Technicians', Dealers' and Salesmen's
Service Bulletin No. 70

Index TECHNICAL SERVICE
Date NOVEMBER 20, 1929

INSTRUCTIONS FOR SERVICING

Brunswick Radio Models S-14, S-21

AND

Combination Radio with Panatrope Model S-31

THE BRUNSWICK-BALKE-COLLENDER CO.
Technical Service Division
MUSKEGON :: :: :: MICHIGAN

NOTE: This is an important Bulletin for permanent record in the Bulletin Book

PREFACE

A problem of service is connected with the selling of merchandise in almost every line of business, and of any, the demand from the radio dealer is probably the greatest. It is to his advantage that this is rendered with great dispatch and with the least cost possible. This begins at the time of sale in affording simple, intelligent information as to the best method of installation and upkeep of the instrument purchased.

Additional service may be required from time to time due to wear and tear, and to deterioration of vacuum tubes. If a definite policy has been established regarding charges for service of this type, it can be and has in many instances been made a paying proposition.

To assist in the promoting of this phase in the dealers' business, the Brunswick-Balke-Collender Company have prepared this, as well as other service manuals, and have established a Technical Service Division at Muskegon, Michigan, from which the dealer may secure further technical information and who will furnish the distributor with replacement parts, as well as the advice and assistance of factory trained service engineers to help them in their more trying service problems.

Service Bulletin No. 70

Models S-14, S-21, and S-31

ELECTRICAL SPECIFICATIONS
Models S-31, S-21, and S-14

Rating	100 to 130 volts—50 to 60 cycles
Also available	100 to 130 volts—25 to 30 cycles
Power consumption	110 watts (depending upon ballast tube)
Power consumption of 25-cycle model	130 watts
Type of circuit	Screen grid radio frequency
Type of tubes	CY-327 or UY-227 ... 1
	CX-345 or UX-245 ... 2
	CY-324 or UY-224 ... 4
For 60-cycle operation	Duresite Ballast D-110 ... 1
For 25-cycle operation	Duresite Ballast D-126 ... 1
Recommended antenna length	30 to 50 feet
Average sensitivity	6 micro volts per meter
Number of radio frequency stages	3
Type of detection	Power grid bias
Number of audio stages	2
Type of audio amplification	Resistance and push-pull
Type of rectifier	100 ma. full wave
Type of loud speaker	Dynamic
Specification of speaker field	Series connected—4750 ohm—160 v.—34 ma.

SPECIAL PANATROPE SPECIFICATIONS

Type of Panatrope motor	Induction disc
Power consumption of Panatrope motor	35 watts
Type of magnetic pickup	Flexible—low impedance

INTRODUCTION

Collectively, the Receiver Chassis of the above models are identical, each utilizing eight tubes in a circuit consisting of a high grain radio frequency amplifier, linear power detector, one stage of resistance coupled audio amplification, and a push-pull power output stage.

The Radio Frequency Amplifier has three high grain stages of tuned and shielded amplification that are inherently stable using three heater type screen grid tubes. This stability is secured by efficient localized shielding and individual ground returns to the condenser gang. Uniform amplification is had over the broadcast range through the correct proportioning of the coupling condenser and plate coils making up the radio frequency coupling unit. Volume is controlled by regulating the screen voltage of the first two tubes.

A local-distance switch is provided to control the sensitivity of the amplifier in order to secure a better graduation of volume on powerful local stations, as encountered by the metropolitan listener. A power detector is employed, using the grid bias method of demodulation instead of the condenser grid leak method. This is necessary and possible because of the tremendous amplification secured from the radio frequency amplifier and results in a truer toned receiver.

The Power Detector permits the use of a low grain audio amplifying system resulting in less power supply hum in the output to speaker. In the radio frequency chassis, and connected in the grid circuit of the detector, is a jack provided for the connection of a phonograph pickup. When a plug is inserted in this jack the grid bias of the detector is automatically changed, making it an audio frequency amplifier. Any good high impedance pickup provided with a volume control may be used and even with a low voltage pickup the volume secured is more than sufficient.

