECTED

Model 40, 42, and 52 Sets

General Description

The Models 40, 42 and 52 are six-tube single-dial A. C. receivers with complete power unit incorporated in the metal cabinet that houses the set. The power unit operates from 110 volt, alternating current, and supplies complete filament, plate and grid voltages to the set. The power unit is sealed in a single metal container.

Models 42 and 52 are equipped with an automatic voltage regulator in series with one side of the A. C. line. This device is so designed that owing to the heating effect, a voltage above normal (110) will increase its resistance value, and a voltage below normal will decrease its resistance, so that the voltage across the primary of the transformer is maintained at a constant value.

The circuit of each set has three stages of radio frequency amplification, the first stage acting as a coupling tube in order to eliminate the detuning effect of different antenna sizes (which would otherwise disturb the synchronism of the three tuned circuits). There is a tuned detector and two stages of audio frequency amplification.

The volume control consists of a resistance connected across a section of the antenna coupling transformer. A slider on this resistance connects to ground, and the antenna is connected to one side of the resistance. By adjusting the slider, more or less of the antenna current may be shunted to ground, thus decreasing or increasing the volume.

Model 52 has a metal cabinet about thirty inches high, with a cone speaker mounted in the lower section of the cabinet.

Removing Set from Cabinet

Lift off the cover of the power unit and remove the nuts from posts which pass through the holes in cable connection panel, releasing the cable from power unit.

Remove dial and vernier knob. Remove two screws which hold antenna-and-ground post bracket on inside back of cabinet. (Model 52 does not have this bracket.) Remove the six screws, three in a vertical row at each end, which clamp the chassis to the inside front of cabinet. Pull chassis straight back horizontally to allow condenser shaft and volume control to clear front of cabinet, then lift set up and out.

In Model 52 pull up the antenna and ground leads and remove speaker leads from posts on set.

Replacing Variable Condensers

If one variable condenser is defective, replace entire group of three condensers. Use pulleys and belts of original group.

Procedure: Remove set from cabinet. Loosen nine screws holding condensers to front of metal frame. Note how pulleys and belts are arranged and then remove them. Replace one condenser at a time. Do not mix old condensers with the replacements.

Remove two nuts on back of first variable condenser, which clamp grid resistor (grid condenser on last variable condenser) and lug of secondary lead. Remove three screws holding condenser to chassis and lift out the condenser.

Put in the replacement condenser and its three screws, without tightening screws, attach grid resistor and lug of secondary lead to top and bottom bolts respectively on back of condenser. Repeat procedure with other two variable condensers. When the replacement condensers are installed, put on the pulleys and belts, adjust belt tension and synchronize condensers (see Section XI).

Replacing R. F. Transformers

If one R. F. transformer is defective, replace R. F. amplifier assembly. (See Fig. 68.) The R. F. amplifier assembly consists of three R. F. transformers mounted on a three-socket moulded base. The filament contacts are wired and have two leads for connection to filament contacts of first A. F. socket. The plate circuits are wired and have one lead for connection to the left hand contact (No. 3) on the R. F. plate circuit resistance. A lead from the grid end of each R. F. transformer is soldered to a lug which is to be fastened to the bottom bolt on back of the variable condenser immediately in front of each R. F. transformer. The three return-leads from secondaries of each R. F. transformer are to be soldered to ground lugs which are held by bolts that clamp the R. F. amplifier base to the frame of set.

In replacing R. F. amplifier assembly, the chassis must be removed from the cabinet. Unsolder three leads from by-pass condenser, lead from grid contact of the first R. F., socket, leads from the grid resistors (unsolder at grid contacts of sockets), two filament circuit leads (at filament contacts of first A. F. socket), and the +B, R. F. lead. Remove secondary wire lug from bottom bolt on each variable condenser. Unsolder, at grid contact, the lead from grid condenser, which passes through a hole in the R. F. base. Unsolder three leads from secondaries of R. F. transformers where they are soldered to lugs under bolts holding R. F. base to metal frame. Remove five bolts holding R. F. base to metal chassis and remove the old R. F. amplifier assembly.

Reassemble with replacement R. F. amplifier, reversing above procedure.

Replacing Volume Control

Remove chassis from cabinet.

The volume control is held to the metal frame by two screws and nuts and is mounted in such a way that the three terminals are on the right hand side when looking at the chassis in its normal position. Remove the two screws, using a long-nose pliers to grip the bottom nut, which is close to the second A. F. transformer.

(Continued on next page.)

A yellow lead connects the top one of the three terminals to the inside end of the antenna coupling transformer.

A red lead connects the bottom one of the three terminals to the tap on the antenna coupling transformer.

A green lead runs from the center terminal (slider contact) to a (ground) lug held under the right hand bolt that clamps the base of the R. F. amplifier assembly to the metal frame.

The lead from the antenna post runs through a braided metal shield and is soldered to the lower one of the three terminals on the volume control. The metal braid is clamped to the center one of the three terminals. The other end of the metal braid is clamped to the ground post.

Model 52 does not have the shielded antenna lead. In this set two twenty-foot leads are connected to the volume control, black for antenna, and black-green tracer for ground.

(The outside end of the antenna coupling transformer is connected to the grid contact of the first R. F. socket).

Inspect the volume control carefully. If the resistance unit is damaged, replace with latest style of resistance unit. Bend the slider so it makes firm contact with resistance wire. Clean the contact end of the slider and the top edge of the resistance unit. See that slider is of latest type.

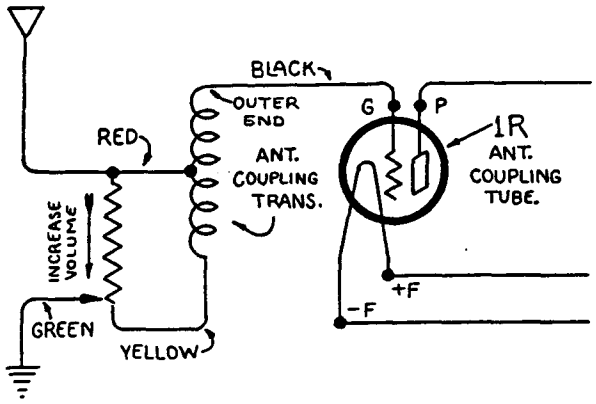

FIG. 69. SCHEMATIC DIAGRAM OF VOLUME CONTROL, MODELS 40, 42, 44 AND 52

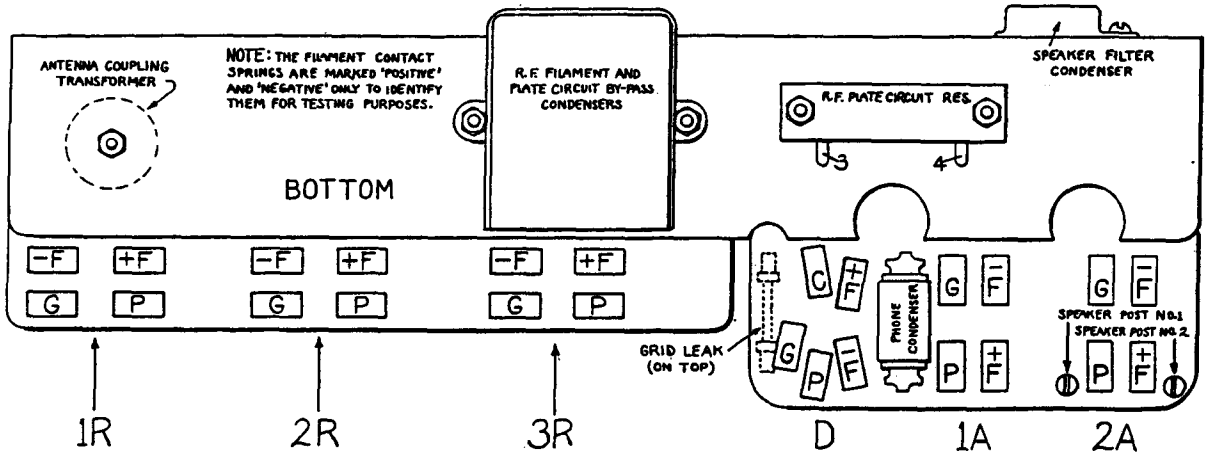

FIG. 70. TEST CHART FOR MODELS 40, 42, 52

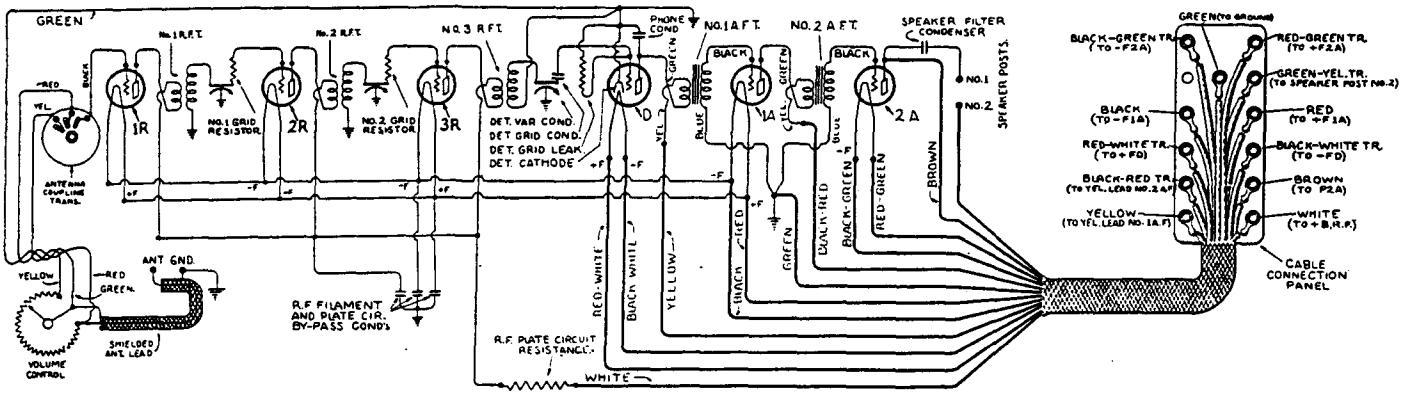

FIG. 71. WIRING DIAGRAM OF MODELS 40, 42 AND 52

Model 52 does not have the shielded antenna lead, but is provided with two twenty-foot leads which are connected to the volume control, black for antenna and black-green tracer for ground.

Continuity Test Table—Models 40, 42 and 52

Colors Refer to Cable Leads

For Following Tests Remove Cable Panel from Power Unit

TEST FROM	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Red-Green Tr. to +F2A Black-Green Tracer to —F2A Red-White Tr. to +FD Black-White Tracer to —FD Red to +F1A Black to —F1A Green-Yellow Tracer to Speaker Post No. 2. Green to Ground Post. Brown to P2A. White to 4 (on R.F. Plate Resistance).	*Full*	Open in cable or connection.	Examine soldered connections at cable connection panel and set.
GREEN to			
P1A	*None*	Grounded 1st A.F. plate circuit.	
PD	*None*	Grounded detector plate circuit.	Or shorted phone condenser.
P3R	*None*	Grounded R.F. plate circuit.	Or shorted R.F. by-pass condenser.
+F3R, —F3R	*None*	Grounded R.F.-1st A.F. filament circuit.	Or shorted R.F. by-pass condenser.
+FD, —FD	*None*	Grounded detector filament circuit.	
+F2A, —F2A	*None*	Grounded 2nd A.F. filament circuit.	
G2R, G3R	*Partial*	None—Open grid resistor or secondary No. 1, 2 R.F.T. Full—Shorted grid circuit.	Test across resistors and secondaries separately. (Resistors mounted on back of R.F. var. conds.)
G1R	*Full*	Open antenna coupling transformer.	Volume control full right.
G1A	*Partial*	None—Open secondary No. 1 A.F.T.	Full—Shorted secondary.
G2A	*Partial*	None—Open secondary No. 2 A.F.T.	Full—Shorted secondary.
Stator of Detector Variable Condenser	*Full*	Open secondary last R.F.T.	
CD	*Full*	Open cathode lead.	
WHITE to			
3 (on R.F. Plate Res.)	*Partial*	None—Open R.F. plate circuit resistance.	Full—Shorted R.F. plate circuit res.
P1R, P2R, P3R.	*Partial*	Open primary No. 1, 2, 3 R.F.T.	
YELLOW to			
PD	*Partial*	None—Open primary No. 1 A.F.T. (or open in cable connection).	Full—Shorted primary.
Black-Red Tracer to			
P1A	*Partial*	None—Open primary No. 2 A.F.T. (or open in cable connection).	Full—Shorted primary.
OTHER TESTS			
GD to Stator of Last Condenser.	*None*	Shorted grid condenser.	Mounted on back of det. var. cond.
P2A to Speaker Post No. 1.	*None*	Shorted speaker filter condenser.	
G1R to Ant. Terminal.	*Full*	Open antenna connection.	
To Test Volume Control, Unsolder Red Lead from Antenna Coupling Transformer and Test Across Antenna and Ground Terminals, Turning Control Knob.	*Smooth and Nearly Full*	No reading—open resistance winding. Erratic reading—damaged resistance winding or slider.	If found defective, repair or install new control. Resolder red lead.

Model 44 Set

General Description

Model 44 set is similar to the Model 38 in design, but with the same improvements as contained on the Model 42, that is, newly designed cabinet, antenna coupling transformer and automatic voltage regulator. The power unit of Model 44, as in Models 40, 42 and 52, is sealed in a single metal container. Model 44 also contains the "local-distance" switch which is featured in the Model 38, but in Model 44, this switch cuts out a part of the primary of the second R. F. T.

The circuit has four stages of radio frequency amplification (with double-coil type R. F. transformers), a tuned detector, and two stages of audio frequency amplification. The first R. F. tube acts as an antenna coupling tube. The second A. F. stage is of the power type with condenser-choke coupling to the speaker.

The volume control consists of a resistance connected across a portion of the antenna coupling transformer. The slider on this resistance connects to ground, and the antenna connects to one end of the resistance. By turning the slider (ground) toward the antenna end of the resistance, the volume is decreased.

Removing Set from Cabinet

Lift off the cover of power unit and remove nuts from posts which pass through holes in the cable connection panel, releasing the cable. Remove dial and vernier knob. Remove two screws which hold antenna-and-ground post bracket on back of cabinet.

As in the Model 38, the chassis of the Model 44 is held to the cabinet by eight machine screws, all reached from inside the cabinet. Three screws are in a vertical

(Continued on page 68.)

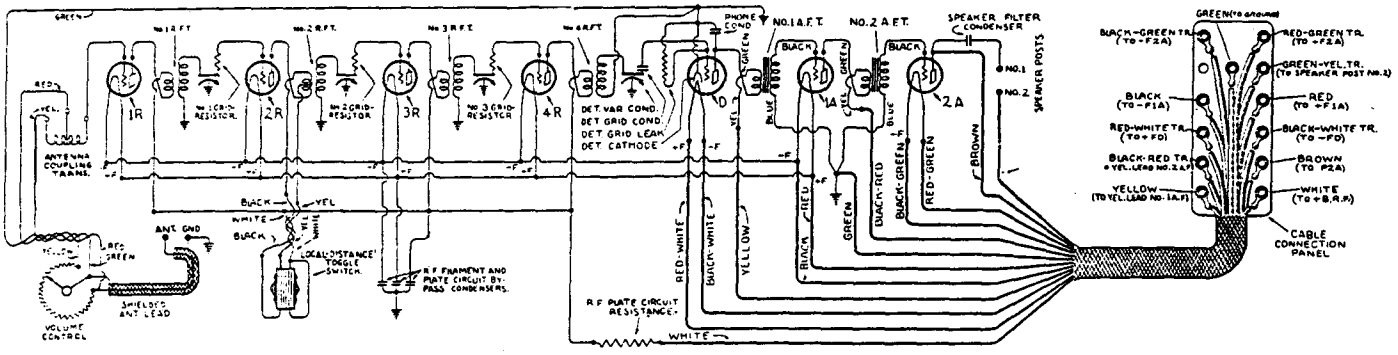

FIG. 72. WIRING DIAGRAM OF MODEL 44

A schematic diagram of the volume control is shown in Fig. 69. The ground connection to the R. F. by-pass condensers, in this and other models, is made through the metal container in which the condensers are sealed. A pictorial representation of the antenna coupling transformer is shown in Fig. 71.

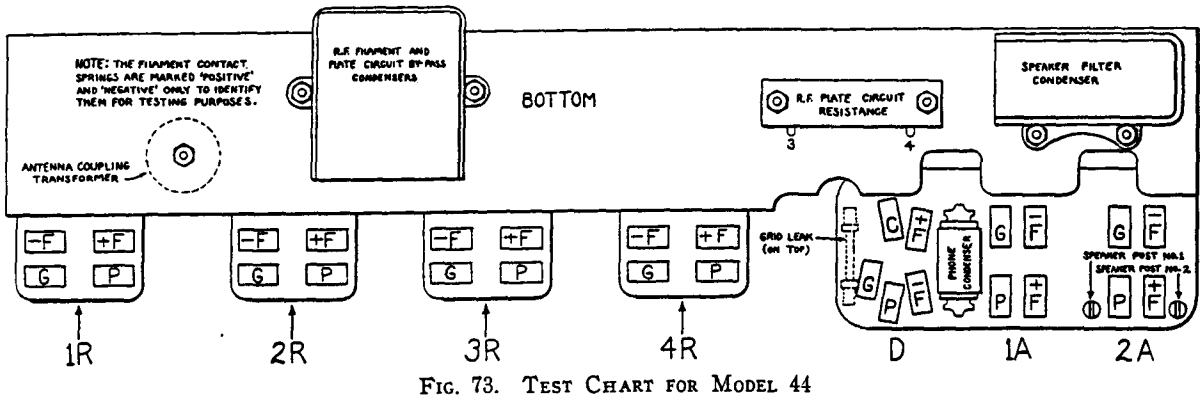

FIG. 73. TEST CHART FOR MODEL 44

Continuity Test Table—Model 44

Colors Refer to Cable Leads

For Following Tests Remove Cable Panel from Power Unit

TEST FROM	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Red-Green Tr. to +F2A Black-Green Tracer to —F2A Red-White Tr. to +FD Black-White Tracer to —FD Red to +F1A Black to —F1A Green-Yellow Tracer to Speaker Post No. 2. Green to Ground Post. Brown to P2A White to 4 (on R.F. Plate Resistance.)	*Full*	Open in cable or connection.	Examine soldered connections at cable connection panel and set.
GREEN to			
P1A	*None*	Grounded 1st A.F. plate circuit.	
PD	*None*	Grounded detector plate circuit.	Or shorted phone condenser.
P3R	*None*	Grounded R.F. plate circuit.	Or shorted by-pass condenser.
+F3R, —F3R	*None*	Grounded R.F.-1st A.F. filament circuit.	Or shorted by-pass condenser.
+FD, —FD	*None*	Grounded detector filament circuit.	
+F2A, —F2A	*None*	Grounded 2nd A.F. filament circuit.	
G2R, G3R, G4R	*Partial*	None—Open grid resistance or secondary No. 1, 2, 3 R.F.T. Full—Shorted grid circuit.	Test across grid resistors separately. (Mounted on back of R.F. variable condensers.)
G1A	*Partial*	None—Open secondary No. 1 A.F.T.	Full—Shorted secondary.
G2A	*Partial*	None—Open secondary No. 2 A.F.T.	Full—Shorted secondary.
G1R	*Full*	None—Open antenna coupling transformer.	Volume control full right.
Stator of Detector Variable Condenser.	*Full*	Open secondary last R.F.T.	
CD	*Full*	Open cathode lead.	
WHITE to			
3 (on R.F. Plate Res.)	*Partial*	None—Open R.F. plate circuit resistance.	Full—Shorted R.F. plate circuit res.
P1R, P2R, P3R, P4R ("Local-Distance" Switch Up.)	*Partial*	None—Open primary No. 1, 2, 3, 4 R.F.T.	Partial reading to P2R with "Local-distance" switch down.
YELLOW to			
PD	*Partial*	None—Open primary No. 1 A.F.T.	Full—Shorted primary No. 1 A.F.T.
Black-Red Tr. to P1A	*Partial*	None—Open primary No. 2 A.F.T.	Full—Shorted primary No. 2 A.F.T.
OTHER TESTS			
GD to Stator of Last Variable Condenser.	*None*	Shorted grid condenser.	Mounted on back of det. var. cond.
P2A to Speaker Post No. 1.	*None*	Shorted speaker filter condenser.	
G1R to Antenna Post.	*Full*	Open antenna connection.	
To Test Volume Control, Unsolder Red Lead from Antenna Coupling Transformer and Test Across Antenna and Ground Terminals. Turning Control Knob.	*Smooth and Nearly Full*	No reading—open in resistance winding. Erratic reading—damaged resistance wire or slider.	If found defective, repair or install new control. Resolder red lead.

row at each end, the seventh is near the center of the horizontal side of the metal frame of set, and the eighth is near the center of the vertical side of the metal frame. Remove these screws, pull the set straight back, so the condenser shaft and volume control clear the cabinet and then lift the set up and rest it on top of the cabinet while removing the "local-distance" toggle switch from front of cabinet. Remove switch by loosening hexagonal nut with an open end wrench and unscrewing front knurled lock nut with fingers. Never use a wrench or pliers on the knurled nut.

Replacing Variable Condensers

If one variable condenser is defective, replace entire group of four variable condensers. Use pulleys and belts of original group.

Procedure: Remove set from cabinet. Loosen twelve screws holding variable condensers to metal frame. Note how pulleys and belts are arranged and then remove them. Replace one condenser at a time.

Remove the double R. F. transformers which are mounted on backs of variable condensers (do not unsolder transformer leads), at the same time removing the grid resistors, the grid condenser and the lugs of secondary leads, which are held to the condensers by the same nuts that hold the R. F. transformer brackets.

Remove the three screws holding first condenser, lift out the condenser and put in replacement without tightening screws. Mount the 1st R. F. transformer, the first grid resistor and the secondary lead lug, on the two bolts on back of the condenser. Make certain that the axes or long sides of the transformer coils are vertical. This may be checked by seeing that the sides of coils are parallel to the vertical metal strip on the back of the condenser.

Repeat procedure with each condenser and when all four are in place, put on the pulleys and belts, adjust belt tension and synchronize condensers (see Section XI).

Replacing R. F. Transformers

If one double R. F. transformer is defective, replace entire group of four R. F. transformers.

Procedure: Remove set from cabinet. In replacing Double R. F. transformers, substitute one transformer at a time, mounting and connecting the replacement exactly like the original. Do not mix up the old coils with the replacements.

Remove two nuts on back of first variable condenser which hold R. F. transformer brackets, unsolder transformer connections and remove old transformer Put replacement transformer in position, seeing that the grid resistor and lug of secondary lead are replaced properly, and tighten the two nuts. The transformer angle brackets must be arranged so that the axis or long side of the coil is vertical. This may be checked by seeing that the long sides of the coils are parallel to the vertical metal strip on the back of the variable condenser. Solder leads exactly like the original.

Repeat procedure with each R. F. transformer.

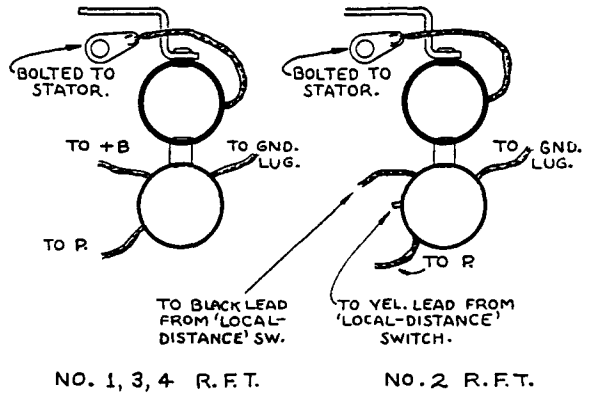

FIG. 74. SKETCH SHOWING CONNECTIONS FROM R. F. TRANSFORMERS

Replacing Volume Control

Remove chassis from cabinet.

The volume control is held to the metal frame by two screws and nuts and is mounted in such a way that the three terminals are on the right hand side when looking at the chassis in its normal position. Remove the two screws, using a long-nose pliers to grip the bottom nut, which is close to the second A. F. transformer.

A yellow lead connects the top one of the three terminals to the inside end of the antenna coupling transformer.

A red lead connects the bottom one of the three terminals to the tap on the antenna coupling transformer.

A green lead runs from the center terminal (slider contact) to a (ground) lug held under the right hand bolt that clamps the fourth R. F. socket to the metal frame.

The lead from the antenna post runs through a braided metal shield and is soldered to the lower one of the three terminals on the volume control. The metal braid is clamped to the center one of the three terminals. The other end of the metal braid is clamped to the ground post.

(The outside end of the antenna coupling transformer is connected to the grid contact of the first R. F. socket).

Inspect the volume control carefully. If the resistance unit is damaged, replace with latest style resistance unit. Bend the slider so it makes firm contact with the resistance wire. Clean the contact end of the slider and the top edge of the resistance unit. See that slider is of latest type.

Power Units in Models 40, 42, 44 and 52 Sets

Power units in Models 40, 42, 44 and 52 are very much like the later type "Y," the 37 and the 38 power units, the greatest difference being that all parts, with the exception of the panel assembly and tube socket, are sealed in a single container. The grid bias resistances are wound on a long strip instead of in two small separate sections. Models 42, 44 and 52 also have a regulating or ballast resistance in series with the primary of the power transformer. This resistance automatically compensates for line voltage variations and fluctuations.

Removing Power Unit from Cabinet

The power units in Models 40, 42, 44 and 52 receiving sets are sealed in a single metal container which is fastened inside the set cabinet by two screws at each end of the bottom and three screws at the top of the back. The rectifier tube socket is mounted on an angle bracket at the left hand end of the power unit. The panel assembly is fastened to the unit by two bolts and nuts which pass through the grid bias resistance strip. One of these bolts is the ground terminal.

Remove the cover or lid of the power unit (it is not screwed down) and release the cable connection panel from the panel assembly. Then remove set chassis from the cabinet. (See instructions for removing 40, 42, 44 and 52 receiving sets from cabinets). Loosen hexagon nut on A. C. toggle switch and unscrew front knurled lock nut with fingers. Note that the leads to the toggle switch come from the right, so that the switch is "on" when the toggle is thrown to the right.

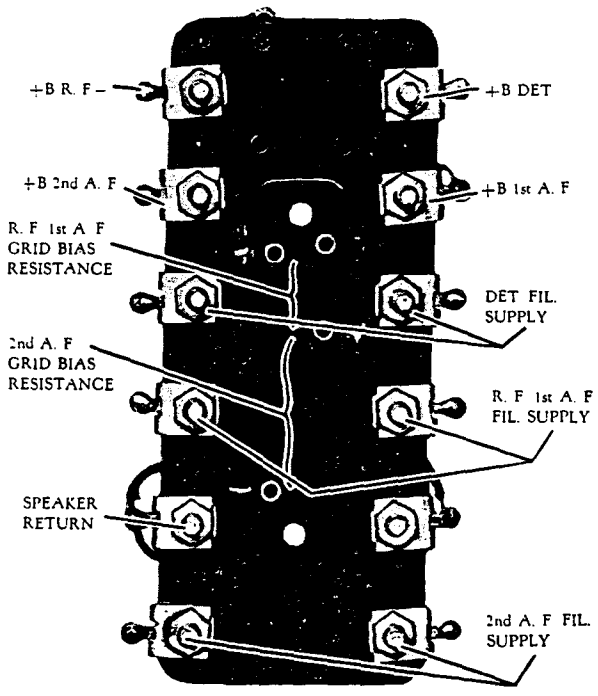

FIG. 75. TOP VIEW OF PANEL ASSEMBLY USED IN POWER UNIT OF MODELS 40, 42, 44 AND 52

Remove screws holding power unit and remove two screws on strap which holds the 110 volt cable and the switch leads. The power unit may then be lifted out, pulling the 110-volt cable through the hole in cabinet.

In Model 52 the four nuts on the bolts holding the bottom of the power unit to the shelf of the cabinet are rather inaccessible unless the rear grill is removed. Or, if desired, one person may hold the nuts with a hexagon wrench while another turns the screws.

Testing

Apply the continuity tests given in the table on the following page. If the tests indicate that one of the resistances is defective, it may be replaced. If anything is defective in the power transformer chokes or condensers (which are all sealed as a unit in the metal container), remove the lid of unit, the panel assembly, the toggle switch, the cable, the regulating resistance, and the rectifier tube socket, substitute a new sealed container for the defective one and connect the panel assembly, switch, cable, regulating resistance and socket to the new sealed container exactly like the original.

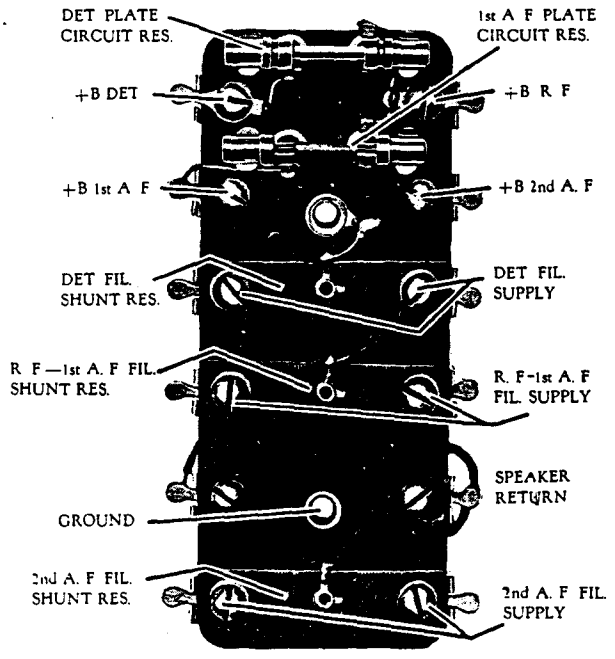

FIG. 76. BOTTOM VIEW OF PANEL ASSEMBLY USED IN POWER UNIT OF MODELS 40, 42, 44 AND 52

The terminal at the left of the ground eyelet (in this view) is used as a junction point for the lead from the centre-tap of the R.F. 1st A.F. filament shunt resistance, and the blue (red in some models) lead from the 1st A.F. by-pass condenser. This terminal is not connected to the set.

Continuity Test Table—Power Unit for Models 40, 42, 44 and 52

For Following Tests Remove Cable Connection Panel from Unit

TEST	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Across 2nd A.F. Filament Supply.	*Full*	None—Open 2nd A.F. fil. winding and open 2nd A.F. filament shunt resistance.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
Across R.F.-1st A.F. Filament Supply.	*Full*	None—Open R.F.-1st A.F. fil. winding and open R.F.-1st A.F. fil. shunt res.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
Across Detector Filament Supply.	*Full*	None—Open det. fil. winding and open detector filament shunt resistance.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
FROM +B R.F. to			
+B 2nd A.F.	*Partial*	None—Open speaker (output) choke.	Full—Shorted speaker choke.
+B 1st A.F.	*Small*	None—Open 1st A.F. plate circuit res.	
+B Detector.	*Very Small*	None—Open detector plate circuit res.	
Ground.	*None*	Shorted filter condenser.	
F1 (on Rectifier Tube Socket.)	*Partial*	None—Open plate supply filter choke.	
FROM GROUND to			
+B Detector.	*None*	Shorted by-pass condenser.	
One Side of 2nd A.F. Filament Supply.	*Partial*	None—Open 2nd A.F. grid bias resistance.	Full—Shorted bias resistance.
One Side of R.F.-1st A.F. Filament Supply.	*Partial*	None—Open R.F.-1st A.F. grid bias resis.	Full—Shorted bias resistance.
One Side of Detector Filament Supply.	*Full*	Open connection to center-tap of detector filament shunt resistance.	Examine connections under panel assembly.
+B 1st A.F.	*None*	Shorted by-pass condenser.	
P1, P2 (on Rectifier Tube Socket.)	*Nearly Full*	None—Open high voltage sec. winding.	
Each Terminal of A.C. Plug.	*None*	Grounded primary of power transformer.	Inspect A.C. cable and switch leads for accidental grounds.
OTHER TESTS			
Across Terminals of A. C. Plug. (Toggle Switch "On.")	*Full*	Open primary of transformer or open cable or switch leads.	
F1 to F2 (on Rectifier Tube Socket.)	*Full*	Open rectifier filament winding or connections.	
One Side of 2nd A.F. Filament Supply to Speaker Return Terminal.	*Full*	Open connection to center-tap of 2nd A.F. filament shunt resistance.	

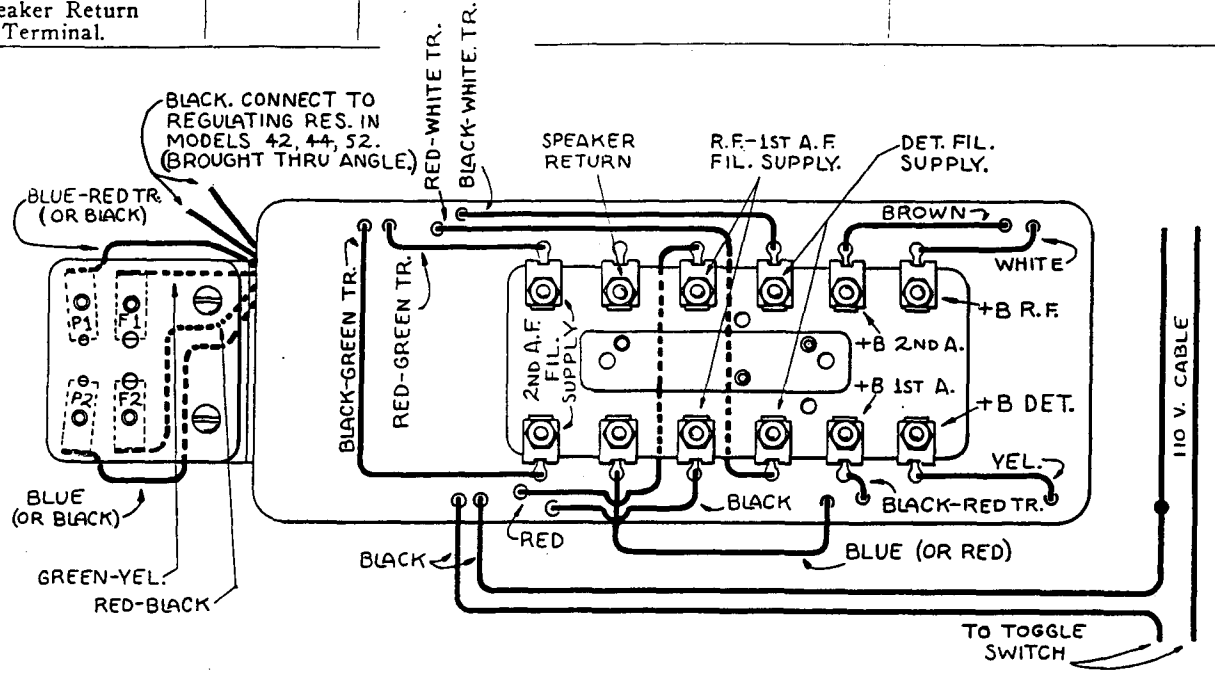

FIG. 77. POWER UNIT IN MODELS 40, 42, 44 AND 52, SHOWING CONNECTIONS FROM SEALED CONTAINER TO PANEL ASSEMBLY, RECTIFIER SOCKET AND REGULATING RESISTANCE

This view shows the approximate position of leads from sealed container. In Models 42, 44 and 52, a hole is cut in the rectifier-socket mounting angle and the two black leads are brought up through the hole and connect to the regulating resistance, which is mounted upright at the left-hand end of the sealed container.

Voltage Test Chart
Atwater Kent A. C. Sets
(Measurements made while set is in operation)

FIL. VOLTAGES (Use 0-5 A. C. meter)	TEST TERMINALS (Colors of cable leads)	Model 36 Model 37 to Serial No. 1,265,000	Model 37, Serial No. 1,265,001 to 1,385,000	Model 37, Serial No. 1,385,001 and up	Model 38	Models 40, 42, 44 and 52	Model	Model	Model	Model
		APPROXIMATE VOLTAGE								
Detector	Red-white tr. to black-white tr.	2.3	2.2	2.3	2.3	2.35				
R. F. & 1st A. F.	Red to black	1.4	1.45	1.3	1.3	1.45				
Power (2nd A. F.)	Red-green tr. to black-green tr.	4.8	4.7	4.8	4.8	4.8				
PLATE VOLTAGES (Use high resistance D. C. meter)										
Detector	Red-white tr. to yellow.	30	25	30	48	44				
R. F.	Red to any R. F. tube "P" contact (thru eyelet).	135	165	170	180	160				
1st A. F.	Red to black—red tr.	110	135	160	160	155				
Power (2nd A. F.)	Red-green tr. to brown.	120	145	175	180	180				
BIAS VOLTAGES (Use high resistance D. C. meter)										
On Power tube	F to G (socket 2A, thru eyelets).	25	30	45	45	45				
On R. F. and 1st A. F. tubes	F to G (socket 1A, thru evelets).	12	12	13	13	13				

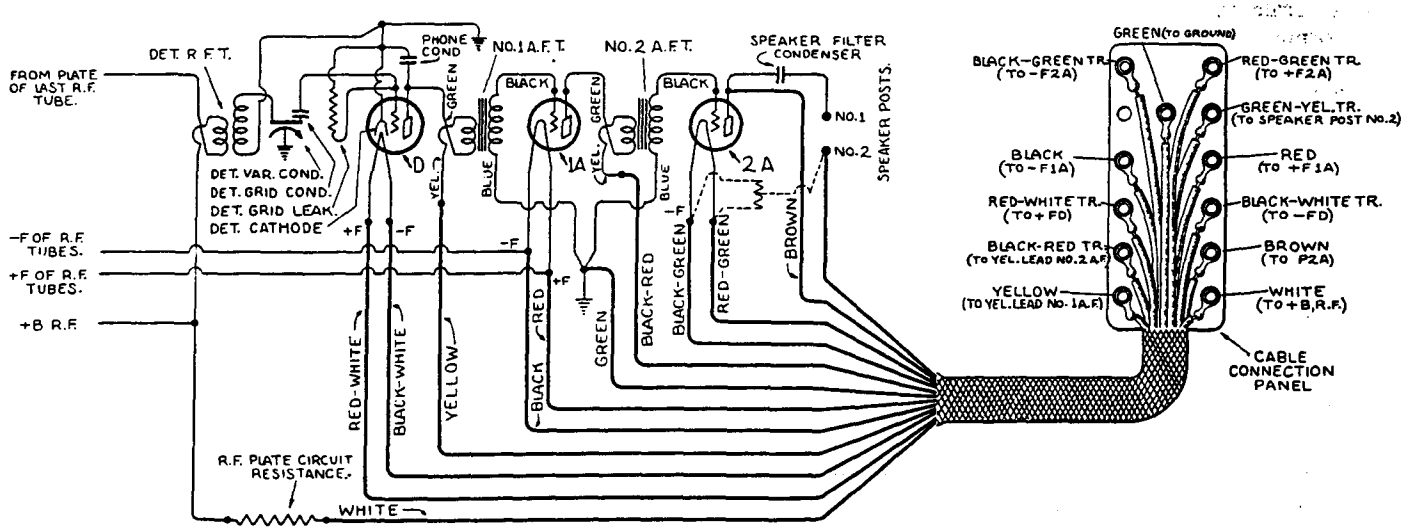

FIG. 78. DETECTOR AND TWO STAGE AUDIO FREQUENCY AMPLIFYING CIRCUIT USED IN LATER MODEL 36, AND IN MODELS 37, 38, 40, 42, 44 AND 52

The 2nd A. F. filament shunt resistance (shown in dotted lines) is used in all Model 36 sets and in many Models 37 and 38. In later Models 37 and 38, and in Models 40, 42, 44 and 52, this resistance is not used in the set, but the 2nd A. F. filament shunt resistance in the power unit is used for the same purpose, a green-yellow tracer lead connecting speaker post No. 2 to the centre tap of the 2nd A. F. filament shunt resistance in the power unit. In Model 36, and in Model 37 console sets, the two terminals on either side of the ground eyelet are used for toggle switch connection in the 110 volt line. In some Model 36 sets a green-yellow tracer lead is used instead of a black-red tracer lead for connection to the yellow lead of the 2nd A. F. T. The R. F. plate circuit resistance is not used in Model 36 nor in some 37 and 38 sets. Except for these minor variations, this circuit is standard in these sets, and the service man should remember the color scheme of A. F. transformers and the colors of cable leads and their location on the connection panel.

SECTION VII

SERVICING THE "B" POWER UNIT

1. General Description

This unit is designed to replace the usual dry or wet "B" batteries as a source of plate current supply, taking its power from the 110-volt, A.C. house-lighting system and converting it into direct current of sufficient voltage for the plate requirements of a standard set. The operation of this device is, briefly, as follows:

The first step in transforming the A.C. to D.C. at required voltages, is to raise or "step up" the 110 volts to the necessary value for plate supply, taking into consideration the losses to be encountered in the later necessary processes of rectifying and filtering the current. This step-up is accomplished by the use of a transformer, which is designed so as to deliver about 500 volts at the secondary terminals.

The next step is the changing of the higher voltage alternating current delivered by the transformer to a current in one direction, and this is done by means of a special design tube known as a rectifying tube This changes the A.C. into pulsating direct current, current in one direction, rising and falling between zero and maximum.

The rectification effect produced by the tube in the "B" Power Unit is somewhat the same as that produced by the detector tube of the radio set; however, the construction of the tube is quite different. No filament is used, there being, however, three electrodes, two of these being single, straight vertical wires and the third a double cylindrical grid of fine wire surrounding the other two. The form of the grid resembles on a small scale that of the double coil used as the R. F. transformer on some of our receivers. A rare metal is used in the construction of both the straight electrodes and the grid. The tube is filled with a specially purified rare gas under reduced pressure. (See Fig. 79.)

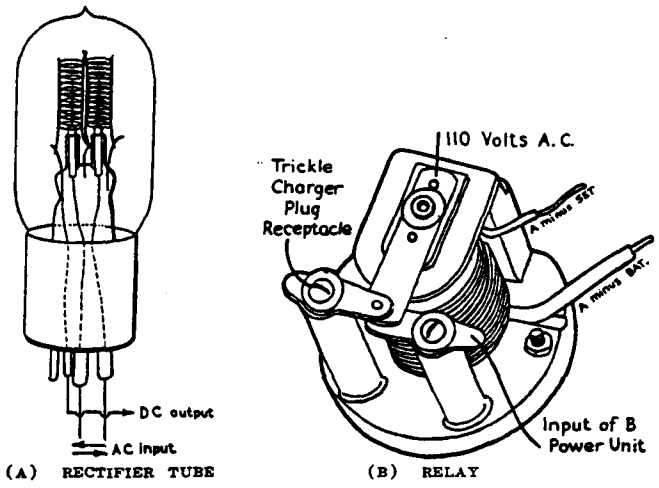

FIG. 79. TWO ELEMENTS OF "B" POWER UNIT.

Due to peculiar properties of the internal elements making up the tube, the gas will conduct current freely when flowing from either of the straight electrodes to the grid, but it acts practically as an insulator for a current in the opposite direction.

The two straight electrodes are connected to the secondary terminals of the step-up transformer, while a wire connected to the cylindrical grid leads to the "load" (filters, resistances and B circuit of the set), the return wire from the load running to a center tap on the transformer secondary. Connection is obtained to the three elements of the tube by having it fitted with a standard UX type base, one of the four prongs being unused. A better understanding of the circuit described above will be had by referring to the schematic diagram furnished in this section (Figs. 80 and 82).

The pulsating direct current delivered by the rectifying tube is not suitable for plate supply, so it is necessary to "filter" or smooth out this current to give an even flow. This is done by means of a special arrangement of choke-coils and condensers, the connection layout and values of these individual parts having been determined after extended laboratory experiments. (See illustration Fig. 82.)

We now have an even flow of direct current and all that remains to be done is to distribute this current to the various plate circuits of the radio set at the proper values for maximum performance. A set of resistances and by-pass condensers is used to accomplish this. Binding posts are provided on the panel of the "B" Power Unit properly marked for connection to the correct cable terminals of the set.

The Atwater Kent "B" Power Unit includes a plug receptacle for connecting a trickle charger to use in keeping the A storage battery charged. The plug from the trickle charger is placed in this receptacle and by means of a "relay" incorporated in the "B" Power Unit, the 110-volt current which is supplied to the "B" Power Unit is automatically transferred to the trickle charger when the radio set is turned off by the switch button on the panel.

The relay is in effect an automatic single-pole double-throw switch directly controlled by the filament switch on the radio set. It consists of a coil of wire with a soft iron core, an armature being supported over the core and carrying a contact spring which is insulated from it (the armature). Two other contact points are mounted, one above and one below the contact spring so as to make and break with the two corresponding points on the spring itself when the relay operates. (See Fig. 79.)

The magnet coil is connected in series with the "A" battery or filament circuit of the set. The contact spring is connected (thru the plug of the "B" Power Unit) with one side of the 110-volt, A.C. supply. The

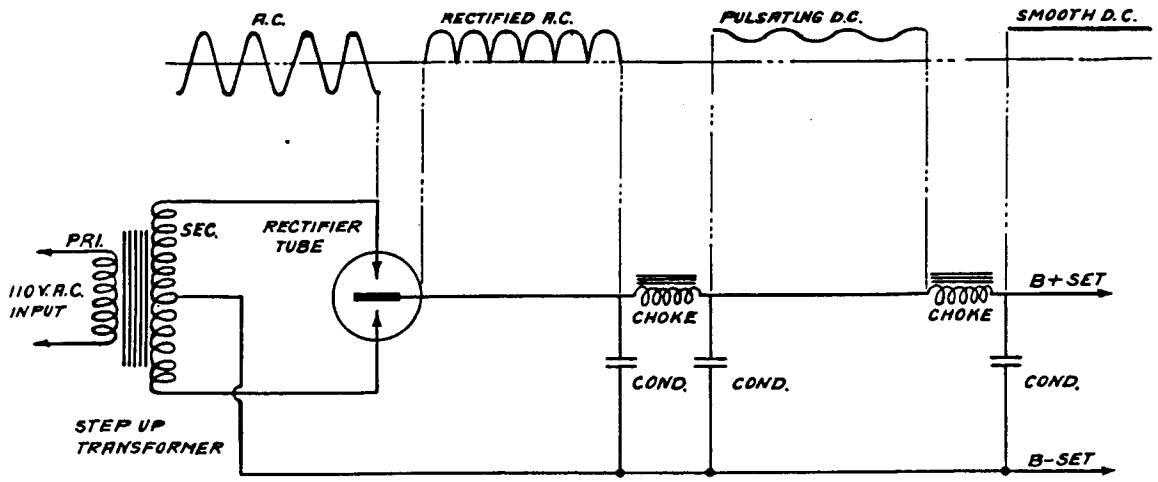

FIG. 80. STEPS IN PROCESS OF RECTIFICATION OF CURRENT BY "B"-POWER UNIT.

upper contact point is connected to one terminal of the trickle charger receptacle and the lower to one side of the input of the "B" Power Unit. The two remaining terminals—one of the trickle charger receptacle and the other of the "B" Unit input—are permanently connected to the other side of the 110-volt, A.C. line. The operation is as follows:

When the radio set is turned on, the coil is magnetized by the "A" battery current passing thru it, causing the armature (carrying contact spring) to be drawn down to make contact with the lower point, thereby closing input circuit to "B" power unit. When the set is turned off, the armature is automatically released by the coil losing its magnetism. The contact spring then touches the upper contact point, sending the 110-volt current thru the trickle charger, which has been connected in the circuit by placing its plug in the receptacle at front of "B" Power Unit.

2. Determining if "B" Power Unit is at Fault

When radio reception is unsatisfactory, and it is felt that the "B" Power Unit may be at fault, it is advisable to first check up on the other accessories used, testing the tubes, A and C batteries, checking connections at A battery terminals, and examining aerial, ground and speaker.

If these accessories all test O. K., it would then be a good plan to temporarily substitute a good set of 45 volt dry B batteries for the "B" Power Unit, which will readily indicate whether the latter has been functioning normally. If this test shows that the "B" Unit may be "dead," a new rectifier tube should first be tried out, as occasionally some trouble may develop in this part. The replacement of the tube will of course correct this, and the defective one should be returned to the distributor.

3. Measuring Voltage of "B" Unit

Another way of determining if the "B" unit is defective is to measure the output voltage while the unit is connected to a receiving set in operation. Measurement should be made with a high resistance D. C. voltmeter. The following approximate voltages should be obtained on a line voltage of 110-115 A. C., assuming a standard six tube set is being used, with a power tube in the last audio socket.

Measure from B minus to	Approximate Voltage
B + PWR	135
B + AMP (Post No. 2 or 3)	70
B + DET	25

If the voltages are considerably different from the values given above, or if no voltage is obtained from B— to each of the B+ terminals, some part of the "B" unit is probably defective, and it will therefore be necessary to dis-assemble the unit.

4. Taking the Unit Apart

Remove the cover by taking out the four machine screws around sides, then remove the four "feet" by taking out screws in them and also remove the single screw from bottom of case. Next remove the screws which hold the bakelite binding post panel to the metal case and also the two which hold the receptacle for plug from trickle charger. The entire unit can then be lifted out of the case, after pushing the panel and plug receptacle inside so that they will not catch as the assembly is being lifted up and out.

5. Continuity Tests

Using the regular testing equipment, consisting of a 45 volt "B" battery and a 0-50 voltmeter, make the tests given in the accompanying test table.

If the test indicates that a section or block of the unit is defective, that section should be replaced and returned to the distributor.

6. Possible Troubles

Condition.	Cause
No reception	Shorted condenser, open choke coil, open primary of transformer.
Noisy reception (crackling)	Defective rectifier tube.
Intermittent reception. (When "B" unit is shaken).	Poor contact of tube in socket, half-broken lead or connection.
Sluggish starting of receiver to function	Defective rectifier tube, dirty or burned relay contacts.
Noticeable darkening of glass of rectifier tube	Defective tube.
Abnormal heating in "B" unit	Shorted turns in transformer.
Excessive hum	One side of secondary open.

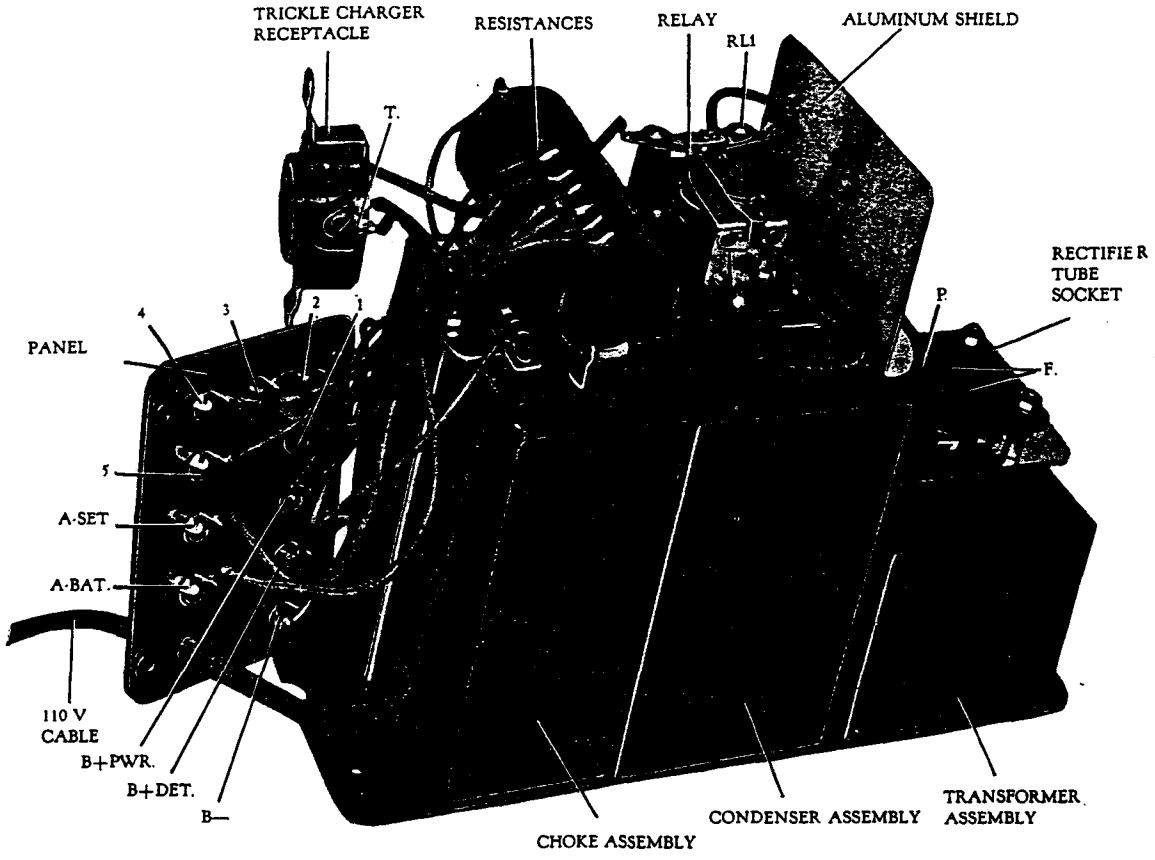

FIG. 81. VIEW OF "B" POWER UNIT.