The Power Pack is ruggedly constructed, and in common with the radio frequency chassis, is mounted on a heavy cadmium finished steel frame. This unit supplies all the necessary voltages to the tubes and speaker, in addition to housing the resistance coupled and power audio frequency stages. The filter in the plate supply system employs a newly discovered method in filter design wherein a certain percentage of the a-c component in the rectified voltage is applied across a choke section, inducing a corresponding current in an adjacent section. This latter section is connected in series with the filter output in such a manner so as to buck out or cancel any alternating current induced across the filter input system. (See Figure 2 on page 7 for further information.)

The Speaker Field is energized by 160 volts which is secured by utilizing its resistance to provide the necessary voltage for the plates of all tubes except the two used in the power stage.

The Panatrope Combination Model S-31 has connected for its source of record sound energy a low impedance flexible pickup which represents the latest advancement in the art. The flexible feature makes for less pressure and wear which results in longer record life. Owing to a light armature and reduced inertia, excellent high frequency response is obtained. The Input Transformer, between the pickup and amplifier, has a very high turn ratio (75 to 1) and is mounted at an angle found to give the least amount of hum. An Induction Disc Type of Motor is used, assuring quiet trouble-proof operation, as has been standard equipment in all electrical Panatropes.

In the 25 Cycle Model an additional filter condenser is used; also the power transformer and filter choke deviate from the 60-cycle standard. As a finer control of hum, a new system of balancing out is included in the power tube grid return circuit.