Wiring Diagram and Test Table for "B" Power Unit

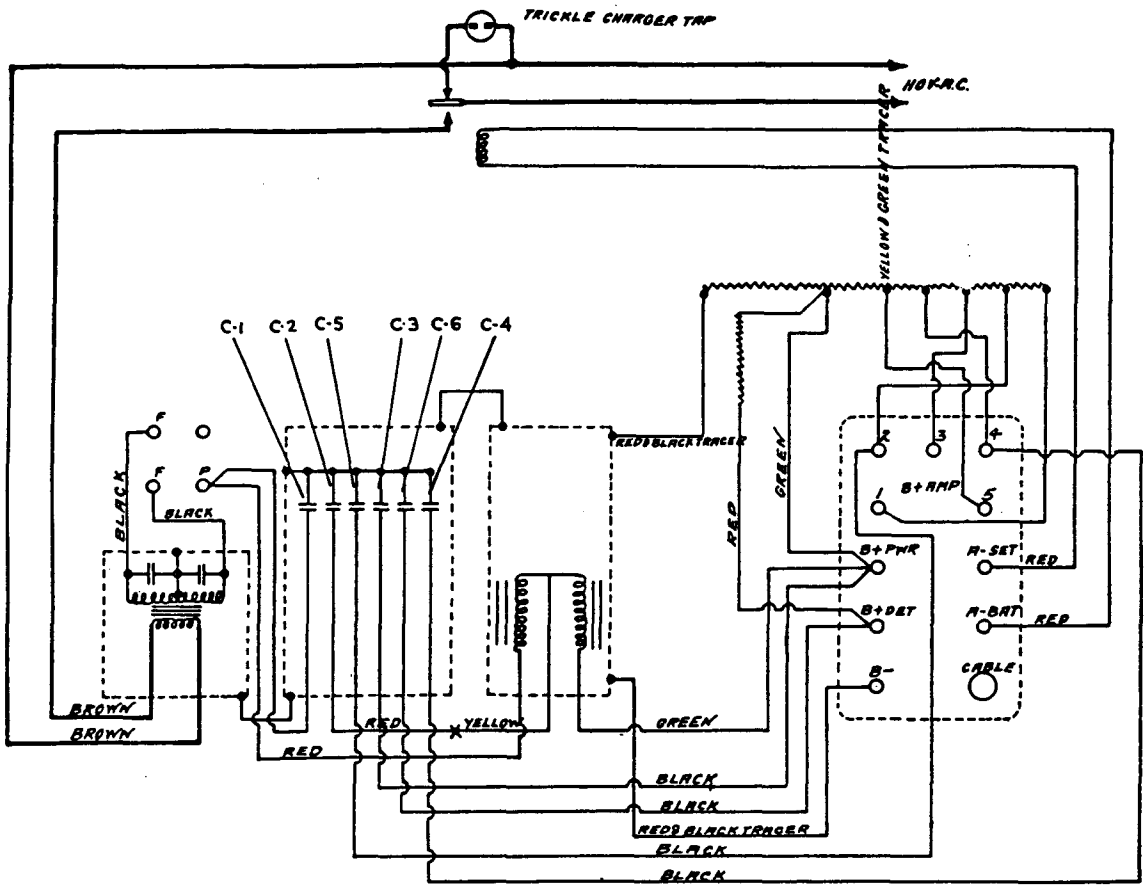

FIG. 82. B-POWER UNIT. MODEL R No. 8800 (Wiring Diagram).
NOTE.—In Model "S" Unit for 25-cycle A. C. Power, Condenser C-5 is Connected to Post 3 of "B plus AMP," and Condenser C-4 is Omitted.

TEST FROM	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
B— to			See that ground straps are soldered together.
Exposed Portion of Three Metal Containers.	*Full*	Open ground connection.	
B+ PWR.	*Partial*	None—Open regulating resistance.	Full—Shorted filter condenser or grounded choke.
B+ AMP. (Taps Nos. 1, 2, 3, 4, 5).	*Partial*	None—Open resistance.	Reading should increase slightly from 1 to 5.
B+ DET.	*Small*	None—Open detector plate circuit resistance.	Full Reading—Shorted by-pass condenser.
A— BAT.	*None*	Grounded relay coil circuit.	
Both Terminals of A.C. Plug.	*None*	Grounded primary circuit of power trans.	
Each of Two Large Holes on Rectifier Socket.	*Nearly Full*	Open connection sec. of power transformer.	
OTHER TESTS			**NOTE: In case any one of the filter or by-pass condensers is thought to be defective, its connecting lead should be unsoldered from the rest of the circuit and the condenser tested separately for possible short circuit. The filter chokes may be tested in the same manner.**
RL1 to Point "T" on Trickle Charger Receptacle.	*Full*	Open primary of power transformer.	
Across Two Large Holes on Rectifier Tube Socket.	*Nearly Full*	None—Open secondary of power trans.	
B+ PWR. to Contact "P" (on Rectifier Tube Socket.)	*Partial*	None—Open filter choke coil.	
A— Set to A— Bat.	*Full*	Open relay coil circuit.	

SECTION VIII

CHART OF TROUBLES AND PROBABLE CAUSES

A—Battery Sets Only

1. Tubes fail to light.....	1. A battery discharged. 2. Badly corroded A battery terminal. 3. Burned out or open rheostat. 4. Broken filament lead in cable. 5. Defective filament switch. 6. Defective tubes.
2. Tubes light, no reception.....	1. B voltage supply dead or defective. 2. Open in B lead in cable. 3. Incorrect B connections. 4. A battery connections reversed. 5. Open primary of transformer (A. F. or R. F.). 6. Shorted grid condenser. 7. Open coil in speaker. 8. Defective tube. 9. Shorted by-pass condenser.
3. Disturbing noises (occurring with antenna and ground disconnected)...	1. Run-down or defective B battery. 2. Defective B power unit. 3. Poor connection at A battery terminal. 4. Loose connection to B supply. 5. Defective phone condenser. 6. Defective audio transformer. 7. Defective speaker cord. 8. Defective by-pass condenser.
4. Distorted tone.....	1. Interference (two stations on same frequency). 2. Batteries exhausted. 3. Speaker out of adjustment. 4. Incorrect C voltage. 5. C battery disconnected. 6. B power unit incorrectly connected or adjusted.
5. Intermittent reception.....	1. "Fading" due to atmospheric conditions. 2. Antenna or lead-in touching grounded object. 3. Loose or corroded connection in fil. circuit. 4. Defective grid leak. 5. Loose connection in set or cable. 6. Local receiving set interfering.
6. Continuous whistle or hum.....	1. Microphonic tube. 2. Speaker too close to set. 3. Defective B power unit. 4. Low Detector B voltage. 5. Heterodyne. 6. Open grid circuit (detector). 7. Grounded A. F. transformer. 8. Open antenna choke.
7. Reception weak.....	1. Defective tube. 2. A or B voltage low. 3. Poor location. 4. Defective battery connections. 5. Weak audio transformer. 6. Grid resistance open. 7. Secondary R. F. transformer open. 8. Condensers poorly synchronized. 9. Defective grid leak.

B—A. C. Sets Only

1. All tubes fail to light	1. Line voltage D. C. instead of A. C. 2. Open primary power transformer. 3. Open lead in A. C. plug cord.
2. One or several tubes fail to light	1. Defective tube. 2. Open secondary of power trans. low voltage. 3. Open wire to filament circuit.
3. Tubes light, no reception	1. Defective rectifier (or other) tube. 2. Open secondary power trans. (high voltage). 3. Shorted condenser in power unit. 4. Open choke in power unit. 5. Open plate voltage resistor. 6. Shorted speaker choke. 7. Defective audio. trans. (open primary).
4. Reception weak	1. Shorted primary transformer. 2. Shorted secondary power transformer. 3. Defective rectifier tube. 4. Same causes as under battery sets except first four.
5. Distorted tone	1. Shorted primary power transformer. 2. Shorted secondary power transformer high or low voltage. 3. Defective rectifier tube. 4. Open biasing resistance. 5. Speaker out of adjustment. 6. Shorted biasing resistance.
6. Intermittent reception	1. Defective rectifier tube (loose filament). 2. Open biasing resistance. 3. Loose connection in power unit. 4. Same reasons as under battery sets.
7. Continuous hum	1. Secondary power transformer open (one side, high voltage). 2. Open ground on secondary. 3. Shorted filter choke (power unit). 4. Open filament shunting resistance. 5. Same causes as under battery sets (except No. 3).
8. Overheating	1. Shorted primary power transformer. 2. Shorted secondary winding or circuit.
9. Disturbing noises	1. Induction thru A. C. power lines. 2. Loose connection in power unit. 3. Causes 5-6-7 under battery sets (A, 3).

C—Both, A. C. and Battery Sets

1. Oscillation	1. Defective ground connection. 2. Unsuitable R. F. tubes. 3. Grid resistance shorted. 4. Excessive R. F. plate voltage. 5. Open secondary R. F. transformer. 6. R. F. by-pass poorly grounded. 7. Antenna lead too close to set (wood cabinet sets).

SECTION IX
TROUBLES MOST FREQUENTLY ENCOUNTERED

A. In Either Type Set (Battery or A.C.)

CONDITION	CAUSE	SYMPTOMS	REMEDY
1. Grid resistance burned out.	Shorted tube.	Reception weak.	Replace resistance unit.
2. Audio Trans. primary open.	Electrolysis.	Reception dead.	Replace transformer.
3. Audio Trans. secondary open.	"	Distorted reception.	" "
4. Antenna choke burned out.	Shorted tube, No. 1 socket.	Reception weak; hum.	Replace antenna choke.
5. R. F. T. primary burned out.	Shorted tube.	Set dead or very weak.	Replace R. F. transformer assembly.
6. Condenser dial out of adjustment.	Dial slipped on shaft.	Incorrect dial setting.	Loosen set screw in dial knob and reset correctly—pointer at 100, with plates fully enmeshed.
7. Condenser rotor assembly out of adjustment (3-dial sets).	Rotor assembly loosened thru jarring.	Irregular dial settings.	Loosen set screws at ends of rotor tension spring and reset assembly so rotor plates are equally spaced from stationary.
8. Condenser pulley belts loose or broken.	Forcing of tuning dial.	Tuning dial does not control condensers.	Replace belt, removing set chassis from cabinet and condenser panel assembly from main panel to make belts accessible. (See Secs. VI and XI.)
9. Condensers out of synchronism.	Rough handling or jarring of set.	Lack of volume and selectivity.	Resynchronize condensers. (See Sec. XI.)
10. Leaky by-pass condenser.	Excessive "B" voltage or excessive humidity.	Weak reception, rapid "B" battery consumption, set fails to operate on "B" eliminator (battery sets).	Replace by-pass condensers. Use No. 8685 for replacement on all battery sets, except No. 4640 and No. 4880.
11. Shorted phone condenser.	Defect.	Noisy reception.	Replace phone condenser.
12. Open wire in power cable.	Indefinite.	Set dead or tubes fail to light.	Repair break or replace cable.
13. Defective grid leak.	Defect.	Reception choked.	Replace leak.

B. In A.C. Sets Only

1. Volume control burned out.	Shorted tube.	Volume can't be reduced.	Replace resistance unit.
2. Volume control noisy.	Resist. wire spread unevenly or slider coated with oil or not pressing hard on resistance wire.	Volume knob does not turn smoothly or turns too smoothly.	Replace resistance unit or clean slider and resistance and bend slider to make better contact with wire. Use latest type of slider and resistance unit.
3. Power transformer pri. open.	Indefinite.	No voltage—set dead.	Replace transformer assembly.
4. Power transformer pri. shorted.	"	Overheating—set weak.	" " "
5. Power transformer sec. open (high voltage winding).	"	Reception weak —hum.	" " "
6. Power transformer sec. open (low voltage winding).	"	One or more tubes fail to light.	" " "
7. Shorted condenser (power unit).	"	No reception.	Replace condenser-choke assembly (on Models 36, 37, 38).
8. Open choke (power unit).	"	No reception.	Replace condenser-choke assembly (on Models 36, 37, 38).
9. Open "B" voltage resistance (detector or No. 1 A. F.).	"	Reception very weak or none at all.	Replace resistance unit (tubular, under small panel top of power unit).
10. Open biasing resistance (226 or 171).	"	Distortion and blocking—hum.	Replace biasing resistance.
11. Defective rectifier tube.	"	Weak, irregular or distorted reception.	Replace tube.
12. Loose power transformer laminations.	"	Hum audible to ear.	Replace transformer (Models 36, 37, 38).

Note—A defect in the transformer, condensers or chokes, in the case of A. C. sets having a single sealed power unit container, will necessitate replacement of the sealed container.

SECTION X

SERVICING ATWATER KENT SPEAKERS

General Description

1. Horn Type

The sound unit of the Atwater Kent horn type speaker consists of a powerful permanent magnet similar to a horseshoe magnet, mounted at the end of a short cylindrical metal chamber. The two poles of the magnet have extension pieces, each of these being wound with a coil of very fine wire. These two coils are connected in series and also thru the speaker cable and plate circuit of the last tube of the radio set.

A diaphragm in the form of a circular disc of special alloy metal, carefully mounted between rubber gaskets, is suspended so that its surface rests but a small fraction of an inch above the extension pole pieces of the magnet.

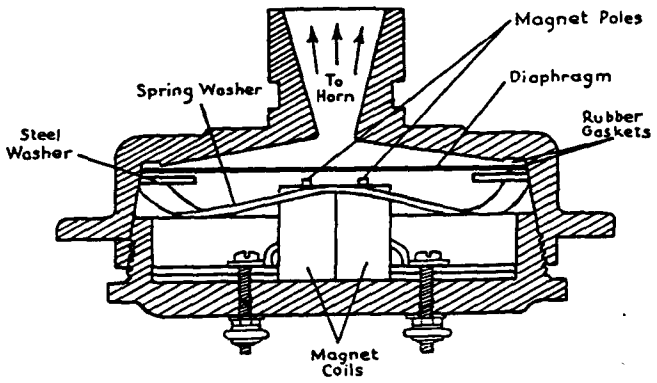

FIG. 83. CROSS SECTION VIEW OF SOUND UNIT (HORN TYPE).

The action of the unit is as follows:—When a radio signal enters the receiving set, as explained under Section I "Theory of Radio Receivers," it causes fluctuations or changes in the flow of current in the plate circuit. Since the magnet coils of the speaker unit are in series with the plate circuit, these changes in current will pass thru these coils, and this in turn will cause variations in the pull of the permanent magnet on the diaphragm. Accordingly the diaphragm vibrates, and in doing so, causes sound vibrations which pass thru the air column of the horn into the room to the listeners' ears, an almost perfect reproduction of the sound at the microphone of the broadcast station.

2. Cone Type (Models "E" and "E-2")

The Models "E" and "E-2" Speakers are of the "free-edge" cone type, and differ in many respects from other cone speakers on the market.

The magnet is a powerful double one, and the vibrating element a thin rectangular reed of special alloy steel, mounted so that one end can vibrate freely between two of the four poles of the magnet. A single magnet coil is mounted so as to surround and enclose the reed without touching it, and the current in the plate circuit of the radio set passes thru this coil.

The apex of the cone is attached directly to the reed by a novel spring mounting which supports the weight of the cone, but at the same time allows it complete freedom of motion.

As in the case of the horn-type speaker, the changes in the current from the set passing thru the coil of the speaker unit cause changes in the pull of the magnet on the reed, thus causing the reed and the cone attached to it to vibrate correspondingly. The cone vibrates the air directly, giving very lifelike reproduction.

Comparison Test

When an Atwater Kent speaker seems to be functioning imperfectly, it should first be tried out on reception in comparison with a speaker of similar type that is known to be good. If this comparison definitely indicates that the speaker is defective, it should be inspected and tested to determine the source of trouble.

Damaged Coil or Cord

If the speaker does not work at all, the trouble may be in an open magnet coil or an open cord. These may be tested with a voltmeter and battery. If the cord or the coil circuit is open, no reading will be secured on the meter. If the cord is damaged, or the connections half-broken, the meter will usually give an erratic reading when the cord is shaken.

In testing the coil, the voltmeter test points should be applied directly to the coil terminals on the sound unit. If the coil is open, the sound unit should be replaced. If the cord has an open lead it may sometimes be repaired satisfactorily, otherwise it should be replaced.

Detailed Service Information

1. Horn Type (including phonograph attachments)

A. Disassembling Horn Unit.

Remove gooseneck and horn from base of speaker, invert base and unscrew knurled cap all the way. Lift

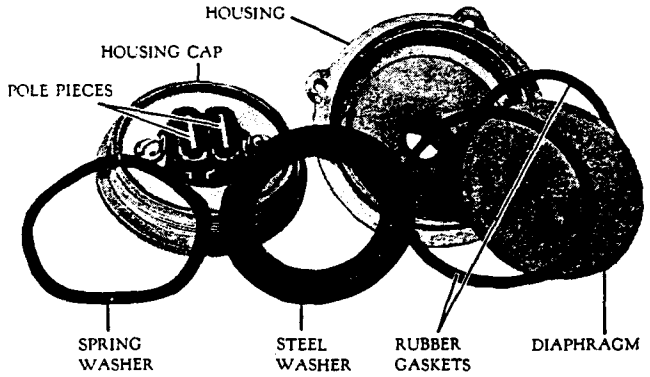

FIG. 84. HORN TYPE UNIT, DISASSEMBLED.

out the bronze retaining spring, then the steel washer and the rubber gasket, then the diaphragm and second rubber gasket at bottom. These parts are indicated in Fig. 84.

B. Testing.

Test the coil and cord for continuity and then carefully inspect the other parts, looking for the following.

C. Possible Troubles.

1—Iron or other foreign particles on pole pieces. (Sometimes these particles are so small as to be hardly visible).
Remedy:—Pick off with a small sharp knife, working outward and upward from between the pole pieces.

2—Diaphragm bent, buckled or up-side down.
Remedy:—Replace diaphragm or assemble correctly.

3—Weak spring. Spring may give insufficient pressure against diaphragm, causing rattling on very loud signals.
Remedy:—Replace spring or bend so as to increase height of all four of the bends, making them all exactly the same height.

4—Rubber gaskets. If these show signs of deterioration they should be replaced. If new gaskets are used in reassembling the unit, each should be stretched to fit tightly in the housing. This may be done by holding the gasket by both forefingers and expanding it for a moment to a length of about eighteen inches, repeating this three or four times.

5—Weak magnet. Test with weight-scale in the following manner:

D. Testing Magnets in Horn Type Units.

Equipment for testing the strength of the sound unit magnet is very simple and inexpensive, consisting of a small spring-type weight scale, about 0-10 pounds,—(which may also be used in testing the cone type sound unit magnets) and a circular flat disc, ground absolutely flat, of soft iron (Swedish or "Armco" iron) about 1 inch in diameter and 1/16 inch thick. This disc should have a small central stud, carrying a hole, attached to the center of one of its sides. A loop of strong flexible string, about an inch or two in length, should be attached to the hole in the stud.

To test the strength of the magnet in a horn type sound unit, place the flat side of the disc centrally on the pole pieces, loop the string over the weight-scale hook and carefully exert a steady pull exactly along the axis of the unit until the magnet lets go. The position of the speaker and scale is shown clearly in the accompanying illustration, Fig. 85.

When pulling on the horn type sound unit, the disc "armature" should not be released until the scale registers a pull of about 4 pounds or more. Assuming that the weight-scale has been checked for accuracy, if the reading is appreciably less than 4 pounds, and if the speaker is noticeably weak in actual reception, the sound unit should be replaced.

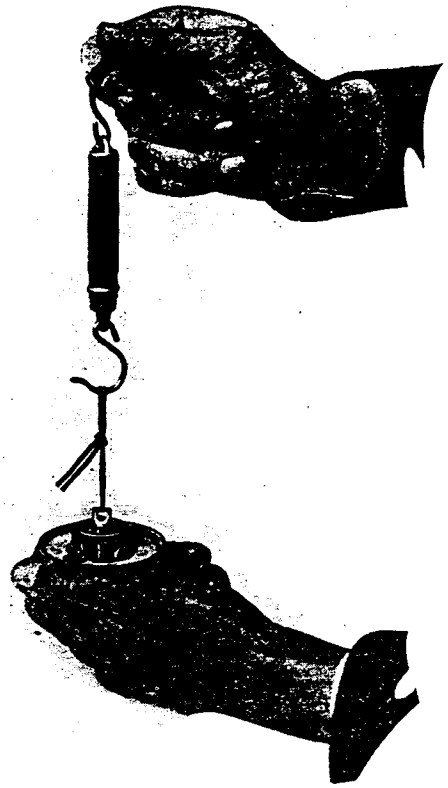

FIG. 85. TESTING MAGNET STRENGTH, HORN TYPE UNIT.

With time and use there is some unavoidable loss of magnetism in speaker magnets. But in general this decrease does not appreciably affect the performance of the speaker, so in all cases the final test should be in listening to actual reception. The magnetic strength tests are chiefly of value in eliminating one possible source of trouble.

After the unit has been carefully examined and tested, and any defective parts repaired or replaced, it may then be reassembled.

E. Assembling Horn Type Unit.

(1) RUBBER GASKET—place in its groove in housing and use the steel washer to press the gasket into place. The gasket should not fall out when the housing is inverted and shaken. The steel washer should, of course, be removed.

(2) DIAPHRAGM—center on the rubber gasket with the concaved side toward the horn. It is very important that the diaphragm should be placed with the concaved or hollow side facing the horn opening. Instructions to this effect are rubber-stamped on the concaved side of each diaphragm. Also it is extremely important that the diaphragm should be centered perfectly on the rubber gasket and that it does not touch the metal housing at any point, otherwise the diaphragm will rattle.

(3) RUBBER GASKET—place over the diaphragm and press into position with the steel washer, taking care not to disturb the diaphragm setting.

(4) STEEL WASHER—place over the rubber gasket with the concaved or hollow side facing the diaphragm. The concaved side of the steel washer may be found by laying a straight edge across the face of the washer and holding both up to the light.

(5) BRONZE SPRING WASHER—place in housing over the steel washer.

(6) HOUSING CAP—screw clockwise on housing.

F. Adjusting the Horn Speaker.

The speaker should be adjusted during reception of a strong and clear broadcast station. Screw up the knurled housing cap clockwise until the diaphragm snaps against the pole pieces, causing reception to become weak and rattling. It should then be unscrewed until a click occurs and reception comes out clear and normal, the best adjustment being as close (turned clockwise) as possible without rattling on a strong signal.

It is necessary to have the horn type speaker leads connected to the receiving set in the proper manner, which is clearly specified on the Atwater Kent horn type sound units and also on the Atwater Kent battery-type radio receivers.

2. Free Edge Cone Type (Models E and E-2)

The Atwater Kent Model E and Model E-2 Speakers are of the free edge cone type. Their construction is much more rugged than that of the average cone, so that repairs are seldom required. All steel parts are thoroughly rust-proofed, and both the coil windings and the cone itself are impregnated with moisture-proofing compound.

The sound unit used in these speakers as now manufactured, is enclosed in a dust-proof rubberized bag which protects the unit from iron particles and dust.

In order to examine and test the parts, it is necessary to disassemble the speaker. Instructions for doing this and instructions for testing, repairing and assembling this type of speaker are given below.

A. Disassembling the "Type E" Speaker.

(1) Removing Grill.

Remove the four screws around the outer housing of speaker, then remove the front (grill) in this way:

Stand the speaker on a firm table, place a double fold of heavy cloth over the top of the grill of the housing, hook the thumb of the left hand under the top edge of the grill, with the other fingers of the left hand pressing down on the top of the housing, and then, through the cloth, hit the top of the edge of the grill several sharp blows with a hammer, at the same time pulling forward with the thumb. The vibrational effect of the hammer blows tends to loosen the grill from the housing, while the steady pull with the thumb tends to move the grill forward and off the housing. The cloth is used to protect the finish of the grill, which would otherwise be marred by the hammer blows. In removing the grill, be careful not to let it hit against the cone.

(2) Removing Cone.

The cone is attached to the flat reed spring by a small bolt and nut. Two special wrenches (Part No. 9255) should be used in removing this bolt, the illustration, Fig. 86, showing how this should be done. Hold the cone by the small metal bracket at its apex and pull straight off from the reed spring.

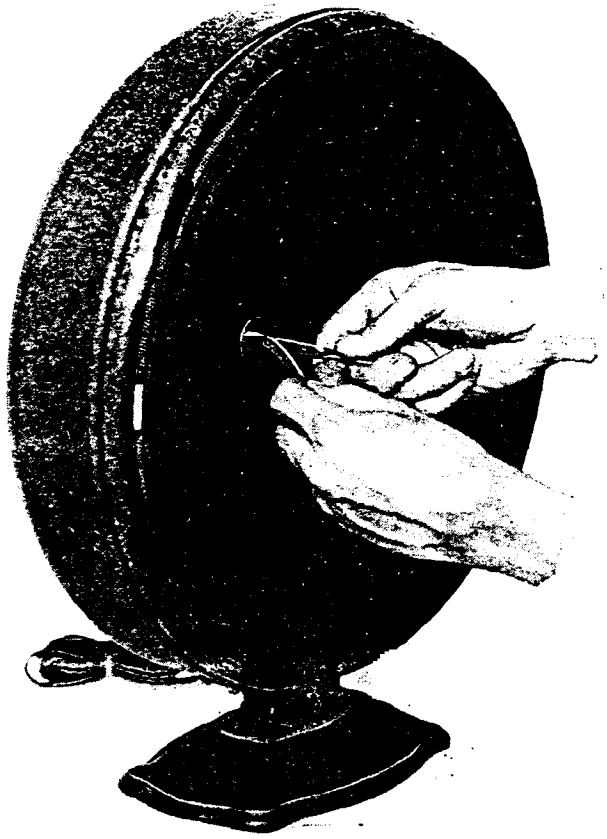

FIG. 86. REMOVING CONE, MODELS E AND E-2.

(3) Removing Sound Unit.

The sound unit is removed by unscrewing the two acorn nuts at the rear of the housing. Note how the cord is brought over the top and in back of the sound unit down to the small hole at the rear of the housing. When assembling the speaker, the cord should be arranged in the same way. In handling the sound unit be very careful not to strain the flat reed spring.

B. Possible Troubles.

1. OPEN COIL OR CORD—test with voltmeter and battery for continuity. Replace if found defective.

2. DAMAGED CONE—examine carefully for cracks and bends, especially around the apex. If no defect is found, hold the cone horizontally with hollow side up about 3 or 4 inches above a firm wood-topped table and then drop so that the apex will hit the table. If the cone is in satisfactory condition it will strike with a clear resonant "knock" rather than a dull, lifeless thump or thud. Replace cone if it seems to be defective.

3. METAL CHIPS ON POLE PIECES—carefully remove the dust-proof bag from the sound unit and examine the air-spaces between the reed and pole pieces to determine whether iron or other particles (caught up by the attraction of the magnets) are clogging up the air-spaces between reed and pole pieces and consequently interfering with free motion of the reed. If such a condition is found, it is sometimes possible to remove the particles, although usually it is advisable to replace the unit.

4. IMPERFECTLY ADJUSTED SOUND UNIT—examine the sound unit to see if the reed is adjusted centrally between the pole pieces so that the air-spaces at each side are equal. If the reed is not centered correctly, the unit should be replaced, although in exceptional cases a qualified service man may adjust the reed.

Adjustment of the reed is made through the two screws which pass through the magnet and bear on the reed. By loosening one screw and tightening the other, the reed may be moved to either side. When the reed has been adjusted exactly to the center the two screws should be tightened alternately little by little, until both are tight.

The adjustment may be tested by clasping the reed spring, near the reed, between the thumb and forefinger and pushing and pulling so as to cause reed to snap against either pole piece. The same force should be required to move the reed in each direction. If the unit is properly adjusted see that the air-spaces are free from chips and then carefully replace the dust-proof bag.

5. LOOSE NAME PLATE OR SERIAL PLATE—Suspend the grill by one hand and with the wood handle of a screw driver sharply tap the grill near the name plate. Listen carefully and if a "tinny" noise is heard, the name plate is not fastened securely and should be tightened by hammering down the holding tabs. Do the same with the serial plate on the back of the housing.

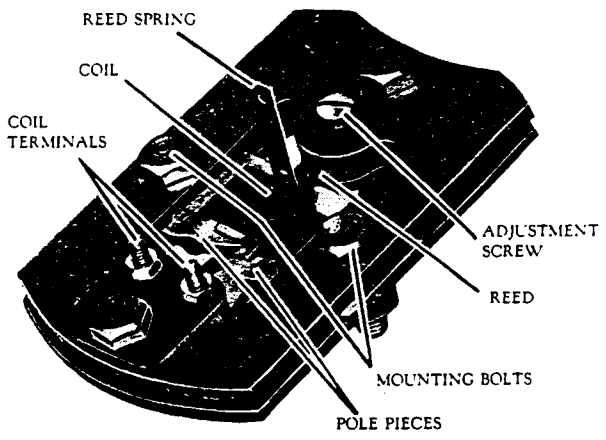

FIG. 87. CONE TYPE UNIT.

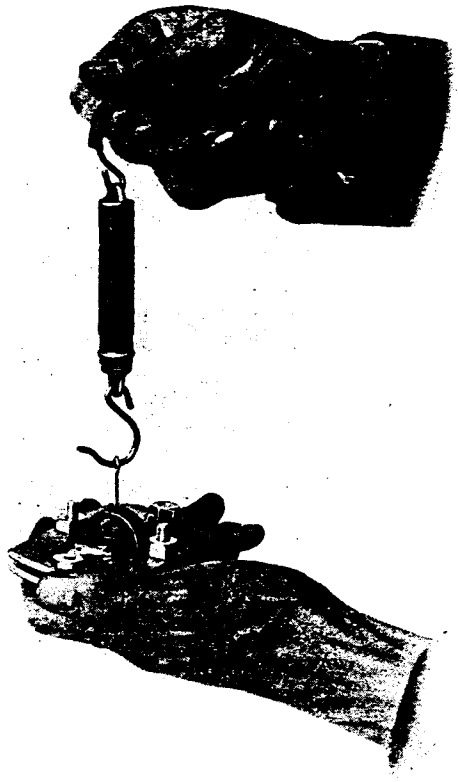

FIG. 88. TESTING MAGNET STRENGTH, CONE TYPE UNIT.

6. WEAK MAGNET—The testing outfit for determining the magnet strength is identical with that used for the horn speaker, except that instead of the flat disk a U-shaped bar is used. This bar must be accurately made so that when suspended, inverted, from the scale, its inside circumference clears the coil winding and the ends of the "U" rest flatly one on each magnet pole, lying clearly within the permanent magnet by about 1/64" on each side. It will be found more convenient to use the front or cone side of the unit for this test.

The dimensions of the bar are—width 3/8", thickness 3/32", diameter (over all) 1-3/16". If a straight pull of less than about 7 pounds will separate armature from magnet, a weak magnet is indicated and the unit should then be replaced. Fig. 88 illustrates the correct method of testing the magnet.

C. Assembling Cone Type Speaker.

1. ATTACHING SOUND UNIT—place the sound unit in the housing so that the mounting bolts pass through the holes in the back of the speaker, and screw on the acorn nuts. The unit should be enclosed in its dust-proof bag and the cord leads should be firmly attached to the coil terminals. The cord should be carried over the top of the unit, around the right-hand side and down to the outlet hole in the rear of the housing.

2. RUBBER DAMPER—push the small piece of rubber tubing on the flat reed spring, bringing it close to, but not touching, the unit.

3. MOUNTING CONE—push the metal bracket at the apex of the cone on to the flat reed spring and push the small screw thru holes. Screw on the nut but do not make it very tight.

With the two special wrenches (part No. 9255) on this small nut and bolt, tip the cone up or down so that its top and bottom edges are equally spaced from the housing, then carefully tighten the bolt. If the cone moves out of position, the bolt must be loosened and the cone again adjusted until the top and bottom edges are equally spaced from the housing when the bolt is fastened tightly.

Then examine the right- and left-hand edges of the cone to see if they are equally spaced from the housing. If they are not, use a pair of pliers to bend the reed spring very carefully and easily toward the side of the cone that is too close to the housing. When the spring is released it will be found that that edge of the cone is now spaced farther from the housing. Repeat this process until the right- and left-hand edges of the cone are equally spaced from the housing. The spacing between the edge of the cone and the housing should then be even all the way around. (In bending the reed spring, hold the pliers horizontally and grip the end of the metal bracket which fits over the reed spring. The best tool for this purpose is a parallel-jaw pliers, 3/8 inch wide, with the ends slotted to fit over the bolt and nut. The slot should be about 7/32 inch wide and 1/4 inch deep.)

4. REPLACING GRILL—Rest the speaker on its back and press the grill on to the housing, taking care to see that the screw holes coincide and that the grill is placed with the name plate right side up. It may be necessary to use a hammer in fitting the grill on the housing and, in this case, as before, a thick cloth should be used to protect the finish of the grill from the hammer blows. When the grill is in place, replace the four screws which hold it to frame.

3. Model E-3 Held-Edge Cone

The manner of disassembling, repairing and assembling the E-3 is exactly the same as for the E and E-2.

The cone of the Model E-3 speaker has a flexible rubberized fringe extending beyond the edge of the cone. Before the grill is placed on the housing, the cone and fringe are clear of the housing, with equal spacing all around between the rubber fringe and the housing. The grill has a strip of felt around its inside edge, and when the grill is pressed down on the housing, the outer edge of the rubber fringe is pressed tightly between the edge of the housing and the felt strip in the grill.

The small rubber damper is not used on the Model E-3 speaker.

Speaker in Model 52 Set

The speaker in Model 52 receiving set is of the "held-edge" type, somewhat like Model E-3. The flexible edge of the diaphragm is pressed all around between the housing flange and a large fibre ring.

To remove speaker, release cord tips from speaker posts on set, rest cabinet on its back, take out the six screws holding the speaker and draw out the speaker, fibre washer and grill.

An inspection of the speaker will then show that the diaphragm is mounted on the reed spring in the same way as in Models E, E-2 and E-3, with the exception that the edge of the diaphragm touches the metal flange all around.

Instructions for disassembling, testing, repairing, and re-assembling this speaker are similar to those given previously for the E, E-2 and E-3, with the following explanatory remarks:

(1) The small rubber reed-spring damper is not used on this model.

(2) In mounting the diaphragm, make certain that the edge of the cone (where it is joined to the flexible fringe) is level all around. If the diaphragm is not mounted properly on the reed spring, or if the spring is bent, the edge of the cone will extend up on one side and be depressed on the other. The remedy is the same as given above under the heading "Mounting Cone."

(3) The speaker is mounted in the cabinet with the outlet hole for speaker cord nearest the top, or set. The speaker cord is brought down and under the sound unit and up to the outlet hole.

(4) When replacing the speaker, put the fibre ring on top of the diaphragm, lining up the holes in the ring and those in the diaphragm and housing flange. Then place the wire grill on top of the fibre ring in such a way that, when mounted upright in normal position in cabinet, one set of equally-spaced grill wires will be horizontal and another set of equally-spaced wires will be vertical. (See paragraph immediately above.) Rest the cabinet of set on its back, and (for convenience of mounting) temporarily place a screw through the left hand hole in the housing flange, fibre ring and grill, with the head of screw toward the back of housing. Arrange the speaker in cabinet so this screw comes up through the left hand hole in front of cabinet and place a nut on this screw, meanwhile holding the speaker in place with one hand. Put in the other five screws (with the heads on outside of cabinet), remove the first screw and replace it properly.

SECTION XI

MISCELLANEOUS SERVICE INFORMATION

1. Use of Power Tubes in Battery Type Sets

The following battery sets were designed to permit the use of a power tube without change:

Model 20 Compact, No. 7960 (Serial Nos. 400,001 up).

Model 30 No. 8000 (later type).

Model 35.

Model 32.

Model 33.

Model 48.

Model 49.

Model 50.

Instructions are given below for changing the various earlier models of battery type sets so that a power tube can be used in the last audio socket:

Model 20 Compact, No. 7570 (Serial Nos. 200,000 to 395,766).

Model 30, No. 8000 (early type)

Remove chassis from cabinet and invert, exposing wiring under audio (3 tube) unit. Locate grid return wire leading from second audio transformer to blue wire of cable, and unsolder it from blue wire. Attach an additional short length (6 or 8 inches) of insulated wire to this lead from transformer, and bring this wire out through back of cabinet. This is the connection for the negative of "C" battery used for power tube. Connect positive of "C" battery to negative "A" battery terminal. Lastly, connect positive (black and red) terminal of speaker direct to highest voltage positive terminal of "B" batteries or "B" power unit, instead of to usual speaker post on set.

Note—If a 4½ volt "C" battery has been used already, it can be left connected, and it will then supply "C" voltage to the first audio tube only.

Model 20, No. 4640 (large cabinet), Model 19 and Model 24

Remove set from cabinet and invert. Locate grid return (red wire) which runs from second audio transformer to black wire leading from rheostat to post "Minus A." Unsolder this one red wire (there are two) from black lead, solder an 8-inch length of insulated wire to end of red wire, and bring this lead out for connection to negative of "C" battery. Connect positive of "C" battery to "Minus A" post of set. Apply 135 volts or required "B" voltage to power tube, by connecting positive speaker terminal direct to high voltage terminal of "B" batteries or other "B" voltage supply.

Open Type Sets (Mounted on Board)

Release cover from 3-tube unit and locate secondary wire from second (right-hand) audio transformer. This wire emerges from sealing compound in base of unit and is soldered to bolt head of post "Minus A." Remove this wire from this bolt, solder a separate length of insulated wire to it, and bring this lead out through ventilating hole in cover, to be connected to negative of "C" battery required by power tube. Connect positive of "C" battery to "Minus A" post of 3-tube unit.

Connect high voltage terminal of "B" batteries or "B" Power Unit, as described above for cabinet sets, direct to positive speaker cord terminal. Power tube is placed in last audio socket (right hand of two front tubes in 3-tube unit).

Note—Where dry batteries are used for "B" power, we suggest the "112A" type of power tube, 135 volts total "B" and about 9 volts "C" battery. Where storage "B" batteries or a good "B" power unit, such as the Atwater Kent Model "R," is used, we suggest using the "171A" type power tube. This tube gives perhaps a little better quality than the "112A" type, but consumes too much current to be economical when dry "B" batteries are used.

2. Replacement of Rheostat (Battery Type Sets)

(a) Removing Rheostat Assembly

(1) MODELS 20 AND 20 COMPACT. First unsolder wires leading from sub-panel to the Detector 2-stage amplifier assembly and the double rheostat. Remove the four screws which pass through the audio transformer bases which hold detector and audio panel to main sub-panel. This will release the assembly, making accessible the three screws which hold rheostat and switch panel assembly. Remove these three screws and rheostat can then be removed from main panel.

(b) Installing New Resistance

Pull out rheostat knob holding spring, releasing knob. Unsolder resistance wire terminal where it comes through panel, and pry out resistance unit. Insert new resistance unit, forcing down equally all around with suitable tool, pushing terminals through small holes in panel. Solder the one terminal, and bend the other over where it projects through panel a fraction of an inch. Replace rheostat knob, then knob holding spring and reassemble, reversing above procedure.

(2) MODELS 30 (early type) and 32. First unsolder the four wires leading to rheostat panel, remove station dial and vernier knob, take out the three screws underneath dial, which hold condenser assembly, then remove four screws (five on Model 32) on bottom of sub-panel. Next, pull condenser sub-panel assembly out from main panel, exposing three screws holding rheostat assembly

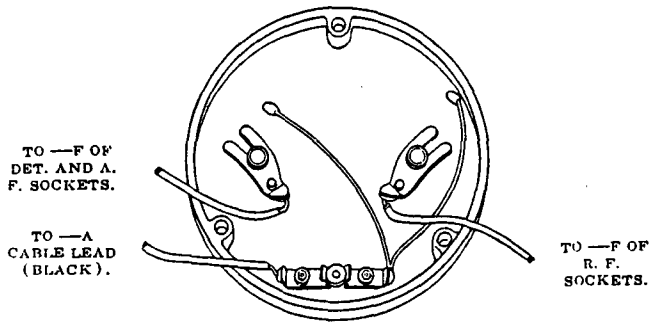

FIG. 89. REAR VIEW OF DOUBLE RHEOSTAT AND FILAMENT SWITCH ASSEMBLY USED IN MODELS 20 (No. 4640-7570), 19 AND 21.

to main panel. Pull rheostat off panel and repair as described under (1B). Reassemble set by reversing above procedure.

(3) Model 35. Remove tuning dial and lift set from cabinet. Then unsolder the three wires leading to rheostat and remove the two screws which hold it to panel. Rheostat can then be removed and repaired as necessary. (See paragraph 1B.)

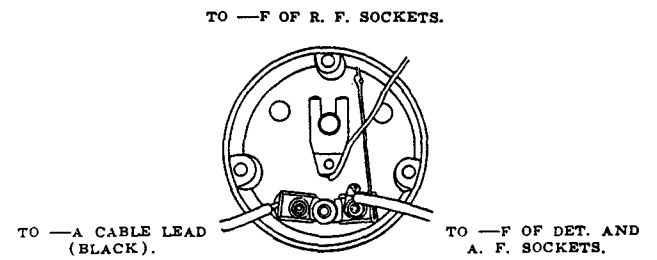

FIG. 90. REAR VIEW OF RHEOSTAT AND FILAMENT SWITCH ASSEMBLY USED IN MODEL 35.

(4) Models 30, 33, 48 and 49. Unsolder the four wires leading from rheostat panel to detector and audio assembly (where they are attached to latter). Remove station dial, vernier knob (also antenna adjustment knob on No. 33). Next remove the machine screws which hold condenser panel assembly to main panel (three at each end on Model 30, also one in center Model 33). Pull away sub-panel, exposing screws holding rheostat panel assembly, and then proceed as described under (1B).

(5) Model 50. Remove set from wood cabinet and metal case. (See Section VI.) Remove the six screws which hold front panel to condenser panel (3 at each

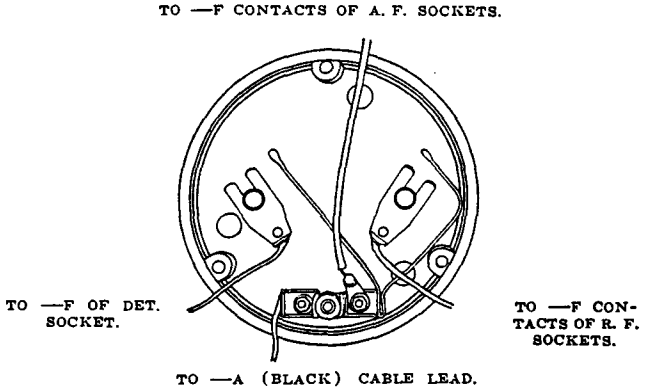

FIG. 91. REAR VIEW OF DOUBLE RHEOSTAT AND FILAMENT SWITCH ASSEMBLY USED IN MODELS 20 COMPACT (No. 7960), 30 (Early Type), 32, 33, 48, 49 AND 50.

NOTE.—The appearance of the rheostat in later Model 30 sets, and in Models 48 and 50, is slightly different from that shown above, but the connections are similar.

side). Let front panel drop forward, leaving rheostat panel attached to sub-panel. Remove the two screws which hold rheostat panel to sub-panel, releasing the former, so that it can be readily approached and repaired in the same manner as the other sets. (See paragraph 1B.)

3. Synchronizing Variable Condensers in One Dial Receivers

In order for a set of the single-dial type to be at maximum efficiency it is extremely important that all the variable condensers be "synchronized," that is, so adjusted on their shafts that they will all tune in a desired wave length with equal efficiency at any point on the wave band.

It is understood, of course, that all the R. F. transformers and condensers in any set are matched properly at the factory, and also are correctly synchronized, however, occasionally the synchronism is disturbed by a jar to the set in shipment, etc., in which case re-synchronizing is required. The apparatus required and procedure of checking is practically the same as described in Section III, under "Testing Set for Output," and is as follows:

For the purpose of checking a set which it is desired to synchronize, a pre-determined standard of volume of output should be made use of. This standard is obtained from a set known to be perfect, or better still, the average of the output of several sets of the same type, all known to be functioning properly. The volume must be checked on three wave lengths, at low, medium and high—as for example, at points 20, 40 and 80 on the dial. The procedure is as follows:

1—Place the signal-producing apparatus at such distance from the receiving test stand that when it is in operation with the dial set at 50, the output reading on the galvanometer of the test stand when connected to the standard set will be around 50 or 60. A little experimenting will be necessary to do this, but by regulating the position of the antenna wire from the transmitter, a satisfactory adjustment can be arrived at.

2—Turn on transmitter, loosen the set screws in condenser pulleys of the set being tested, and turn switch on test stand, so that the set being tested will register on the galvanometer. (Do not loosen screws in dial-condenser pulley.)

3—Set condenser dial of transmitter at 80 (high) and then turn the condenser rotor assemblies in the set by hand, until the signal is tuned in on the test stand, as shown by a maximum output reading on the galvanometer. Make a notation of the reading on paper. Great care should be taken that the position of antenna wire from transmitter is not changed during the following process, the setting of the tuning dial only being carefully changed when passing from one wave length to another.

4—Next set transmitter dial at 40 (medium) and readjust condensers in set for maximum galvanometer reading, again making a pencil notation of the reading.

5—Repeat this with the dial at 20 (low), again jotting down the reading obtained.

6—With condensers set for maximum volume at low, tighten set screws in pulleys very carefully so as not to disturb adjustment. The reading after they are tightened should be the same as when they were loose.

7—Now readjust transmitter to medium and high successively and note how the reading compares with the one obtained previously, when the belts were loose. If there is more than 25 or 30% lower output on either medium or high, it indicates that the radio frequency units are not matched and the set will not be up to standard on that particular band of waves, especially on distant reception. In such cases the trouble will most likely be found in either the R. F. transformer assembly or the variable condenser group. If a thorough visual inspection of the R. F. transformers does not reveal any defect, the condensers may be "out" and had best be replaced, as per instructions in Section VI.

8—The standard set should be connected to the test stand while the test is being made, so that by simply switching over to the standard set, the reading of the galvanometer on each wave length can be compared with the standard immediately. The standard set is used as a means of checking and keeping constant the output from the transmitter.

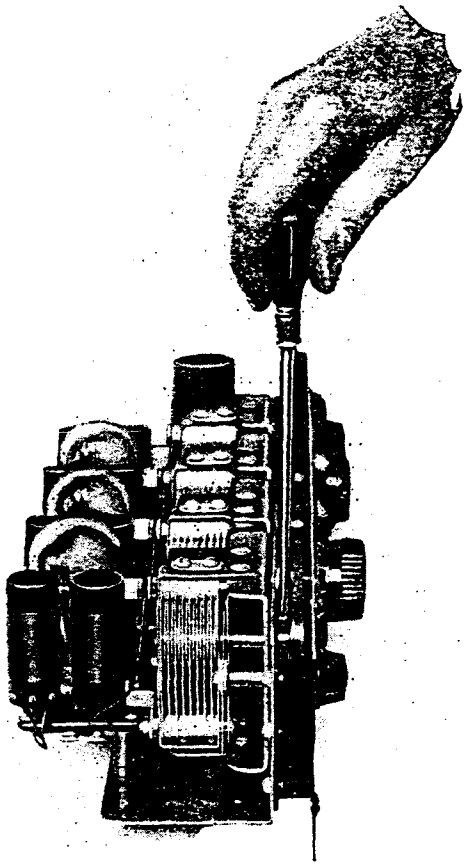

FIG. 92. TIGHTENING PULLEY SET SCREWS AFTER CONDENSERS HAVE BEEN SYNCHRONIZED AT A LOW WAVE LENGTH.

4. Adjusting Tension of Belts in Single Dial Atwater Kent Receivers

On Atwater Kent single dial receiving sets the variable condenser to which the dial is attached (termed the "dial-condenser") is held in a fixed position by three screws.

Each of the other variable condensers is arranged in such a way that when its three screws are loosened, it may be moved independently a fraction of an inch toward or away from the dial-condenser, thus loosening or tightening one belt. When the condenser has been moved to the point giving the correct belt tension the three screws holding the condenser are carefully tightened.

At the factory the belt tension is determined by the use of an auxiliary gauge which gives an accurate indication of tension. These gauges are not available outside, so dealers' and distributors' service men must judge the tension by the "feel" of the belt when it is pressed down lightly with the forefinger. The belt must be tight enough to avoid "play" in the movement of the condenser, but the tension must not be great enough to bind the rotary plates.

The service man should carefully estimate the tension of belts on sets that have been adjusted at the factory, and then endeavor to secure the same tension on all belts that he may adjust.

In the case of sets in which the pulleys and belts are already properly arranged, the belt tension should be adjusted in accordance with the instructions given under the heading, **"Adjusting Belt Tension."** If the pulleys and belts have been removed from the set, as is neces-

sary when replacing the condenser assembly, they should be replaced as described under the separate headings "Pulleys" and "Belts."

PULLEYS

Put dial-condenser pulley on the shaft of dial-condenser, with hollow side of the pulley facing set. This pulley has two short "pins" on its outside surface. Turn pulley so the **outer** one of the two pins is exactly on top. Hold pulley in this position and move rotary plates of the dial-condenser all the way inside the stationary plates. Then, with the pulley and condenser in this position, carefully tighten the two set-screws in the pulley. Make sure these screws are tight. The pulley should not be pushed in too far on the condenser shaft or the belt will rub against the set.

The illustrations (Figures 93, 94 and 95) show clearly how the other pulleys should be arranged on the condenser shafts.

The pulleys on the shafts of all variable condensers (except the dial-condenser pulley) must turn freely or difficulty will be experienced in synchronizing the condensers. Twirl each pulley to see if it moves freely. If it does not move easily, rub the condenser shaft and pulley-bearing free from dirt and try again. If the pulley sticks, replace it or smooth off the condenser shaft with a fine grade of emery cloth. Also remove any burrs from the ends of the pulley bearing.

Do not proceed further until the pulleys turn easily. If the difficulty is caused by a damaged condenser shaft, replace the group of condensers.

BELTS

(a) Each belt must be arranged with the eyelets (that clamp the two ends of the belt together) at the bottom of the belt loop. Each belt has two small holes, one to fit over one of the pins on the dial-condenser pulley and the other hole to fit over the pin on the pulley which that belt controls.

Loosen screws in the outer condensers and move them toward the dial-condenser so the belts will fit easily over the pulleys. In moving condensers, hold them by the heavy frame of the stator plates. Never place any strain on the pulley, shaft, or rotary plates of the condenser.

(b) Models 30, 35, 37, 40, 41, 42, 48 and 50, Arranging Belts

First put on the belt that fits over the **inner** one of the two pins on the dial-condenser pulley and over the pulley of the third (right) condenser.

Then put on the belt that fits over the **outer** one of the two pins on the dial-condenser pulley and over the pulley of the first (left) condenser.

(c) Models 32, 33, 36 and 49, Arranging Belts

First put on the belt that fits over the **inner** one of the two pins on the dial-condenser pulley and over the third pulley.

Then put on the belt that fits over the **inner** one of the two pins on the dial-condenser pulley (it will be on top of the first belt) and over the pulley of the fourth (right) condenser.

Finally put on the belt that fits over the **outer** one of the two pins on the dial condenser pulley and over the pulley of the first (left) condenser.

(d) Models 38 and 44, Arranging Belts

First put on the belt that fits over the first (dial-condenser) and second pulleys, then the belt that fits over the first and third pulleys, and finally the belt that fits over the first and fourth pulleys. All three belts fit over the **inner** one of the two pins on the dial-condenser pulley.

ADJUSTING BELT TENSION

Preliminary Procedure

(a) See that the three screws holding dial-condenser to chassis are tight, and that the three screws in each of the other variable condensers are slightly loosened. Note that the holes through which these latter screws pass are slotted, allowing the condenser to be moved horizontally a fraction of an inch toward or away from the dial-condenser. Two pins projecting from the front of the condenser fit into two horizontal slots and serve to keep the condenser properly aligned. Be certain that the condenser pins are in the slots and not jammed outside. (Models 30 (early type) and 32 have moulded end-plate variable condensers and these do not have the projecting pins.)

(b) In Atwater Kent single-dial receivers having metal frame variable condensers, a hole is provided in the front of the chassis at the edge of each condenser. The hole is placed on that side of the condenser which is nearest to the dial-condenser. The frame of the condenser partly covers the hole. By inserting the blade of a screw driver (held in the left hand) in this hole and twisting the blade, the condenser may be moved away from the dial-condenser, thus tightening one belt. When the condenser is moved to the point giving the correct belt tension, keep the condenser in that position and then, with another screw driver in the right hand, tighten the three screws that hold the condenser to the chassis.

In Models 30 (early type) and 32, both of which have moulded end-plate variable condensers, holes for moving the condensers are not provided in the metal bracket on which the condensers are mounted. In these sets the condensers may be moved with the fingers when adjusting the belts.

In four-condenser sets where two or three belts are placed over each other, the tension of the **under** belt must be adjusted first and the upper belts must be slack. If the upper belt is adjusted first, it will not be possible to judge the tension of the lower belt. The correct order for adjusting belts in the different sets is given below under separate headings for the various types of sets.

(c) The screws must be tightened carefully so the condenser will not move and change the belt tension. If the condenser does move, causing the belt tension to change, loosen the three screws, readjust the tension, and again tighten the screws. Repeat, if necessary, until when the screws are tight, the tension is correct. Make the screws very tight.

Models 30 (later type), 35, 37, 40, 41, 42, 48, 50 and 52, Adjusting Belt Tension

Adjust right-hand belt first. Insert the blade of a screw driver in the chassis hole at the left-hand edge of the third condenser. Twist the blade slowly, forcing the third condenser toward the right until the belt seems to have the correct tension, as judged by the finger, hold the condenser in that position and, with another screw driver, tighten the three screws. Adjust the left belt in the same general way. See paragraph (c) above.

Models 38 and 44, Adjusting Belt Tension

First adjust tension of belt that passes over pulleys of dial-condenser and second condenser. Then adjust belt passing over pulleys of dial-condenser and the third condenser, judging the tension by pressing down on this belt between the second and third pulleys. Finally adjust tension of belt passing over pulleys of dial-condenser and the right-hand condenser, judging the tension by pressing down on this belt between the third and fourth pulleys. See paragraph (c) above.

Models 32, 33, 36 and 49, Adjusting Belt Tension

First adjust belt passing over pulleys of dial-condenser and third condenser. Then adjust belt passing over pulleys of dial-condenser and fourth condenser, judging tension by pressing down on this belt between the third and fourth pulleys. Finally adjust left-hand belt. See paragraph (c) above.

Part Numbers of Pulleys and Belts

(Refer to Illustrations for Identification and Arrangement of Pulleys and Belts)

MODEL OF SET	BELTS			PULLEYS			
	"A"	"B"	"C"	No. 1	No. 2	No. 3	No. 4
30 (Molded end-plate variable condensers.)	7965	7965		9168	9169	9168	
35, 37, 48 and 30 (with metal frame variable condensers).	8146 (Long)	8136 (Short)		9168	9169	9168	
32	8146	8146	8282 (Long)	9168	9169	9168	9171
38	8963 (Short)	8964 (Long)	13264 (Extra Long)	9169	9168	9171 (Identified by two holes through side).	13263 (Identified by one hole through side and letter "E" stamped inside.)
50	8146	8146		9168	9169	9168	
33, 36 and 49	8963	8963	8964 (Long)	9168	9169	9168	9171
40-42-52	13484 (Long)	13483 (Short)		9168	9169	9168	
44	13675 (Short)	13676 (Long)	13677 (Extra Long)	9169	9168	9171	13263

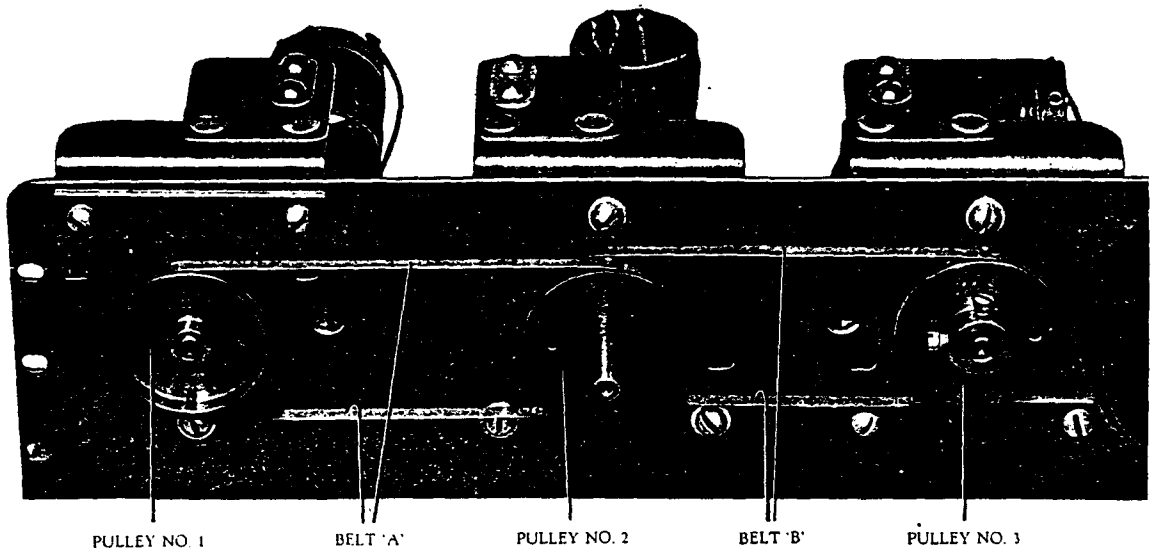

FIG. 93. VIEW OF 37 CHASSIS, SHOWING HOW PULLEYS AND BELTS ARE MOUNTED. The same arrangement is used in Models 30, 35, 40, 41, 42, 48, 50 and 52.

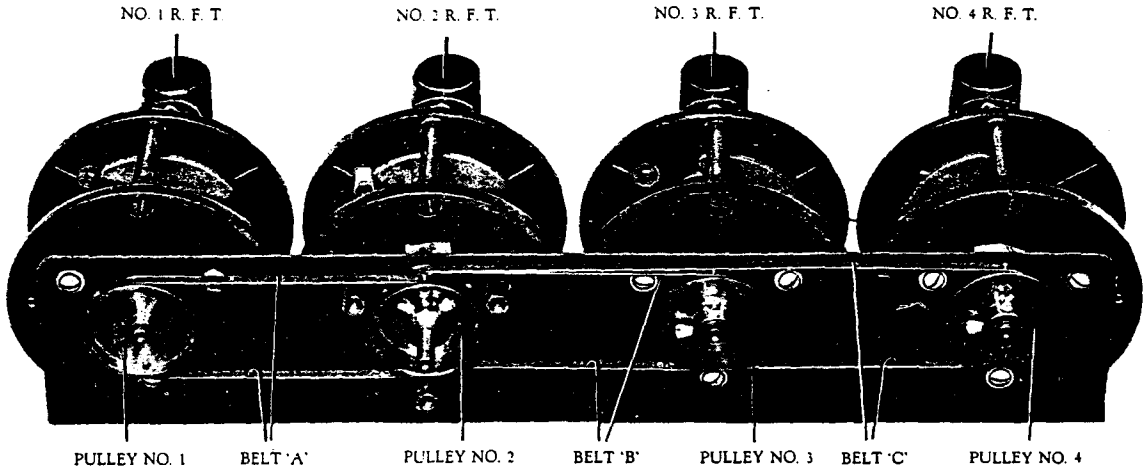

FIG. 94. FRONT VIEW OF MODEL 32 SUB-PANEL ASSEMBLY. The same arrangement of pulleys and belts is used on Models 33, 36 and 49, except that the dial-condenser pulley is usually placed with the hollow side toward the condenser.

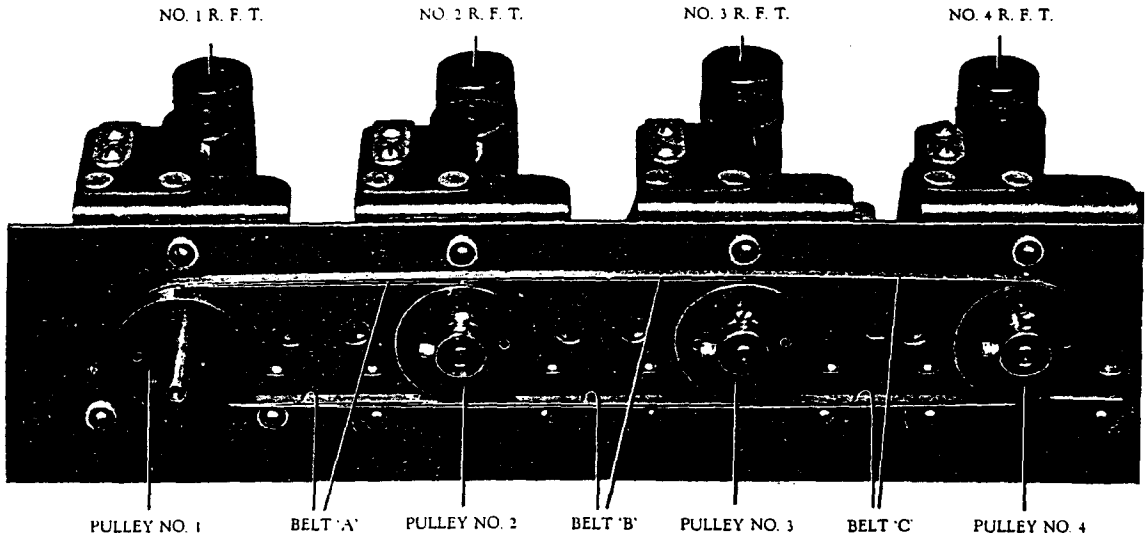

FIG. 95. FRONT VIEW OF MODEL 38 CHASSIS. The pulleys and belts on Model 44 are arranged in a similar manner.

SECTION XII
Model 41 Direct Current Receiver

General Description

The Model 41 is a seven tube receiver similar in appearance to Model 40, but designed to operate on 110 volts **Direct Current** (D. C.). The power unit and filament circuits are therefore quite different from those in the A. C. sets, and owing to the low maximum voltage available for plate supply, the audio frequency circuit is arranged differently from that in the battery type and A. C. electric sets.

Since the power supply for this set is direct current, and D. C. type tubes are used throughout, the function of the power unit is simply to act as a filter to smooth out the current as received from the original source, and reduce and distribute it as necessary for the plate and filament supply of the tubes.

As will be noted from the simplified diagram (Fig. 96), the power unit consists of the following parts:

(a) 2 R. F. Chokes, one in each side of line.
(b) 2 A. F. Filter Chokes connected in series in positive side of line.
(c) 3 Fixed Condensers connected across line at points between the series of choke coils.
(d) A Series Resistor, mounted on outside of power unit at one end, and connected in series with one side of the D. C. line. The purpose of this resistor is to reduce the line voltage to a value such that, when all the tube filaments are connected in series across the line, each will receive approximately its rated voltage.
(e) Output choke, through which the filtered positive voltage is applied to the plates of the two last audio tubes.
(f) Detector plate voltage resistor. This is mounted along with the R. F. chokes (a) on the lower side of the power unit panel assembly.

It will be noted that the audio amplifier tubes receive practically the full line voltage as their plate supply, except that there is a slight drop in voltage in passing through the filter system.

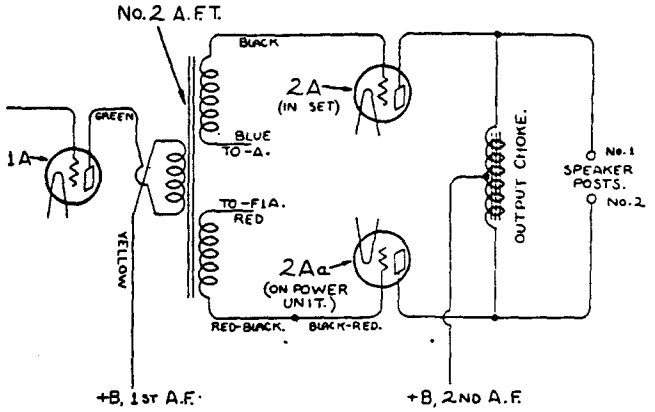

FIG. 97. SCHEMATIC DIAGRAM OF THE "DOUBLE AUDIO" 2ND A. F. STAGE IN MODEL 41.

The series resistor reduces the 110-volt supply to 35 volts, and this 35 volts is applied to the terminals of the filament circuit of the set, which includes the filaments of all the seven tubes in series. Since in accordance with a fundamental law of electricity this voltage is divided among the filaments, each receives approximately 5 volts. To further equalize the voltage on the tubes, shunt resistors are connected across some of the tube filaments. Without these resistors, the tubes at the negative end of the series would receive the highest voltage, due to the cumulative addition of the plate currents.

The audio amplifier system used on the Model 41 is somewhat different from that used on previous models. The first stage of audio is the same, but the second stage consists of two of the 171-A type tubes arranged with a double secondary audio transformer, as shown in the diagram, Fig. 97. The additional tube socket required is mounted on the outside of the right hand end of the power unit.

(Continued on page 94.)

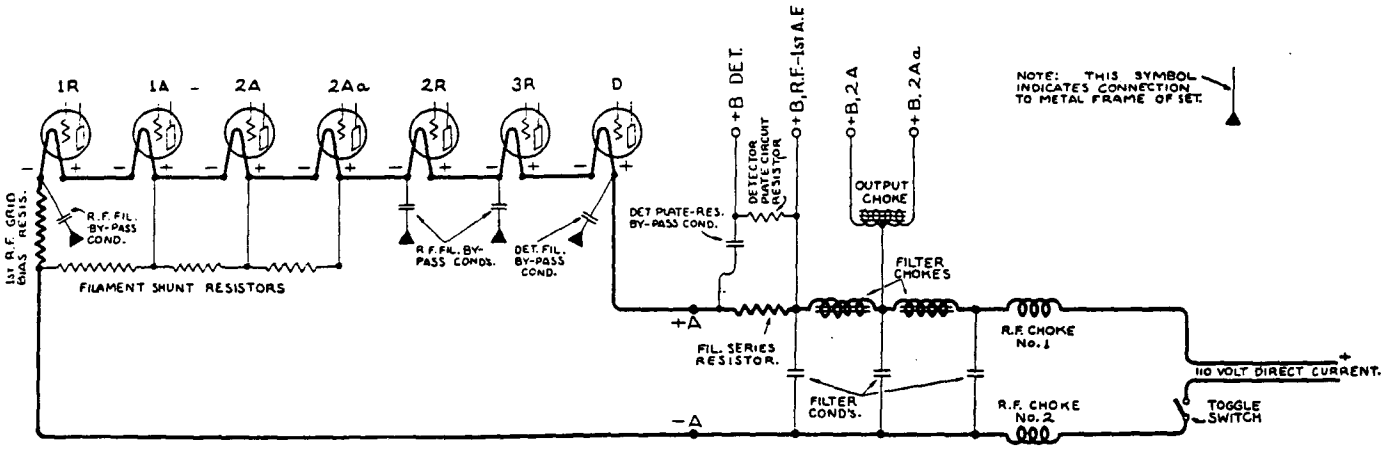

FIG. 96. SIMPLIFIED DIAGRAM OF POWER UNIT AND FILAMENT CIRCUIT IN MODEL 41 RECEIVER.
Tubes of the 112-A type are used in all sockets except 2A and 2Aa.

Continuity Test Table and Chart—Model 41 D. C. Set

(For Following Tests, Remove Cable Panel from Power Unit. Colors Refer to Cable Leads)

TEST FROM	Correct Reading	WRONG READING INDICATES.	REMARKS and FURTHER POSSIBILITIES
Each cable lead end to corresponding soldered cable connection under set (except yellow, and black-red tracer).	*Full*	Open in cable or connection.	**Examine cable for broken leads and short circuits. Repair or replace cable if necessary.**
GROUND POST to Metal Chassis.	*Full*	Open connection.	Examine lead from volume control to metal chassis.
Black.	*None*	Shorted R.F. by-pass condenser, grounded fil. circuit, or grounded A.F. grid. circuit.	**NOTE.—If a by-pass condenser is thought to be defective, unsolder its lead from rest of circuit and test condenser separately.**
White.	*None*	Shorted R.F. by-pass condenser, or grounded R.F.-1st A.F. plate circuit.	
Black-Red Tracer.	*None*	Grounded secondary No. 2 A.F.T.	
Yellow.	*None*	Grounded detector plate circuit.	
+FD	*None*	Shorted detector filament condenser.	
—F3R	*None*	Shorted R.F. by-pass condenser.	
Stator Each Var. Cond.	*None*	Shorted variable condenser.	Or grounded R. F. grid.-fil. circuit.
Top Cont. of Vol. Cont.	*Nearly Full*	Open resistance unit in volume control.	
Antenna Terminal. (Turn Volume Knob.)	*Smooth and Nearly Full*	No reading—open res. winding. Erratic reading—damaged winding or slider.	
Center (Tap) Contact On Ant. Coup. Trans.	*None*	Shorted volume control condenser.	
BLACK to Red-White Tracer.	*Nearly Full*	Open filament shunt resistor.	
—F1R	*Full*	Open 1st R.F. grid bias resistor.	Green (or black) covered wire.
+F1A	*Nearly Full*	Open between +F1A and contact No. 2.	
—F2A	*Nearly Full*	Open connection between +F1A and —F2A.	
+F2A	*Nearly Full*	Open between +F2A and contact No. 3.	
—F2R	*Nearly Full*	Open between —F2R and contact No. 4.	
G1R	*Nearly Full*	Open antenna coupling transformer.	
G2R	*Partial*	None—Open secondary No. 1 R.F.T. or open No. 1 grid resistor.	Full-Shorted grid circuit or resistor.
G1A, G2A	*Partial*	None—Open secondary No. 1, 2 A.F.T.	Full—Shorted secondary.
YELLOW to PD	*Partial*	None—Open primary No. 1 A.F.T.	Full—Shorted primary.
YELLOW to —FD	*None*	Shorted phone condenser.	
WHITE to P1R	*Partial*	Open primary No. 1 R.F.T.	Or open 1st R.F. plate resistor.
P2R, P3R	*Full*	Open primary No. 2, 3 R.F.T.	
P1A	*Partial*	None—Open primary No. 2 A.F.T.	Full shorted primary.
OTHER TESTS			
+F1R to —F1A	*Full*	Open connection.	
+F2R to —F3R	*Full*	Open connection.	
+F3R to —FD	*Full*	Open connection.	
G3R to —F3R	*Partial*	None—Open secondary No. 2 R.F.T. or open No. 2 grid resistor.	Full—Shorted grid circuit.
Stator of Det. Var. Cond. to GD	*None*	Shorted grid condenser.	
Stator of Det. Var. Cond. to +FD	*Full*	Open secondary No. 3 R.F.T.	

NOTE.—The readings vary somewhat, depending on the resistance of the meter.

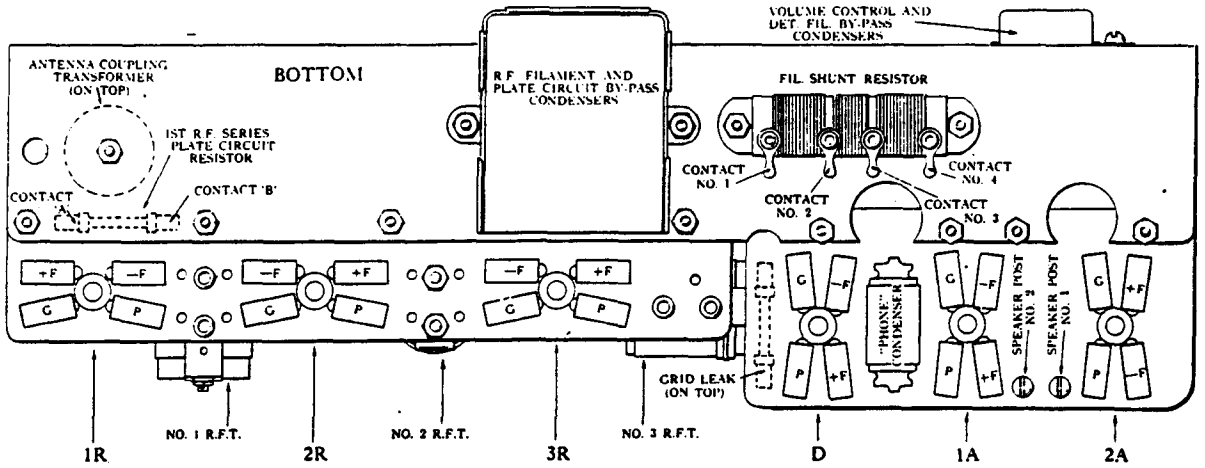

FIG. 99. TESTING CHART FOR MODEL 41.

(Note that the filament contacts of sockets 1-R and 2-A are reversed from the usual polarity.)

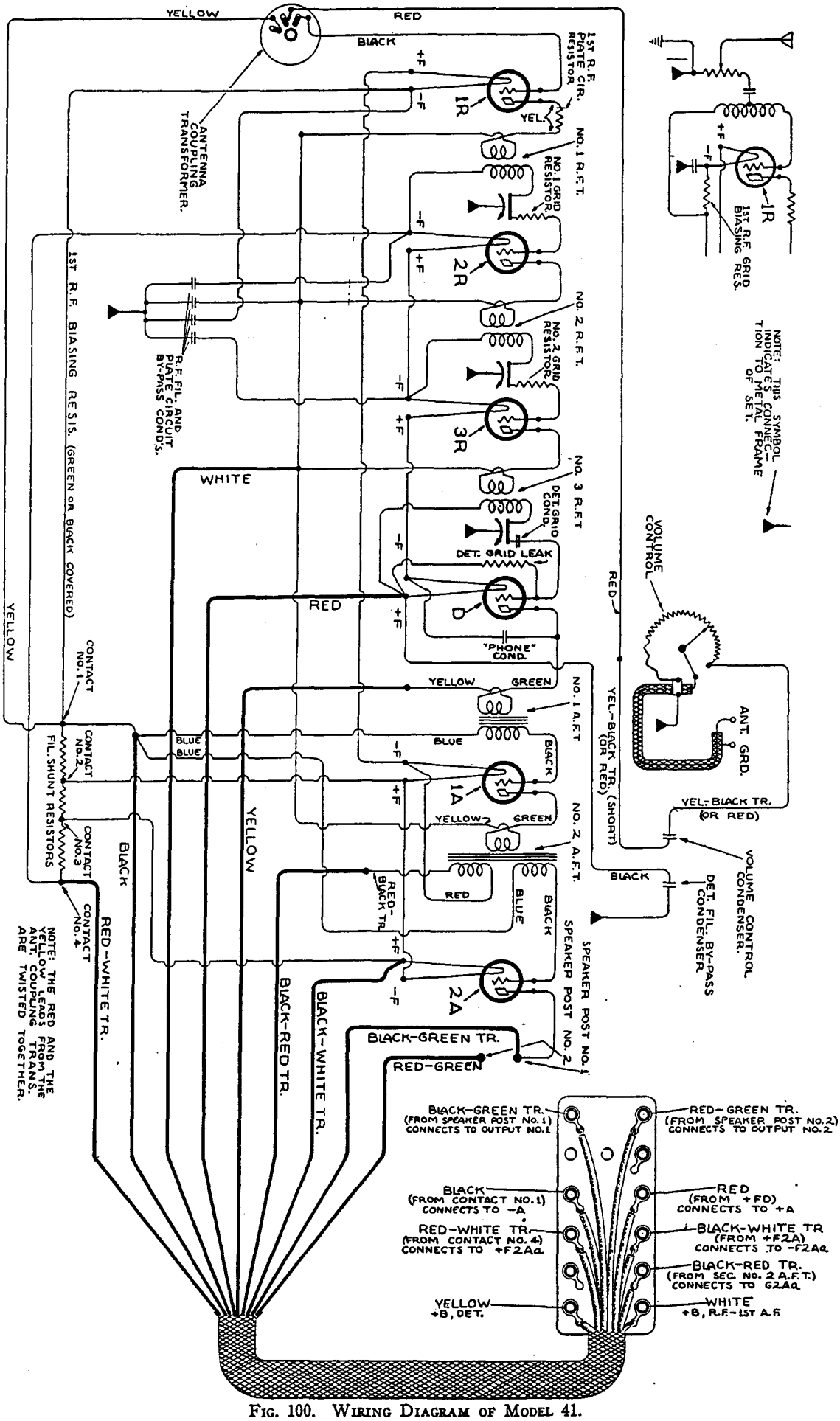

FIG. 100. WIRING DIAGRAM OF MODEL 41.

Due to the comparatively low plate voltage available (approximately 90 volts after filtering) two stages of straight audio amplification connected in standard fashion, would not provide sufficient undistorted output volume. The use of two tubes in this 2nd A. F. "double audio" arrangement causes the available undistorted volume to be equal to that of the A. C. sets, although the plate voltage is much lower.

Special Notes on Installation

The service man should be familiar with several special points which must be observed in connection with the satisfactory installation of Model 41.

REVERSING PLUG: If the set does not operate when first installed (although the tubes light), reverse the two-pronged plug into the electric socket, so that the current flows in the proper direction.

USING COUNTERPOISE: In some cases where an unpleasant hum is experienced in reception, this can be overcome by the use of a "counterpoise" instead of a ground connection. A counterpoise consists of a length of insulated wire connected to the ground post of the set, the other end being open. This wire can be strung in any convenient manner, preferably in a straight line, or nearly so.

DETECTOR CAP: The metal cap furnished with the set (in small envelope) should be placed over the detector tube, which is fourth from left. This will prevent microphonic noises, such as a howl or hum.

Removing Chassis from Cabinet Replacing Variable Condensers

Instructions for removing the chassis from cabinet and for replacing the group of variable condensers are the same as given on page 63 for Model 42.

Replacing R. F. Amplifier Assembly

If one R. F. transformer is defective, replace the R. F. amplifier assembly, an illustration of which is shown in Fig. 98.

Procedure: Remove chassis from cabinet. Unsolder four leads from by-pass condensers, and filament leads at filament contacts —F1A and —FD. Unsolder lead from the secondary of No. 3 R. F. T. at filament contact +FD. Loosen lower nut on rear of each variable condenser and remove the secondary lead lugs. Unsolder green (or black) insulated resistance wire from —F1R and unsolder blue lead from —F2R. Unsolder white cable lead and yellow lead of No. 2 A. F. T. from the exposed section of the +B, R. F lead at the right hand end of the R. F. assembly. Unsolder leads to contacts "A" and "B" on R. F. plate circuit resistor. Unsolder black lead from antenna coupling transformer at G1R and unsolder leads from grid resistors at contacts G2R and G3R.

Unscrew four bolts holding the assembly and the 1st R. F. series plate resistor strip, then remove the assembly.

Reassemble with replacement R. F. amplifier, reversing above procedure. Replace the 1st R. F. resistor mounting strip.

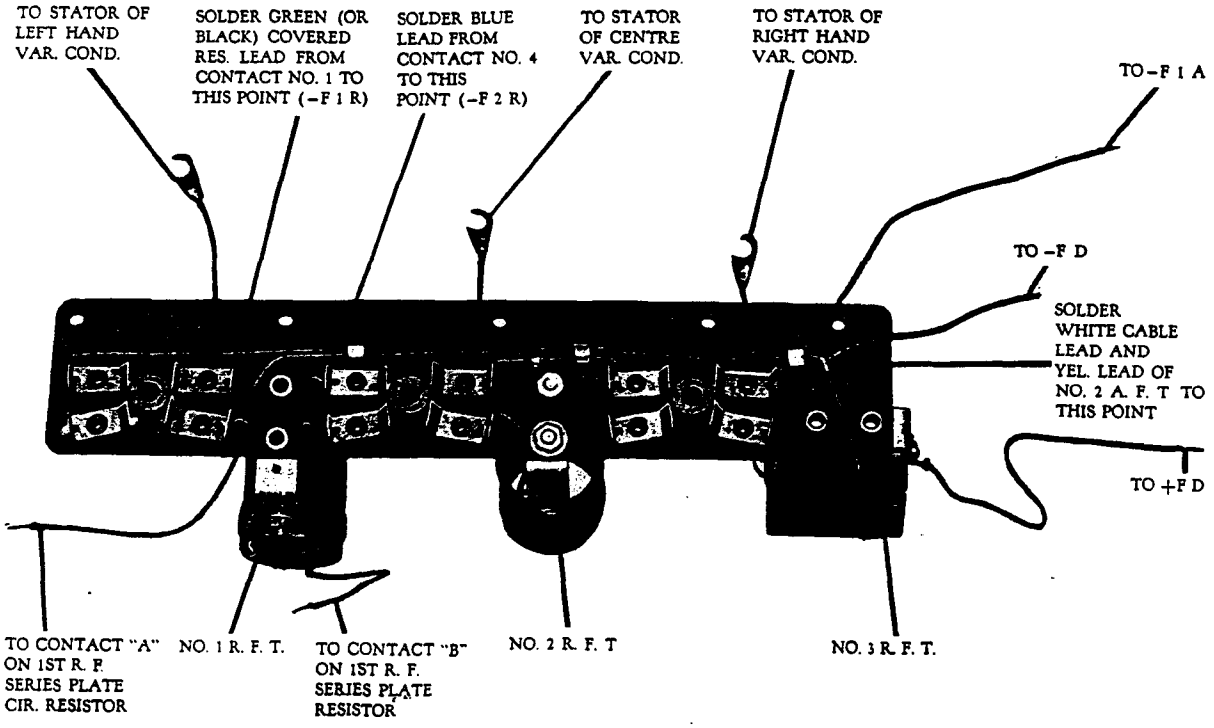

FIG. 98. VIEW OF R. F. AMPLIFIER ASSEMBLY, SHOWING WHERE EACH LEAD IS TO BE CONNECTED.

Voltage Test Table

ATWATER KENT DIRECT CURRENT RECEIVERS

All Measurements Made While Set Is in Operation
Use high-resistance D. C. Voltmeter‡

Voltage at Power Unit Panel Assembly.	APPROXIMATE VOLTAGE Models 41-51
—A to +A.	35 V.
—A to +B, R.F.-1st A.F.	90 V.
—A to +B, Detector.	60 V.
—A to Output No. 1.	95 V.
—A to Output No. 2.	95 V.
Filament Voltage at Set.*	
—F1R to +F1R (1st R.F. Filament).	4.8 V.
—F2R to +F2R (2nd R.F. Filament).	4.9 V.
—F3R to +F3R (3rd R.F. Filament).	4.6 V.
—FD to +FD (Detector Filament).	4.6 V.
—F1A to +F1A (1st A.F. Filament).	4.9 V.
—F2A to +F2A (2nd A.F. Filament).	4.8 V.
Grid Bias at Set.*	
—F1R to G1R (1st R.F. Bias).	2 V.
—F1A to G1A (1st A.F. Bias).	4.8 V.
—F2A to G2A (2nd A.F. Bias).	9.7 V.
Plate Voltage at Set.*	
—F1R to P1R (1st R.F. Plate).	60 V.
—F2R to P2R (2nd R.F. Plate).	65 V.
—F3R to P3R (3rd R.F. Plate).	65 V.
—FD to PD (Detector Plate).	24 V.
—F1A to P1A (1st A.F. Plate).	81 V.
—F2A to P2A (2nd A.F. Plate).	81 V.
Voltage at 2nd A.F. Tube on Power Unit.*	
—F to +F (Filament Voltage).	4.8 V.
—F to G (Grid Bias Voltage).	9.7 V.
—F to P (Plate Voltage).	85 V.

* Contact made through socket eyelets. ‡ The readings in the table were taken with a Weston No. 489 (0—50—250) voltmeter. Other types of voltmeters may give slightly different values.

Model 51. The Model 41 receiver is also manufactured in a thirty-inch high metal cabinet like that of Model 52. This receiver is known as Model 51. The chassis is identical with Model 41, except that the shielded antenna lead is not used—instead, two twenty-foot leads are furnished for connection to the regular antenna and ground. The speaker in Model 51 is the same as in Model 52—service instructions for this type speaker are given on page 83.

Power Unit in Direct Current Receivers

General Information

A simplified circuit diagram of the power unit used in the Atwater Kent Model 41 direct current receiver is shown in Fig. 96. A wiring diagram of one of the first units of this type is shown in Fig. 103. Slight modifications were made subsequently in order to improve the reliability of the unit. The modified arrangements are shown in Figs. 101 and 105.

A socket for one of the 2nd A. F. amplifying tubes is mounted at the right hand end of the power unit. A filament series resistor (similar in appearance to the regulating resistor in A. C. power units) is mounted at the left hand end of the unit.

Instructions for removing the power unit from cabinet are similar to those given on page 69 for Model 42 unit.

Testing

Apply the continuity tests given in the table on this page. If the tests indicate that the filament series resistor, detector plate circuit resistor or one of the R. F. choke coils is defective, it may be replaced. If anything is defective in the A. F. filter chokes or condensers, which are sealed in the metal container, a new sealed container should be substituted.

Replacing Sealed Power Unit Container

Remove the lid of unit and the filament series resistor. Unsolder leads from sealed container at panel assembly. Unsolder four leads from tube socket contacts and the two primary winding leads where one connects to the toggle switch and the other connects to one side of the 110-volt supply cable.

Remove two screws holding socket to angle bracket and remove socket. Pull the power-unit cable leads up through the hole in tube socket angle-bracket and pull the red-green tracer lead and the primary winding leads up through the cable covering. Remove the panel assembly with attached power-unit cable leads. (In the early type of unit shown in Fig. 103, the primary winding leads are not brought through the power unit cable.)

Reassemble with replacement sealed container, reversing the above procedure. Note that the red-green tracer lead and the primary winding leads from the replacement sealed container should be brought through the power-unit cable. This may be accomplished with the aid of a piece of bus-bar, hooked at one end, by pushing the bus-bar up through the cable from the socket end, fastening the lead to the hook, and pulling the bus-bar back again, thus drawing the lead through the cable covering.

Note.—In servicing or assembling the direct current power unit, make certain that the R. F. choke coil contacts do not make accidental connection with any of the terminals on the panel assembly.

Continuity Test Table for Direct Current Type Power Unit

For Following Tests, Remove Cable Panel from Power Unit

TEST FROM	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Each Socket Contact to Corresponding Terminal on Panel.	*Full*	Open in lead or connection.	
Test Across Contacts on Each R.F. Choke.	*Full*	Open R.F. choke.	
+B R.F.-1st A.F. to +110 Volt Input.	*Nearly Full*	None—Open filter choke or connection.	
+B Detector.	*Partial**	None—Open detector plate circuit resistor.	Nearly Full—Shorted detector by-pass condenser.
+A	*Nearly Full*	None—Open filament series resistor.	Examine resistor carefully to see if it is open, shorted, or damaged in any way.
—A	*None*	Shorted filter condenser or shorted pos. cir.	
Output No. 1.	*Nearly Full*	None—Open output choke or connection.	
Output No. 2.	*Nearly Full*	None—Open output choke or connection.	
—A to —110 Volt Input.	*Full*	Open connection in negative line.	
Exposed Edge of Metal Container to —A, +A	*None*	Grounded circuit.	Examine power unit wiring for external grounds. If ground is internal, replace the sealed container.

* If using a low-resistance testing voltmeter, this reading will be "small."

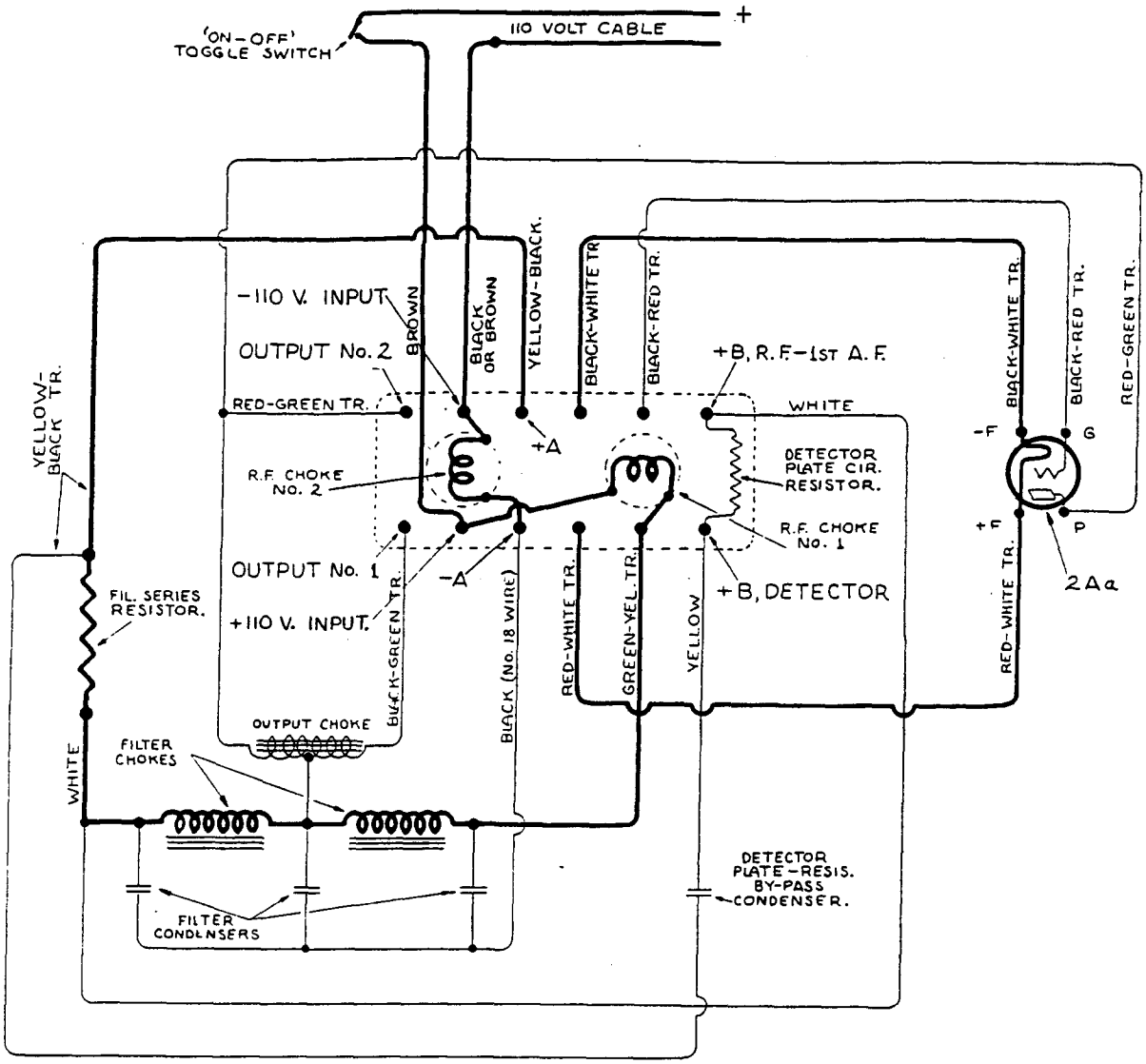

FIG. 101. WIRING DIAGRAM OF 3RD TYPE OF POWER UNIT FOR MODEL 41.

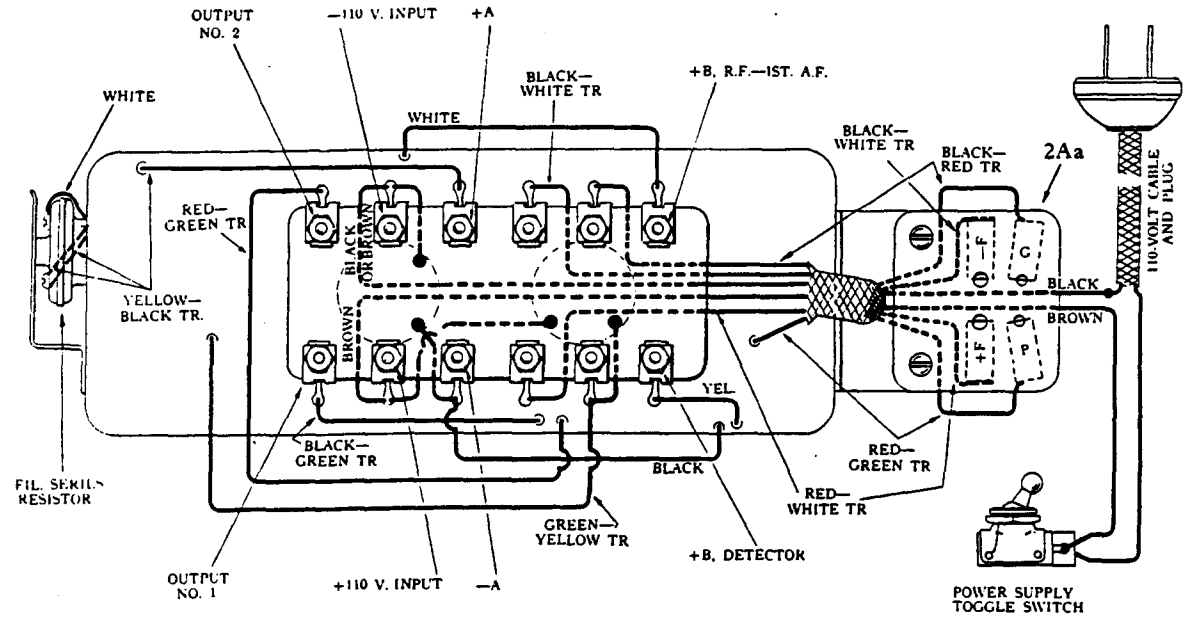

FIG. 102. SHOWING CONNECTIONS AND APPROXIMATE POSITION OF LEADS FROM SEALED CONTAINER IN 3RD TYPE OF POWER UNIT.

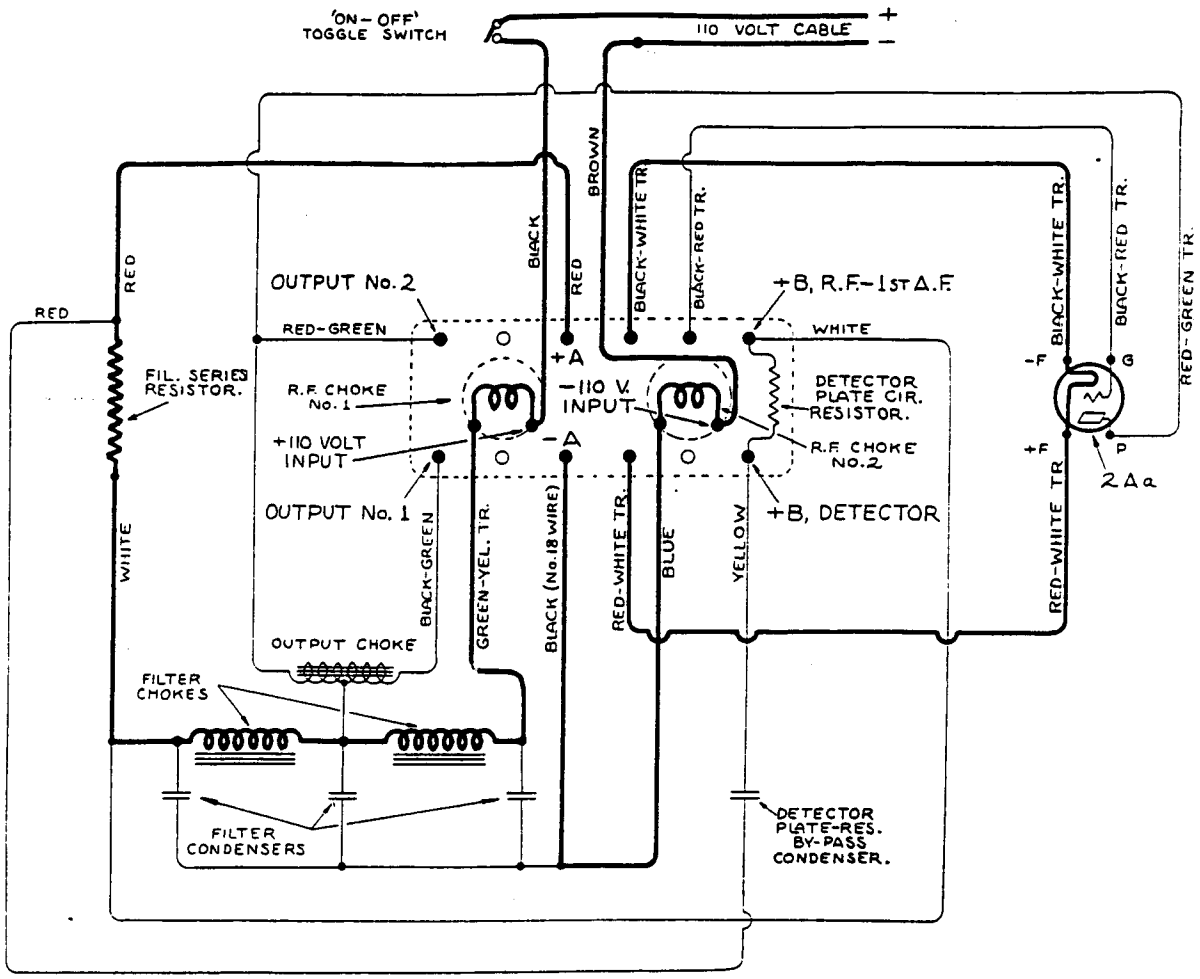

FIG. 103. WIRING DIAGRAM OF 1ST TYPE OF POWER UNIT FOR MODEL 41.

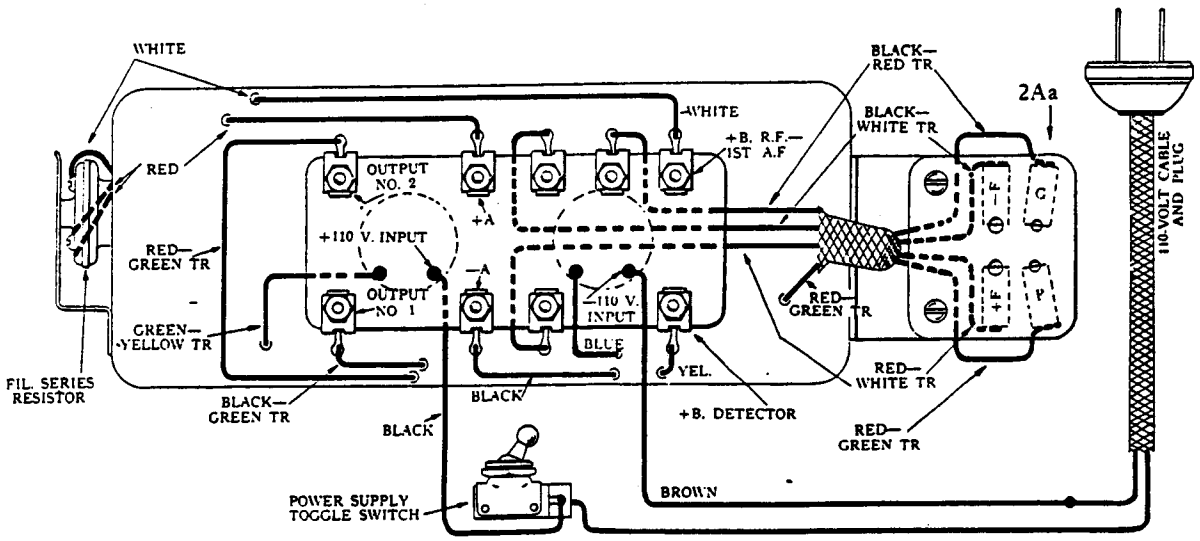

FIG. 104. SHOWING CONNECTIONS AND APPROXIMATE POSITION OF LEADS FROM SEALED CONTAINER IN 1ST TYPE OF POWER UNIT.

NOTE.—Complete direct current power units of the 1st, 2nd and 3rd type are interchangable in Model 41 receiver. Only the 3rd type is supplied as replacement.

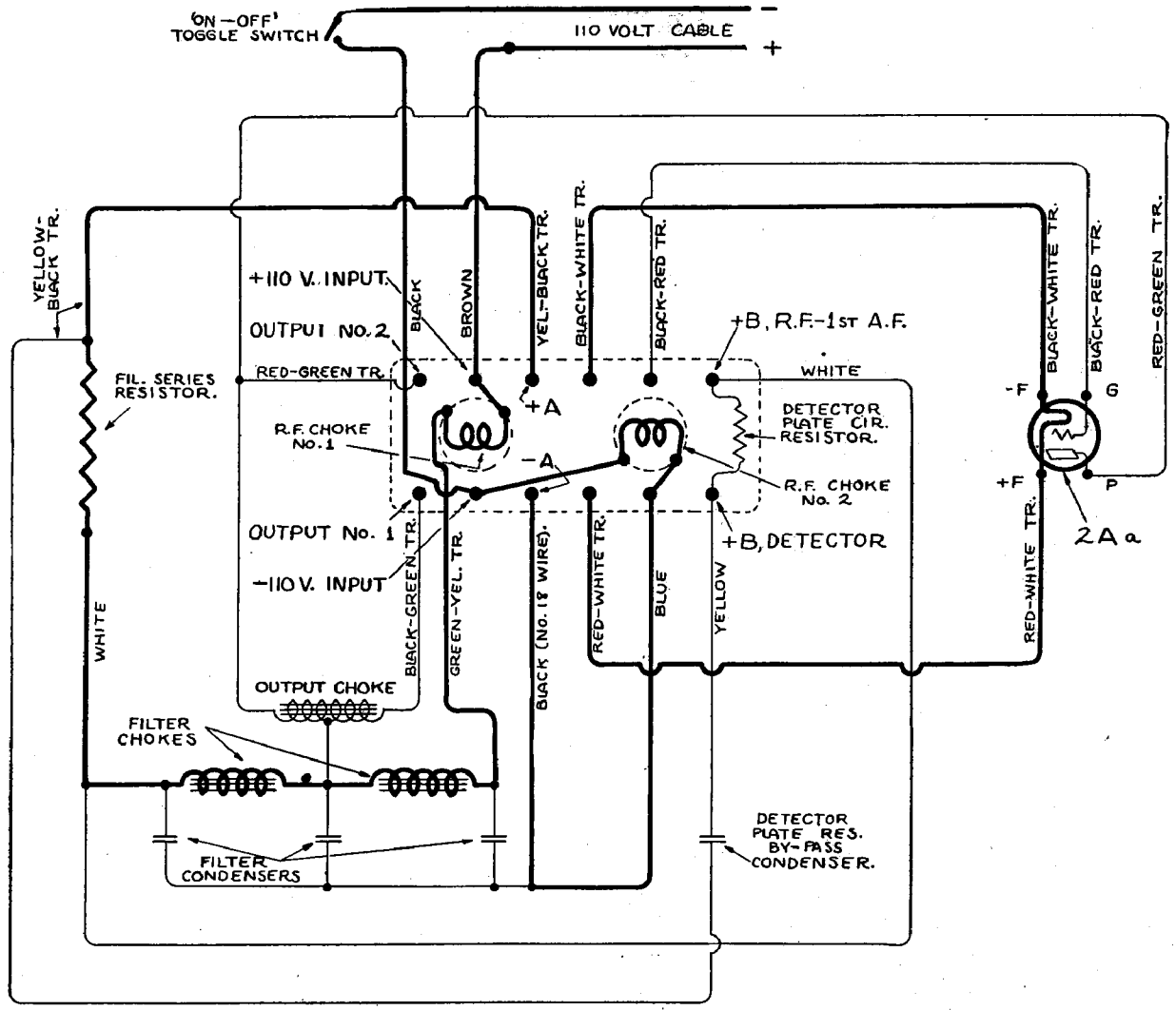

FIG. 105. WIRING DIAGRAM OF 2ND TYPE OF POWER UNIT FOR MODEL 41.

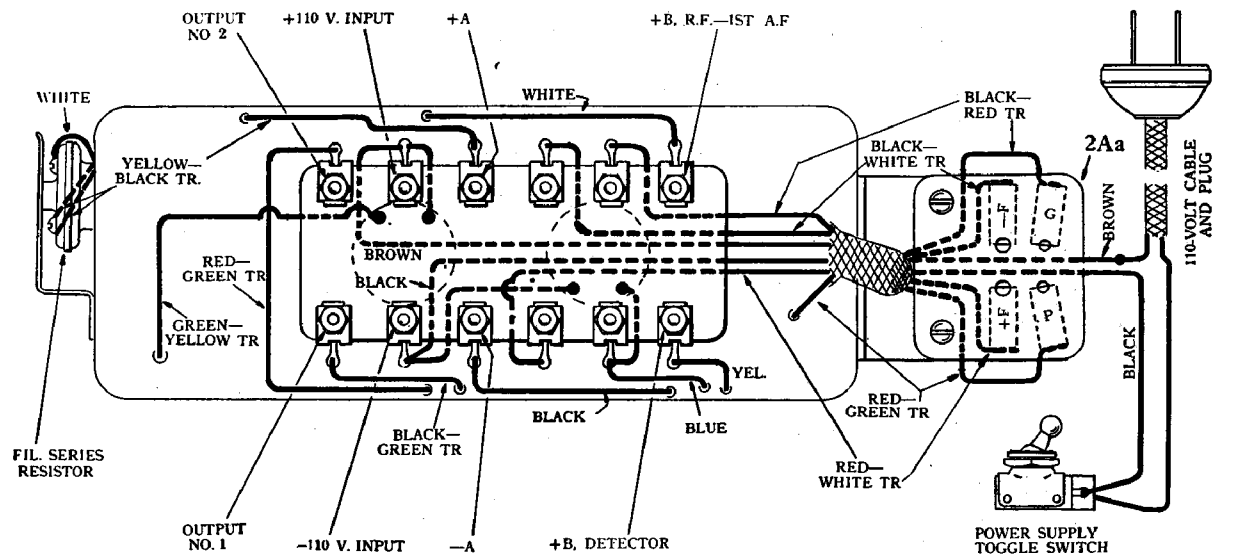

FIG. 106. SHOWING CONNECTIONS AND APPROXIMATE POSITION OF LEADS FROM SEALED CONTAINER IN 2ND TYPE OF POWER UNIT.

NOTE.—Complete direct current power units of the 1st, 2nd and 3rd type are interchangable in Model 41 receiver. Only the 3rd type is supplied as replacement.

SECTION XIII
Model 43 Set

General Description

The Model 43 is an A. C. receiver similar in appearance and general design to the Model 42, but designed to operate in connection with the Atwater Kent type F (Dynamic) speaker.

In order to secure the benefits of the remarkable reproduction of which the type F speaker is capable, the audio amplifier of the Model 43 is of a somewhat different type from that used in the other A. C. sets, a single stage of straight audio being followed by a stage of "double audio" using 2 tubes of the power type. The set, therefore, requires 7 tubes in addition to the rectifier tube.

A special step-down output transformer is employed in the Model 43 to connect the output of the set to the "diaphragm coil" or floating coil of the speaker. The 125 volts D. C. required by the field magnet coil of the speaker is supplied by substituting for one of the filter chokes in the power unit filter, the field coil of the speaker. This coil, therefore, receives the rectified current of the unit, which serves to create a strong magnetic field, and at the same time it functions as part of the power unit filter system.

Connection between the power unit and speaker field is made through two prongs of a four-pronged plug on the end of the speaker cord, the other two prongs connecting the output of set to the "floating" diaphragm coil of speaker. This plug is of special design and fits into a special socket in the set, mounted in the rear of cabinet. **It is very important not to remove this plug from its socket when the set is in operation, as this will put an excess voltage on certain parts in the power unit.**

The radio frequency amplifier used in the Model 43 is the same as that in Model 42.

Correcting Noisy Volume Control (All Types of Sets)

If the volume control is noisy in operation, thoroughly clean off the resistance unit and slider with alcohol, then spread a few drops of "Nujol" on these parts. **Do not use any type of oil other than Nujol.**

Replacing Parts

Instructions for removing the chassis from set and for replacing various parts are the same as given on pages 63 and 64 for Model 42 receiver.

Power Unit in Model 43 Set

The power unit in Model 43 A. C. receiver has three sockets attached to the outside of container, a single socket at the left end for the rectifier tube, and a double socket at the right-hand end for the speaker plug and for one of the two 2nd A. F. amplifying tubes. The speaker plug socket is designed to fit only the speaker plug, so the speaker plug can not be inserted into any of the other sockets.

The power unit contains a step-down output transformer with a centre-tapped primary. One end of the primary connects, through the set cable, to the plate of the 2nd A. F. amplifying tube in the set. The other end of the primary connects, through the power unit cable, to the plate of the other 2nd A. F. amplifying tube located at end of power unit. The centre tap of the primary is connected to the rectified and filtered high-voltage plus "B" supply terminal. The secondary of the output transformer consists of a comparatively few turns of heavy wire and is connected, through the speaker-plug socket, to the "diaphragm coil" of the type F (Dynamic) speaker.

The magnet coil in the speaker is connected, through the speaker-plug socket, to the power unit, where it serves the purpose of a filter choke; consequently only one filter-choke is required in the power unit. The entire direct current plate supply for the set is passed first through the speaker field coil, where it produces an intense magnetic field in the circular air gap of the speaker magnet.

Testing

If the power unit does not deliver the correct voltage, or seems to be otherwise defective, remove the cable connection panel and apply the continuity tests given in the table. If the detector or 1st A. F. plate circuit resistors, or the regulating resistor is defective, it may be replaced. If anything is defective in the filter chokes, power transformer, or condensers, which are sealed in the metal container, a new sealed container should be substituted.

Replacing Sealed Power Unit Container

Remove the lid of unit, unsolder leads to regulating resistor, rectifier socket, speaker-plug socket and 2nd A. F. socket. Remove the resistor and sockets. Unsolder leads from sealed container to panel assembly. Lift off the panel assembly, pulling the four leads (two yellow-black tracer, one blue, one brown) from sealed container up through the power unit cable. Unsolder two leads from primary winding at points where they connect to toggle switch and to one side of the 110-volt leads respectively.

Reassemble with replacement sealed container, reversing above procedure. Note that the two yellow-black leads, the blue, and the brown (No. 18 wire) leads from the top of the sealed container are to be brought through the cover of the power unit cable.

Filament, Plate and Grid Voltages, Model 43

The tube voltages in Model 43 are approximately equal to the voltage given for Models 40, 42, 44 and 52 in the table on page 71, with the exception that the 2nd A. F. grid bias is about 15 volts as measured between the eyelets on contacts —F and G on socket 2A and on socket 2Aa.

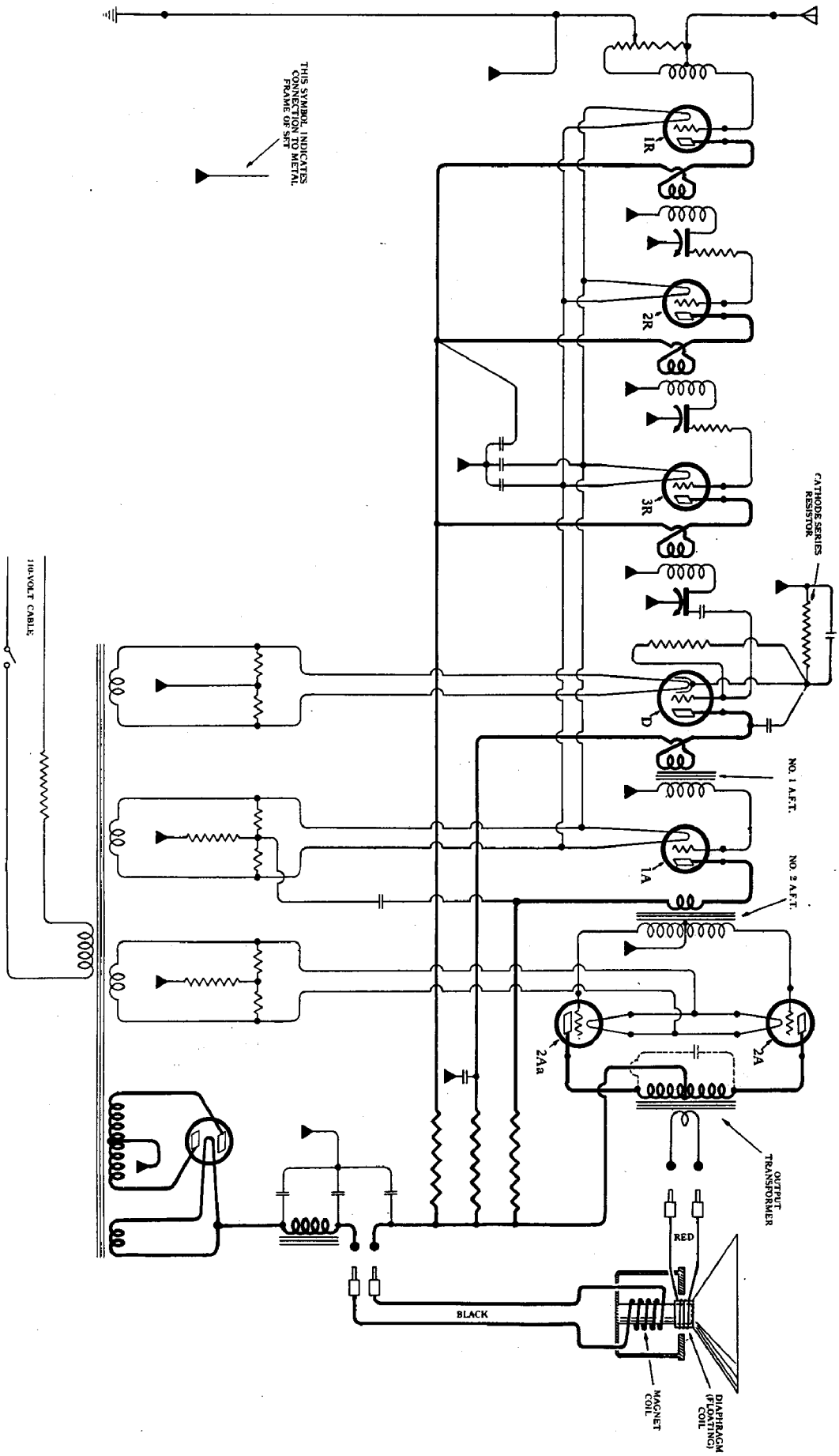

FIG. 107. DIAGRAM OF MODEL 43 SET AND POWER UNIT.
The output transformer is sealed in the power unit.

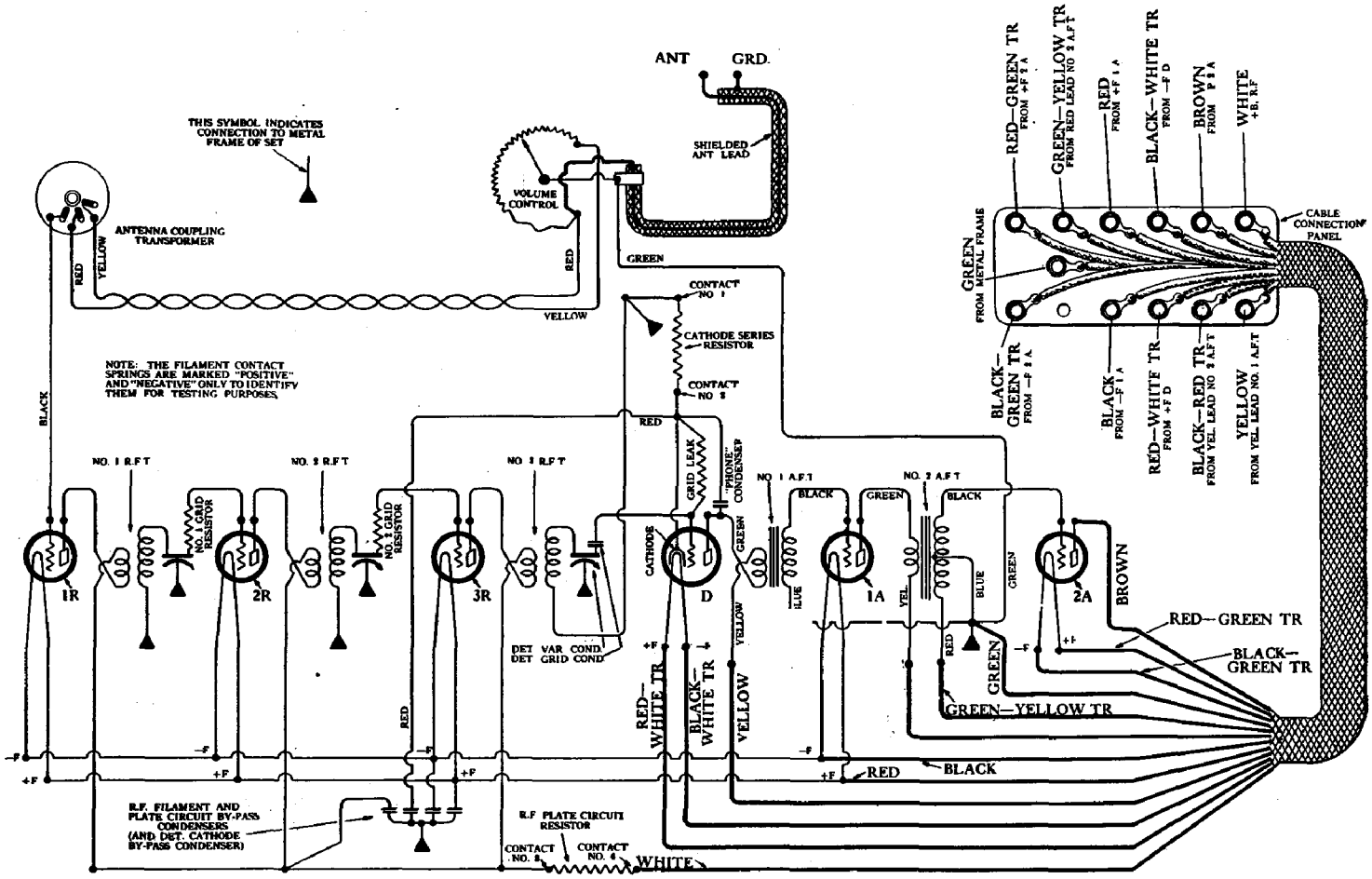

FIG. 108. WIRING DIAGRAM OF MODEL 43 SET.
The +B, 1st A. F. cable lead is black with a red tracer.

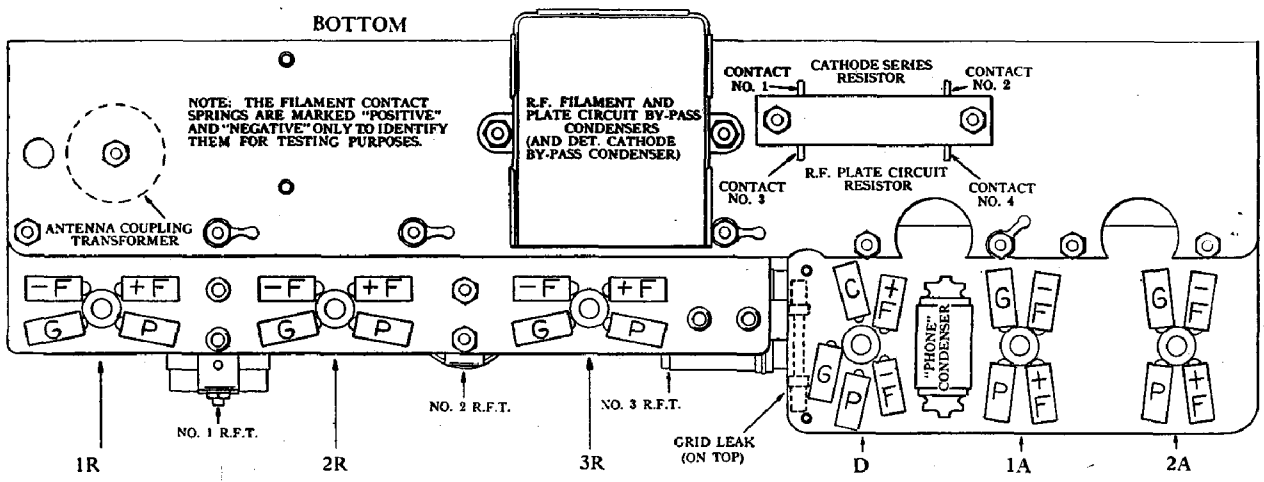

FIG. 109. TEST CHART FOR MODEL 43.

Continuity Test Table—Model 43

Colors Refer to Cable Leads

For Following Tests Remove Cable Connection Panel from Power Unit and Remove Chassis from Cabinet

TEST FROM	Correct Reading*	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Red-Green Tr. to +F2A Black-Green Tracer to —F2A Red-White Tr. to +FD Black-White Tracer to —FD Red to +F1A Black to —F1A Green to Chassis Frame Brown to P2A White to 4 (on R.F. Plate Resistor).	*Full*	Open in cable or connection.	Examine soldered connections at cable connection panel and set.
GREEN to			
P1A	*None*	Grounded 1st A.F. plate circuit.	
P3R	*None*	Grounded R.F. plate circuit.	Or shorted R.F. by-pass condenser.
+F3R, —F3R	*None*	Grounded R.F.-1st A.F. filament circuit.	Or shorted R.F. by-pass condenser.
+FD, —FD	*None*	Grounded detector filament circuit.	
+F2A, —F2A	*None*	Grounded 2nd A.F. filament circuit.	
G2R, G3R	*Nearly Full*	None—Open grid resistor or secondary No. 1, 2 R.F.T. Full—Shorted grid circuit.	Test across resistors and secondaries separately. (Resistors mounted on back of R.F. var. conds.)
G1R	*Full*	Open antenna coupling transformer.	Volume control full right.
G1A	*Partial*	None—Open secondary No. 1 A.F.T.	Full—Shorted secondary.
G2A	*Partial*	None—Open secondary No. 2 A.F.T.	Full—Shorted secondary.
Green-Yellow Tracer	*Partial*	None—Open secondary No. 2 A.F.T or open cable connection.	Full—Shorted secondary.
Stator of Detector Variable Condenser	*Full*	Open secondary last R.F.T.	
CD	*Partial*	Open cathode series resistor or lead.	Full—Shorted cathode by-pass condenser.
PD	*None*	Grounded detector plate circuit.	Or shorted phone condenser.
WHITE to			
3 (on R.F. Plate Res.)	*Partial*	None—Open R.F. plate circuit resistor.	Full—Shorted R.F. plate circuit res.
P1R, P2R, P3R	*Partial*	Open primary No. 1, 2, 3 R.F.T.	
YELLOW to			
PD	*Partial*	None—Open primary No. 1 A.F.T. (or open in cable connection).	Full—Shorted primary.
Black-Red Tracer to			
P1A	*Partial*	None—Open primary No. 2 A.F.T. (or open in cable connection).	Full—Shorted primary.
OTHER TESTS			
GD to Stator of Last Condenser	*None*	Shorted grid condenser.	Mounted on back of det. var. cond.
G1R to Ant. Terminal	*Full*	Open antenna connection.	
To Test Volume Control, Unsolder Red Lead from Antenna Coupling Transformer and Test Across Antenna and Ground Terminals, Turning Control Knob.	*Smooth and Nearly Full*	No reading—open resistance winding. Erratic reading—damaged resistance winding or slider.	If found defective, repair or install new control. Resolder red lead.

* The readings vary somewhat, depending on the resistance of the testing voltmeter.

Continuity Test Table—Power Unit for Model 43‡

For Following Tests Remove Cable Connection Panel, Speaker Plug and Vacuum Tubes from Unit

TEST	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Across 2nd A.F. Filament Supply.	*Full*	None—Open 2nd A.F. fil. winding and open 2nd A.F. filament shunt resistor.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistor separately.)
Across R.F.-1st A.F. Filament Supply.	*Full*	None—Open R.F.-1st A.F. fil. winding and open R.F.-1st A.F. fil. shunt resistor.	
Across Detector Filament Supply.	*Full*	None—Open det. fil. winding and open detector filament shunt resistor.	
FROM + B R.F. to			
+B 1st A.F.	*Partial*	None—Open 1st A.F. plate circuit resistor.	
+B Detector.	*Small*	None—Open detector plate circuit resistor.	
Ground.	*None*	Shorted condenser.	Or grounded positive circuit.
P2Aa	*Nearly Full*	None—Open primary of output transformer.	Or open connection.
+B, 2A	*Nearly Full*	None—Open primary of output transformer.	Or open connection.
FROM GROUND to			
+B Detector.	*None*	Shorted by-pass condenser.	
One Side of 2nd A.F. Filament Supply.	*Nearly Full**	None—Open 2nd A.F. grid bias resistor.	Full—Shorted bias resistor.
One Side of R.F.-1st A.F. Filament Supply.	*Nearly Full**	None—Open R.F.-1st A.F. grid bias resistor.	Full—Shorted bias resistor.
One Side of Detector Filament Supply.	*Full*	Open connection to center-tap of detector filament shunt resistor.	Examine connections under panel assembly.
+B 1st A.F.	*None*	Shorted by-pass condenser.	
P1, P2 (on Rectifier Tube Socket.)	*Nearly Full**	None—Open high voltage sec. winding.	
Each Terminal of A.C. Plug.	*None*	Grounded primary of power transformer.	Inspect A.C. cable and switch leads for accidental grounds.
F1 (on Rectifier Socket.)	*None*	Grounded filter choke or condenser.	
OTHER TESTS			
Across Terminals of A.C. Plug. (Toggle Switch "On.")	*Full*	Open primary of transformer, open regulating resistor or open cable.	Test separately across resistor contacts and across primary leads.
F1 to F2 (on Rectifier Tube Socket.)	*Full*	Open rectifier filament winding or connections.	
D1 to D2 (on Speaker Plug Socket).	*Full*	Open secondary or leads of output transformer.	
From one 2nd A.F. Fil. Supply Terminal to Each Fil. Contact on Socket 2Aa.	*Full*	Open in cable or connections.	
From P2Aa to +B, 2nd A.F.	*Nearly Full**	None—Open primary or connections of output transformer.	Full—Shorted primary or shorted primary shunt condenser.
From M2 (on Speaker Plug Socket) to F1 (on Rectifier Tube Socket.)	*Nearly Full**	Open filter choke or connection.	
From G2Aa to Green-Yellow Tracer Terminal on Panel Assembly.	*Full*	Open lead or connection.	

* These readings are "Partial" when using a low-resistance testing voltmeter.

‡ A description of this power unit is given on page 100.

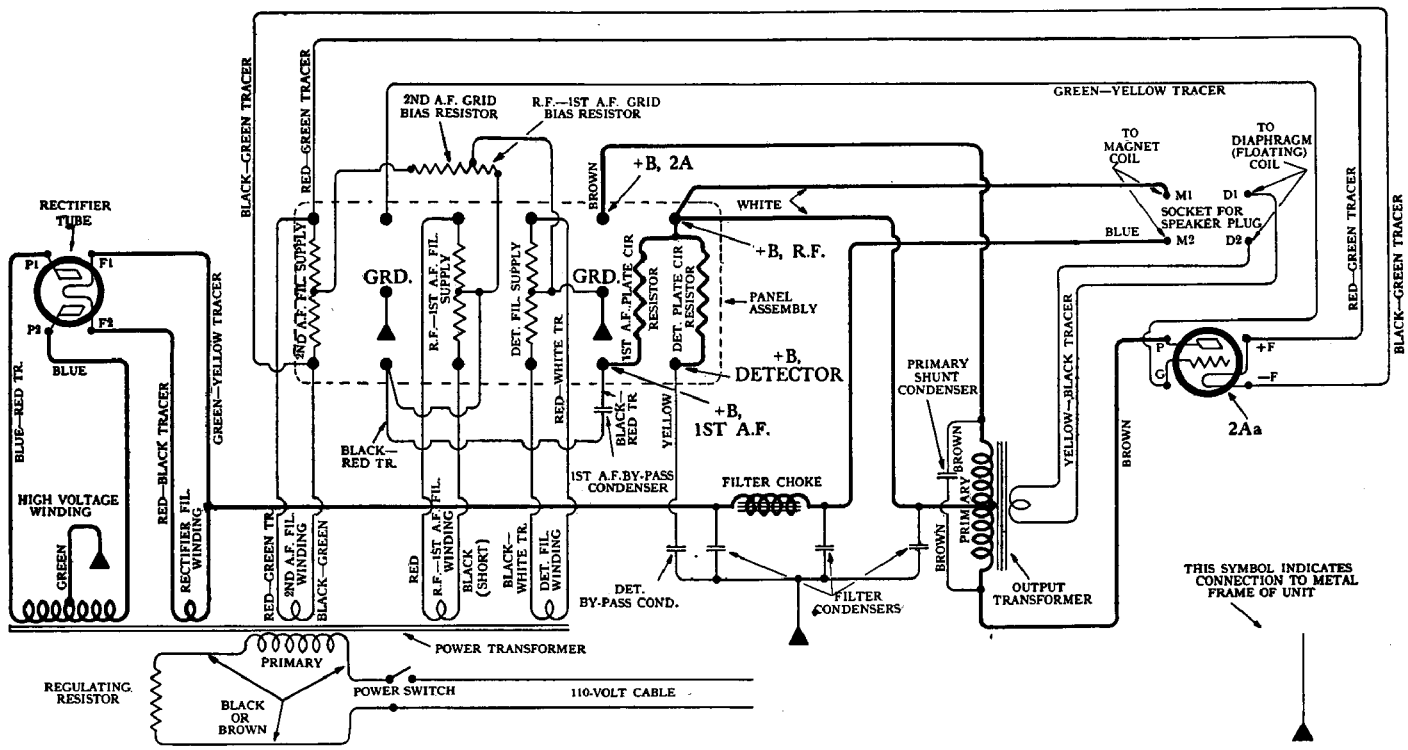

FIG. 110. WIRING DIAGRAM OF POWER UNIT IN MODEL 43.

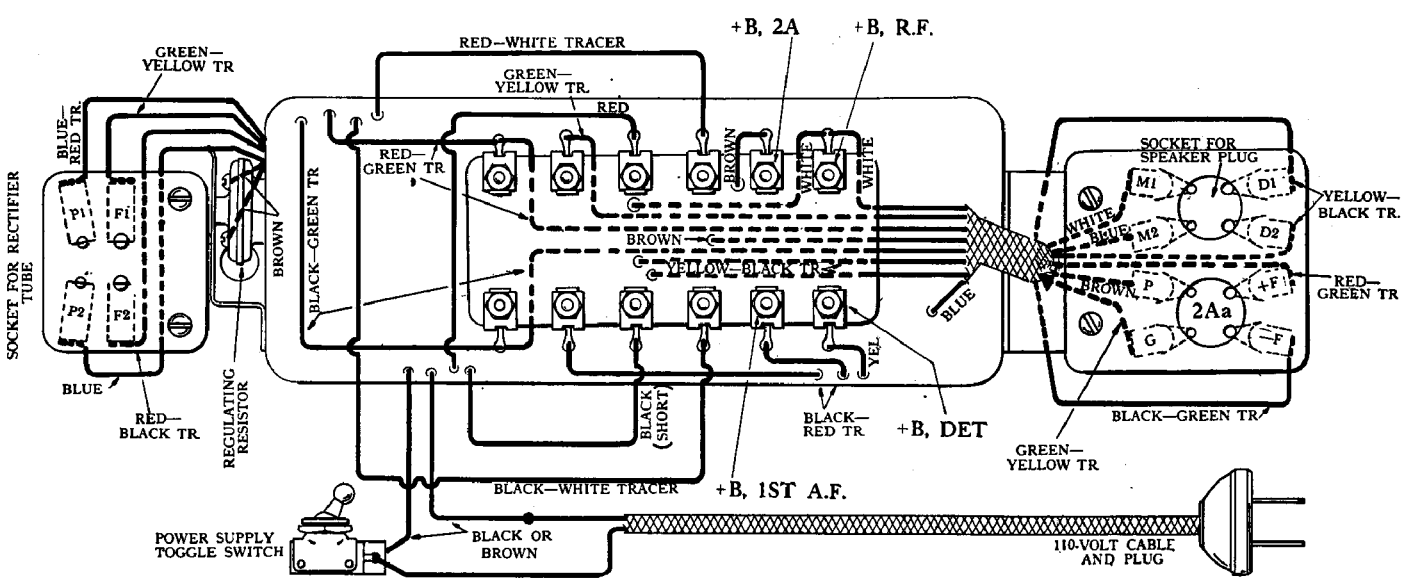

FIG. 111. SHOWING CONNECTIONS AND APPROXIMATE POSITION OF LEADS FROM SEALED CONTAINER IN MODEL 43 POWER UNIT.
In early type of power unit for Model 43, two brown leads from the primary-shunt condenser connect to the +B, 2A terminal and to the brown P2Aa lead respectively. In later models these connections are made internally.

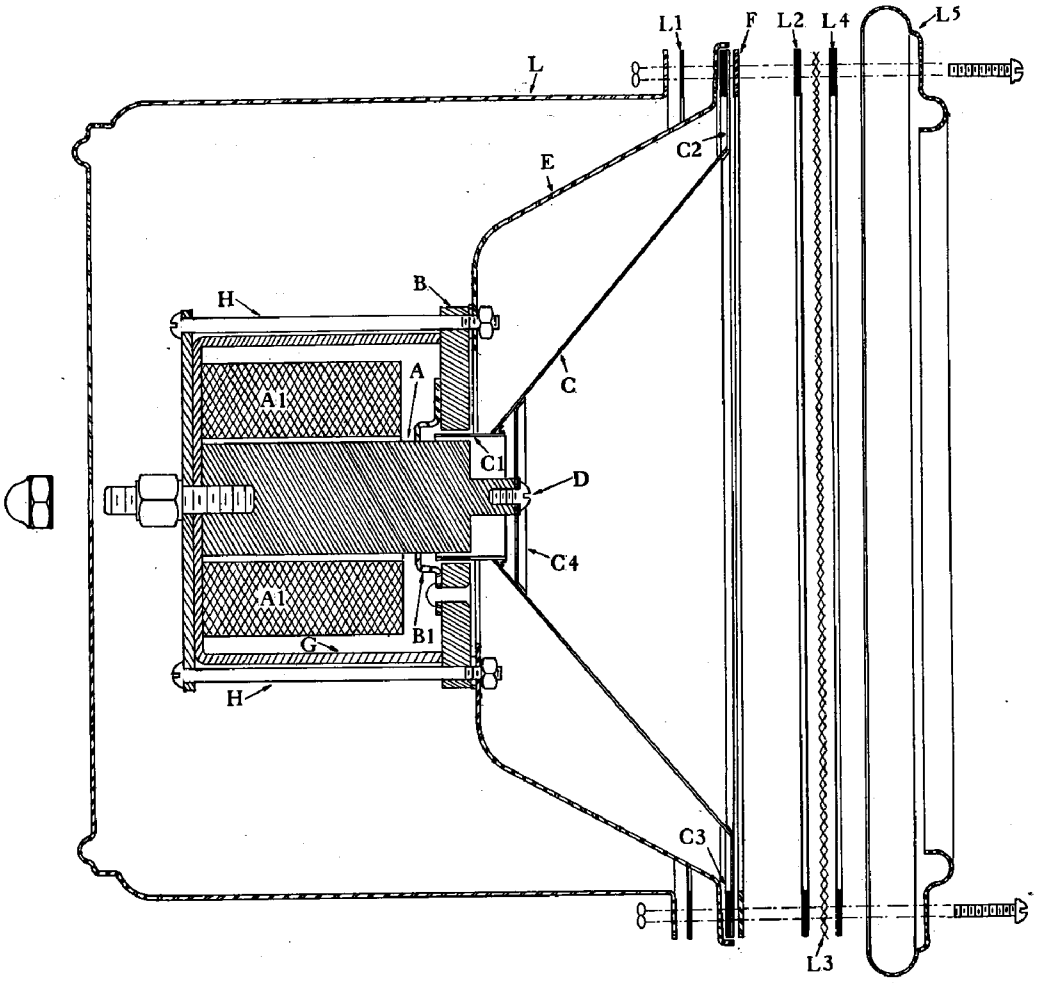

FIG. 112. CROSS SECTION VIEW OF DIS-ASSEMBLED TYPE F DYNAMIC SPEAKER.

A=Round soft-iron rod, forming core of magnet coil and serving as one pole-piece of the magnet.
B=Round steel top plate with 1½" hole at center. This forms the other pole-piece of magnet.
B1=Brass (non-magnetic) centering disc, riveted to the steel disc "B" serves to make the space or air-gap between pole-pieces "A" and "B" equal all around.
C=Diaphragm or cone assembly, consisting of the following parts:
C1=Diaphragm coil or "Floating" coil, attached to cone. This coil fits into the air-gap between pole-pieces "A" and "B." The top of the winding should be approximately level with the top of the air-gap.
C2=Flexible seal or baffle, portion of diaphragm. (This is a separate leather piece in the early model.) This serves to prevent undesired neutralization of air pressure at front and rear of cone.
C3=Fibre ring (about 11" in diameter) permanently attached to the edge of the flexible seal.
C4=Flexible fibre cone center support.
D=Round-head screw which clamps the fibre cone center support to the pole-piece "A."
E=Cone-supporting or diaphragm-supporting frame.
F=Steel ring (about 11" diameter) with twelve holes, 6 countersunk. The edge of the flexible seal "C2" and the fibre ring "C3," are clamped between "E" and "F" by six flat-head machine screws.
G=Magnet-coil case which completes the metal part of the magnet by linking pole-pieces "A" and "B."
H=Bolts (four used) which clamp together the cone-supporting frame, the circular pole-piece "B" and the magnet coil case "G."
L=Speaker housing.
L1=Thin fibre ring.
L2=Cloth screen with attached fibre ring.
L3=Wire grill, arranged with unbent wires horizontal when speaker is standing in normal position.
L4=Fibre ring (about 11" diameter).
L5=Grill-front.

Servicing the Type F (Dynamic) Speaker

General Description

The Atwater Kent Type F speaker is of the electro-dynamic type, that is the type in which the magnetic field of the speaker is produced by an electro-magnet energized by an external source of direct current (about 100-150 volts). A small coil fitted to the apex of the cone or diaphragm, and moving with it, receives the fluctuating current which represents the radio broadcast signal. The fluctuations in this current through the diaphragm coil interact with the steady field around the center pole piece of the electro-magnet, causing the diaphragm to vibrate along the axis of the magnet coil.

Type F speaker is designed to be used with Model 43 Atwater Kent A.C. receiver, however, any receiver can be used that meets the proper electrical requirements. To facilitate connecting the speaker to Model 43 set, the speaker cord is fitted with a special plug which fits into a corresponding socket in the receiver.

The field coil of the speaker consists of a very large number of turns of fine enameled copper wire, wound on the central magnet pole. Current is supplied to it by making this field coil act as one of the filter-choke coils in the power unit of the set (Model 43), so that the total filtered D. C. current passes through the speaker field coil before it reaches the point where it supplies B voltage to the set.

A step-down transformer built into the power unit of the set connects the plates of the two "double audio stage" tubes, representing the output of the set, inductively to the speaker diaphragm coil, the small secondary winding being connected to the speaker coil. This connection is also made through the speaker plug and four-wire speaker cable.

The outstanding advantages of the dynamic type of speaker, such as Model F, are its ability to respond over the entire musical range with equal fidelity, and to handle tremendous volume without distortion.

The first characteristic is due to the method of feeding the output of the receiver into the speaker, which is entirely different from that of previous speakers such as the horn or magnetic cone type. Instead of the output of the set being passed through the field coils of a permanent magnet, which have a high inductance value, it is passed through a small coil of slight resistance, but practically no inductance, located on the apex of the vibrating cone and immediately within the field of electro-magnet. Since resistance, unlike inductance, does not vary with frequency, the response to all frequencies, or "notes" of the musical scale is equal.

The ability to handle volume is largely due to the method of mounting the cone, which is so suspended that it has unlimited freedom of movement horizontally, as far as any requirements of reception are involved.

The powerful magnetic field created by the electro-magnet (energized by D. C. taken from the power unit of the set) helps to give the Type F speaker a maximum of sensitivity and power.

Experiments show that the tone of the speaker varies considerably in different parts of the room, and therefore it is usually advisable to try several locations for the speaker. Best results will generally be obtained when the speaker is placed six to ten inches from a wall, and it is also well, if possible, to have it located in or near a corner of the room.

NOTE.—Never remove the speaker plug from its socket without first turning off the 110-volt supply switch.

Comparison Test

If the Type F speaker seems to be defective, it should first be tried out in comparison with a speaker of the same type that is known to be good, using the same receiver and tubes, but plugging in first one Model F speaker and then the other. If this comparison definitely indicates that the speaker is defective, it should be inspected and tested to determine the source of trouble.

Defective Diaphragm Coil, Magnet Coil or Speaker Cord

If the speaker does not work at all, the trouble may be in an open, shorted or grounded coil or cord. These may be tested with a voltmeter and battery as per table on page 111.

If the speaker works, but gives a clattering noise, or if it seems unable to handle the full volume of the receiving set, the trouble is probably in the diaphragm, some part of which may be defective, or the diaphragm coil may not be properly centered in the air-gap. In any case the speaker should be disassembled and tested, according to the following instructions:

A. Disassembling Type F Speaker

(a) Removing Cone-and-Magnet-Coil from Housing.

Remove nut at the center rear of housing and rest the housing on its back with grill facing up. Remove the six screws around the grill-front and take off the grill-front, fibre ring, wire grill and cloth screen. Grip the edge of the cone-supporting frame with both hands and lift out the cone-and-magnet-coil assembly, drawing the speaker-cord up through the outlet hole in the rear of the housing.

(b) Separating Cone-Supporting Frame from Magnet Coil.

Remove the four speaker-cord leads from terminals on cone-supporting frame. Remove the round-head screw which passes through the flexible cone center support. This fibre support is cemented near the inside apex of the cone. Unsolder the two leads from magnet coil at the two terminals on the cone-supporting frame.

The magnet-coil assembly and the cone-supporting frame are held together by four long bolts which serve also to clamp the round steel top-plate to the magnet coil case. Remove the four bolts and carefully lift up the cone-supporting frame, with attached cone or diaphragm. **In handling this section, do not rest it on the apex or diaphragm-coil end of the cone, as the weight of the supporting frame, pressing downward, will tend to strain the flexible seal or damage the diaphragm coil.**

(c) Removing Cone.

If it is desired to remove or replace the cone, unsolder the two leads from diaphragm coil at the two terminals on the cone-supporting frame. Take out the six flat-headed screws around the frame, and lift out the steel ring and the diaphragm.

(d) Removing Circular Pole-Piece.

The top circular steel pole-piece may be removed from the magnet-coil case by gently pulling and turning it up and off the iron core of the magnet-coil. Do not use force in removing this pole-piece because the brass centering disc may be bent or otherwise injured, and in such a case, when the pole-piece is replaced, the air-gap will not be equal all around.

B. Possible Troubles

(a) Open Speaker Cord. (Cord removed from speaker terminals.)

Put the two red-lead lugs in contact with each other and, with a voltmeter and battery, test across the two thick prongs on the speaker-plug. A full reading should be secured; no reading indicates an open red lead. Place the two black-lead lugs in contact with each other and test across the two thin prongs on the speaker plug. A full reading should be secured; no reading indicates an open black lead.

If two or more of the leads in the speaker are thought to be shorted, test from one lead to each of the other three, repeating the test from two of the other three leads. No reading should be secured, otherwise a short circuit is indicated. Carefully examine the cord and repair or replace it if necessary.

(b) Grounded Terminal on Cone-Frame. (Speaker-cord and coil-leads removed from terminals.)

Test from an exposed edge on the cone-supporting frame to each of the four terminals on the frame. No reading should be obtained, otherwise a grounded terminal is indicated, in which case the insulating washers should be inspected and replaced if necessary.

(c) Open, Shorted or Grounded Magnet Coil.

Test across the magnet-coil leads. The reading should be partial. A full reading indicates a shorted coil, and no reading indicates an open coil. In either of the latter cases, inspect the leads carefully for possible break under the insulation. Test from one magnet-coil lead to the magnet-coil case. A reading indicates grounded coil or lead.

(d) Open Diaphragm Coil.

Test across the flexible leads from the diaphragm coil, the reading should be full. If the diaphragm coil is defective replace the entire diaphragm.

(e) Damaged Cone.

Carefully inspect the cone for cracks, loose fibre cone center support, loose diaphragm coil form, damaged coil, or other defects. Replace the cone if it is not in good condition.

(f) Metal Chips in Air-Gap.

Disassemble the speaker and remove the top circular pole-piece from the magnet-coil case. Thoroughly clean off the projecting steel core of the magnet-coil, and the circular pole-piece. Make certain that no magnetic chips cling to these parts.

(g) Loose Serial Plate.

With the wood handle of a screwdriver, sharply tap the housing near the serial plate. Listen carefully and if a "tinny" noise is heard, the serial plate probably is not fastened securely and should be tightened by hammering down the holding eyelets. This test is made with the cone-and-magnet-coil assembly removed from housing, and with the four base screws perfectly tight.

(h) Imperfectly Centered Diaphragm Coil.

The diaphragm coil fits into the circular air-gap and should be centered perfectly without touching the pole-pieces at any point. If the coil does touch, as indicated by a faint scraping sound as the diaphragm is moved straight in and out (see Fig. 115), readjustment is necessary. Instructions for centering the diaphragm coil are given in the following paragraphs:

(i) Centering Diaphragm Coil.

Loosen the six flat-headed screws around the cone-supporting frame. (These screws need not be loosened if the diaphragm has not been changed in any way from the factory adjustment.) Loosen the round-headed screw which passes through the flexible fibre cone support near the inside apex of the cone.

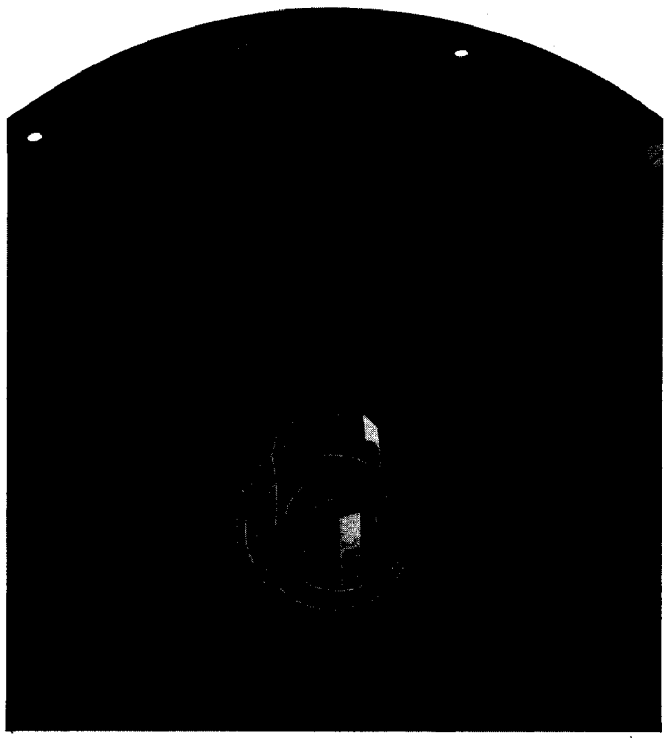

FIG. 113. CORRECT POSITION OF SHIMS USED IN CENTERING DIAPHRAGM COIL.
The shims or "diaphragm coil centering-guages" are Part No. 14622.

Put three shims (see Fig. 113) in place between the inside of the diaphragm coil form and the centre pole-piece. The shims should be equally spaced (120° apart) by placing them at the three points where the outermost and next inner circles of the fibre cone support are linked together. The position of the shims is clearly shown in Fig. 113. The shims should be pressed straight down till they touch the brass centering disc.

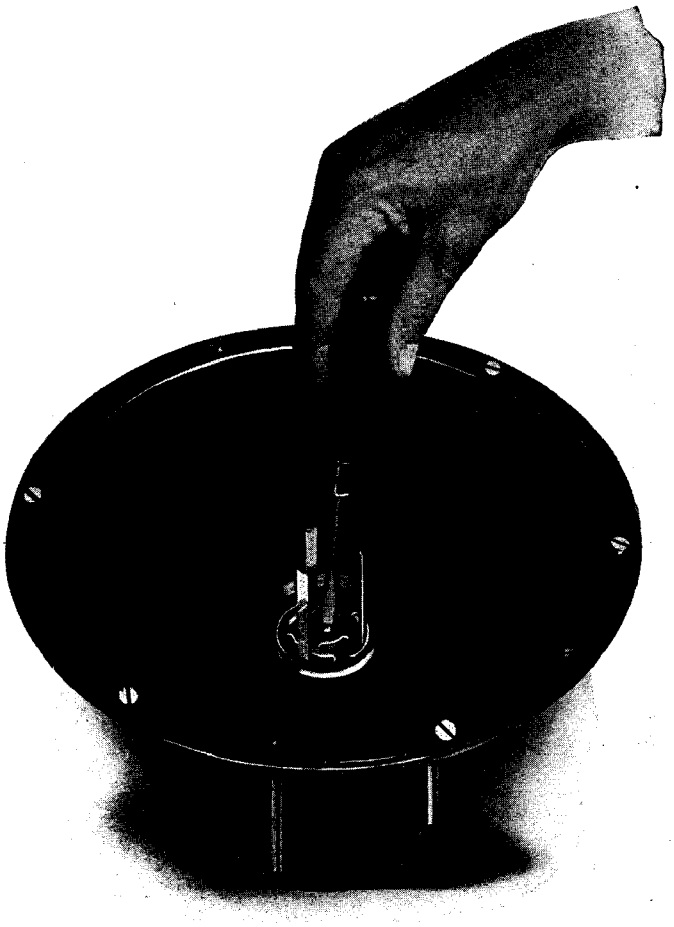

FIG. 114. TIGHTENING ROUND-HEAD DIAPHRAGM SCREW, AFTER DIAPHRAGM COIL HAS BEEN PROPERLY CENTERED.

With the shims in place, the diaphragm coil will be thus properly centered, and the round-head screw may be tightened, clamping the fibre cone support in the correct position. Note that a metal washer is used between the head of the screw and the fibre washer. If the six flat-head screws in the cone-supporting frame are loose, they should be tightened. When the screws are tight, remove the three shims.

The next step is to determine if the diaphragm coil is properly centered. Move the diaphragm coil straight up and down with the thumbs, as shown in Fig. 115. By listening carefully, and by the 'feel' of the thumbs, it will be possible to determine if the diaphragm coil is scraping against the pole-pieces. If the diaphragm coil does scrape, loosen the round-head screw, put the three shims in place and tighten the screw. Remove the shims and again test for scraping. If the diaphragm coil continues to scrape, the trouble may be caused by a warped diaphragm-coil form or a badly warped fibre cone support. In either case it is advisable to substitute a new diaphragm or cone (consisting of the cone with attached flexible seal, flexible fibre cone support, and the diaphragm coil).

Inspect the diaphragm coil to see if the top of this **winding** is approximately level with the top of the air-gap. Any condition other than this indicates either that the fibre cone support is warped or that the metal washers between the cone-supporting frame and the circular pole-piece are not of the correct thickness. First examine the fibre cone support to determine if it is warped; normally it should be flat. If it is warped, replace the diaphragm assembly.

If it is not warped, the thickness or number of metal washers between the cone-supporting frame and the circular pole-piece should be adjusted by inserting or removing metal washers equally on each of the four bolts, so that when assembled, the top of the diaphragm coil will be approximately level with the top of the air-gap.

C. Assembling Type F Speaker

(a) Assembling Magnet-Coil Case, Circular Pole-Piece and Cone-Supporting Frame.

Fit the circular pole-piece on the core of the magnet coil with the brass centering disc inside. There are four possible ways in which this pole-piece can be placed with respect to the holding screws. See that the position is used which brings the center pole most nearly in center of large hole in top plate. Put the cone-supporting frame in place on the circular pole-piece. Arrange the four long bolts to pass through the holes in the projecting base of the magnet-coil case, in the circular steel pole-piece, spacing washers and cone-supporting frame. Tighten the bolts and solder the magnet-coil leads to the two lower terminal lugs on the cone-supporting frame. If the diaphragm is already attached to the cone-supporting frame, see that the diaphragm coil fits into the circular air-gap and be careful not to strain or twist the diaphragm in any way when bolting the cone-supporting frame to the magnet-coil case. If the diaphragm is not attached to the frame, it should be mounted as follows:

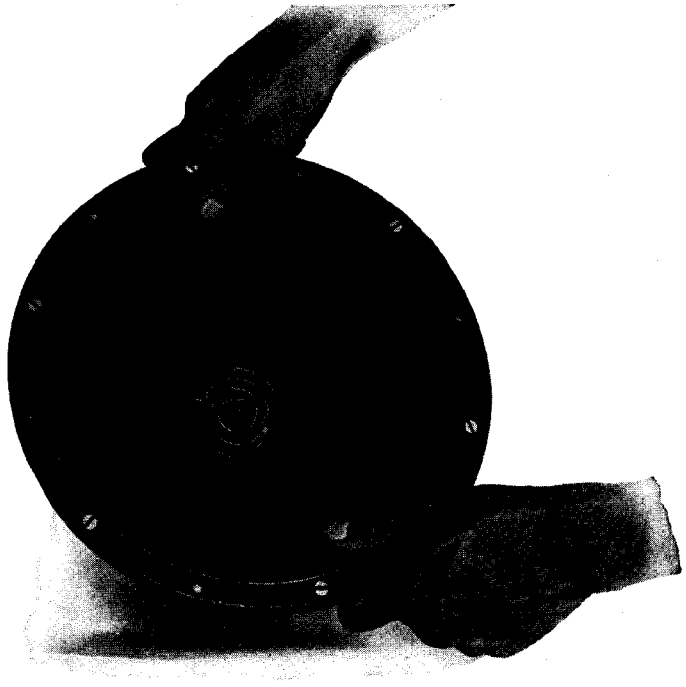

FIG. 115. TESTING TO DETERMINE IF DIAPHRAGM COIL SCRAPES ON POLE-PIECES.

(b) Mounting Diaphragm.

The diaphragm or cone, consists of the cone with attached flexible seal or baffle, attached flexible fibre cone support, and attached diaphragm coil with two flexible leads. A fibre ring is permanently fastened to the flexible seal, and both are pierced by twelve holes for the mounting screws.

Place the diaphragm in position with the coil in the circular air-gap and the fibre ring resting on top of the cone-supporting frame. Turn the diaphragm so the coil leads will be close to the terminals on the frame and so the holes in the flexible seal and fibre ring line up with the holes in the frame.

Put the steel ring in place with the countersunk side of the screw holes facing out. Only six of the twelve holes in the steel ring are countersunk, and these countersunk holes should be lined up with the threaded holes in the cone-supporting frame. Insert the six flat-headed screws without tightening them. Solder the diaphragm coil leads to the two terminals nearest the seal. These leads may be connected in either direction, but make certain that they are arranged to minimize possible short circuiting. Form these leads into a loop which is entirely free and clear from cone and frame.

(c) Centering Cone.

Follow instructions given previously. (See Section **B(i).**)

(d) Mounting Housing.

After the diaphragm coil has been centered and tested and the leads from both coils soldered to their terminals, insert the speaker-cord through the outlet hole in the housing. Fasten the four speaker-cord leads to the terminals on the cone-supporting frame. Connect **the red** leads to the terminals of the **diaphragm** coil, and the **black** leads to the terminals of the **magnet** coil.

Rest the housing on its back, place the thin fibre ring on the edge of the housing, and set the cone-and-magnet-coil assembly into the housing with the four terminals near the base of speaker. The large screw projecting from the rear of the magnet-coil case should pass through the hole in the center rear of housing. Place the cloth screen on top of the steel washer with the fibre ring facing in. Place the wire grill on top of the cloth screen in such a way that the straight (unbent) grill wires are horizontal when the speaker is standing in normal position. Place a fibre ring over the wire grill, and finally set the grill-front down over all. The holes in these parts should, of course, be lined up with the holes in the housing edge.

Put in the six round-head screws and make them tight. Screw the acorn nut on the projecting screw in rear of housing and tighten it up.

Console Type Dynamic Speaker

The console type dynamic speaker is the same as the Type "F," except that the housing "L," the thin fibre ring "L1" and the grill-front "L5" are not used. The screw projecting from the center rear of magnet-coil case is clamped with a nut to a metal strip fastened horizontally across the inside of cabinet. The metal strip is held to the cabinet by separate angles at each end.

To remove the speaker, rest the cabinet on its back, take out the six screws in front of speaker and the four screws which hold the metal strip to the angles at each end. The speaker, together with the cloth screen, wire grill and fibre ring may then be removed.

The method of testing, repairing and re-assembling the Console Type Dynamic is the same as given for Type F.

Improved Cone-Type Sound-Unit

The design of the sound unit in Atwater Kent cone-type speakers has been slightly modified to afford greater ruggedness and slightly better performance. An illustration of the modified unit is shown in Fig. 116.

The distance between the reed-spring and the mounting bolts is slightly different from that of the earlier units; consequently the modified unit is not interchangeable with the earlier type which will continue to be used as replacement in speakers designed for the earlier unit.

Instructions for testing, repairing and assembling cone speakers with the modified unit are similar to those given on pages 81, 82 and 83 for the cone-type speakers.

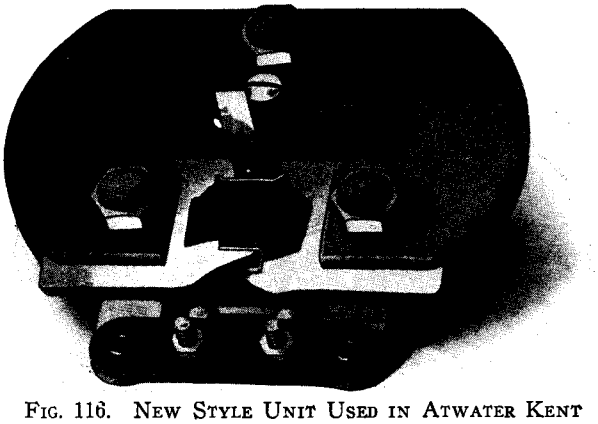

FIG. 116. NEW STYLE UNIT USED IN ATWATER KENT CONE TYPE SPEAKERS.

Causes and Remedies for Rattling in Type F Dynamic Speaker

Possible Cause	Remedy
Defective diaphragm (cracked, torn or badly warped). Diaphragm coil not rigidly attached to diaphragm. Flexible fibre support not securely cemented to diaphragm all around.	Replace diaphragm. (Consists of diaphragm, with attached coil, fibre washer and flexible seal.)
One or more of four bolts that clamp the magnet-coil case, circular pole-piece and cone-supporting frame not screwed tight.	Make bolts very tight.
Ends of grill wires touching grill-front.	Cut off ends of grill wires and center grill correctly.
Fibre ring or rings not inserted between metal parts of grill assembly.	Put fibre rings at places shown in cross-section view Fig. 112.
Diaphragm coil scraping against pole-pieces, caused either by incorrectly centered coil, or by warped coil-form or warped fibre cone support.	Center diaphragm coil correctly according to instructions given in text, or replace diaphragm if coil-form or fibre cone-supporting washer is warped.
Diaphragm coil flexible leads touching or close to edges of cone-supporting frame, or lying against cone.	Form leads into a loop which is entirely free and clear from cone and frame.
Loose terminal screws on cone-supporting frame. Loose base screws. Loose flat-head screws in cone-supporting frame. Loose screws in grill assembly. Loose hexagon nut at rear of housing. Loose screws in rear metal supporting strip (console type speaker).	Tighten screws.

Continuity Table for Type F Dynamic Speaker

Tests Made with Speaker Assembled

TEST	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Across two Thin Prongs on Speaker Plug.	*Partial*	None—Open magnet coil. Full—Shorted magnet coil.	Or open or shorted speaker cord. Erratic reading (shake cord)—Half open cord or loose connection.
Across two Thick Prongs on Speaker Plug.	*Full*	None—Open diaphragm coil.	Or open speaker cord. Erratic reading (shake cord)—Half open cord or loose connection.
From one Thin Prong on Speaker Plug to Exposed Edge of Housing.	*None*	Grounded magnet coil or speaker cord.	
From one Thick Prong on Speaker Plug to Exposed Edge of Housing.	*None*	Grounded diaphragm coil or speaker cord.	
From one Thin Prong to one Thick Prong on Speaker Plug.	*None*	Shorted speaker cord.	

Circuits for Testing Model 43 Receivers and Dynamic Speakers

Owing to the design of the output circuit, Model 43 receivers cannot conveniently be tested with the Galvanometer Test Stand described on pages 18, 19 and 20. However, suitable circuits for testing Model 43 receivers and Type F speakers are very simple and easily built, as will be noted by inspecting the accompanying diagrams.

In the test circuit for Model 43 receivers, a thermo-coupled galvanometer is connected in series with the secondary of the output transformer in the set and the diaphragm coil in the speaker. An extra magnet-coil assembly is used to complete the filter circuit of the set being tested, thus avoiding the necessity of switching the magnet coil of the speaker from the standard Model 43 to the Model 43 being tested, and thereby preventing the unnecessary strain on the filter condensers which results from removing or switching the magnet coil from the filter circuit while the line switch is "on."

The circuit for testing Type F speakers is very simple as it is necessary only to change the output circuit of a Model 43 standard from a standard Type F speaker to the Type F speaker being tested. Quick-acting toggle switches are recommended for this circuit on account of the fact that the filter circuit of the set must not be open longer than necessary when switching from the magnet-coil of the standard speaker to the magnet-coil of the speaker under test.

With these two test circuits, a Model 43 receiver and a Type F speaker are required as standards for comparison purposes.

The signal-producing device used in testing other types of sets may be used in testing Model 43. A separate "pick-up" lead from the signal-producing device should be connected to the blade of a single pole, double throw switch. One contact of the switch should be connected to the antenna post of the standard Model 43 receiver, and the other contact should be connected to the antenna post of the Model 43 being tested. Toggle switch No. 13678 may be used for this purpose, and if desired, this switch may be placed close to the toggle switch used in the circuit of Fig. 117, the two switch handles being linked together to permit switching both with one motion.

The 110-volt line switch must be turned off when removing or inserting test-plugs and speaker-plugs in these test circuits.

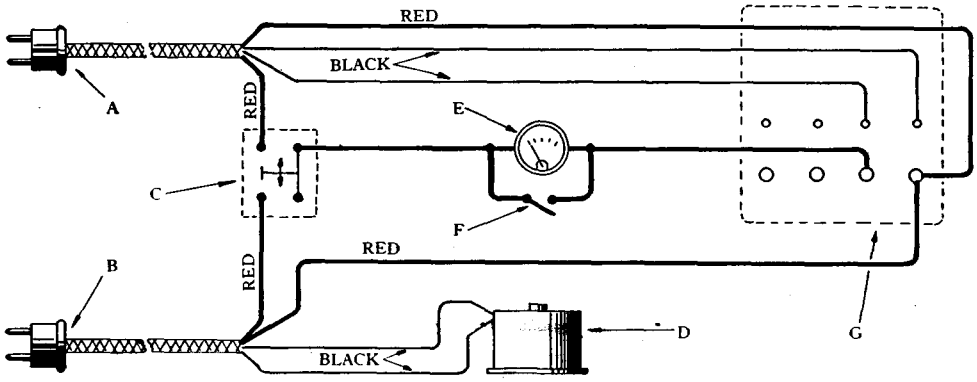

FIG. 117. CIRCUIT FOR COMPARING OUTPUT VOLUME OF MODEL 43 RECEIVERS.
This circuit is used also in synchronizing the variable condensers.

A=Plug-and-cord No. 14537 to be inserted in speaker-plug socket of standard Model 43 receiver.
B=Plug-and-cord No. 14537 to be inserted in speaker-plug socket of Model 43 receiver being tested.
C=Single pole, double-throw toggle switch No. 13678 to change the diaphragm-coil and thermo-coupled galvanometer from standard Model 43 to Model 43 being tested.
D=Magnet coil assembly No. 14361 to close filter circuit of Model 43 receiver being tested.
E=Thermo-coupled galvanometer (Weston No. 425). This meter gives an indication of the output volume.
If a meter of this type is being used in the test circuit of other sets, a double pole, double-throw switch may be arranged to change the meter from one test circuit to the other.
F=Single pole, single throw toggle switch No. 13664 to short circuit galvanometer when testing set for quality.
G=Speaker-plug socket No. 14412 for plug of a standard Type F speaker.
IMPORTANT—All connections shown in heavy lines must be short and of low resistance.

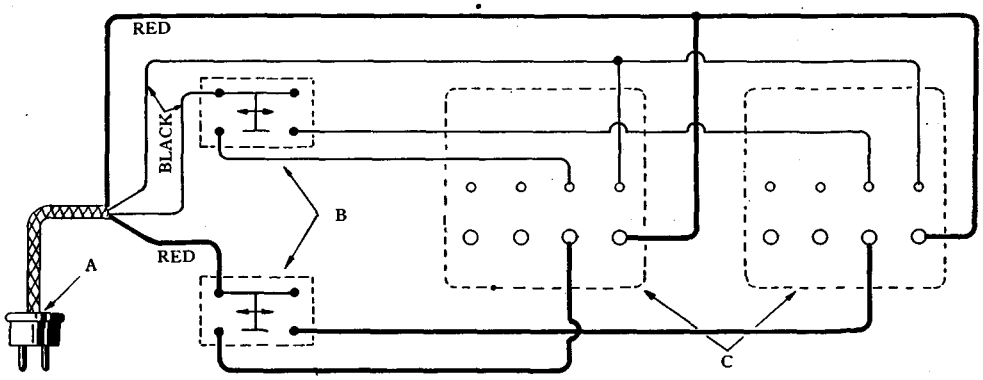

FIG. 118. CIRCUIT FOR TESTING TYPE F SPEAKERS.

The switches change one lead from set-output, and one lead from magnet-coil supply, from socket for standard Type F speaker to socket for Type F speaker being tested.
A=Plug-and-cord No. 14537. This plug is to be inserted in speaker-plug socket of standard Model 43 receiver.
B=Single pole, double-throw toggle switch No. 13678 (two required.) These switches may be arranged to operate together by coupling the handles with a piece of wood or wire.
C=Speaker-plug socket No. 14412 (two required).
IMPORTANT—All connections shown in heavy lines must be short and of low resistance.