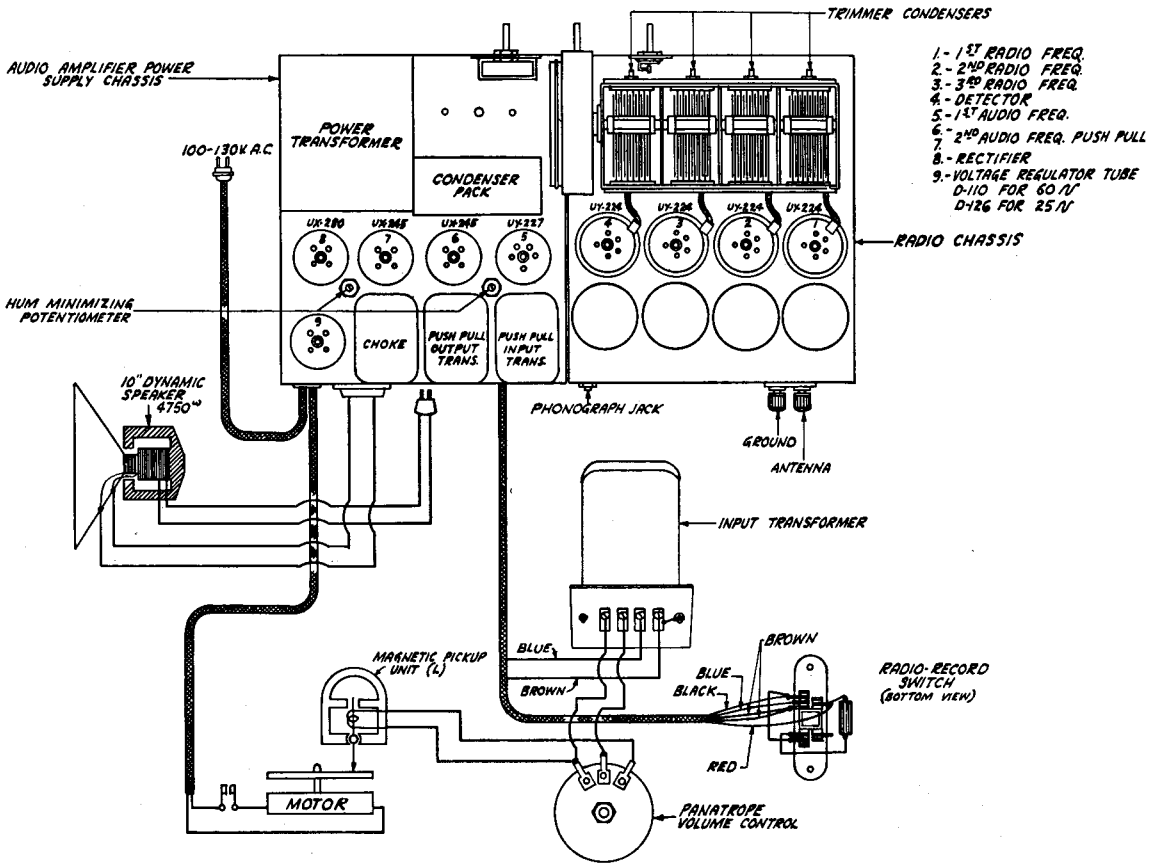


Figure 1—Cabinet Wiring Diagram of S-31

PART I—INSTALLATION AND MINOR SERVICE ADJUSTMENTS

Antenna and Ground

Requirements as to antenna (or aerial) and ground installation vary with different local conditions. The following general antenna characteristics should be borne in mind in making the installation.

1. Indoor Antenna—Suggested for areas near powerful broadcasting stations. The indoor antenna gives a high degree of selectivity and fair distance.

   Use an insulated stranded or single conductor wire of as large a gauge as convenient. The wire is best run in the attic, but if more convenient it may be run from the set up the window or door casing to the picture moulding and around two or three sides of the room until the required length of 50 feet has been attained. Care should be taken that the antenna does not short on any metal obstacles, such as stove pipes, radiators, ventilators, etc., and it will be found that any large metal surface in the wall, such as metal lath, steel vaults, etc., will diminish the signal received. Connect the antenna lead-in to the short antenna post.

2. Outdoor Antenna—Superior in volume and sensitivity to the indoor antenna, but less selective if too long a length is used. Recommended for installation removed from powerful stations and where sensitivity is more important than selectivity.

   The outdoor antenna consists of a single wire suspended from two suitable supports and insulated from these supports and all other objects. The supports should be as high as possible, sturdy in construction and so aligned that the wire running between them will not have to cross over or under any electric light or telephone wires.

   Very satisfactory results will be obtained when using an outdoor antenna 30 to 50 feet in length, including the lead-in wire, which, if possible, should be a continuation of the antenna wire itself. Connect the antenna lead-in to the binding post giving the best results.

   The use of enamel or some other insulation on the wire is recommended from a standpoint of mechanical durability, since it has been found that an insulated wire will not corrode and need replacement as often as the bare uninsulated wire, and the results will be found to be as good with one as with the other.

   If there are electric light or power lines near, the antenna should be run at right angles to them to minimize the amount of hum that may be picked up. The same holds true for the lead-in, which should be well insulated from the side of the building and not run parallel at a distance of less than two feet to any electric light lines.

   To bring the lead-in into the building a hole may be bored in the window casing and a porcelain tube inserted or a lead-in strip laid under the window frame. All splices and joints in the antenna and lead-in wires should be properly soldered and taped.

   An outdoor antenna is slightly more efficient in the direction it points. Also the higher the antenna is above the roof or ground the greater a signal voltage it will pick up.

3. Ground—A good ground is fully as important as a good antenna, and is essential for best reception. Water piping is usually the most convenient and will make a very good ground if the pipe is scraped well and the ground wire connected by soldering or with a properly installed ground clamp. An iron rod or pipe driven several feet into the earth may be used if a water pipe is not available.

   Note: A lightning arrestor that has been approved by the Underwriters' Laboratories must be properly inserted in the antenna and ground circuit in accordance with the directions enclosed with such equipment.

The Voltage Regulator Tube

While ballast D-110 is normally intended for use in these models, there are special conditions encountered where the line voltage is extremely high. When this is the case, it is advisable to use a D-105 tube, which will effect a reduction in the voltages applied to the different tubes, preventing short life due to over-voltage.

Hum

In the majority of cases where hum is encountered, it may be traced directly to a gassy or otherwise defective detector tube. It is a good practice to try each of the screen-grid tubes in the detector socket, the one which is nearest the tuning dial, using the one which gives the least hum. There are two hum minimizing potentiometers on the socket power unit chassis, which should be adjusted, as they also are an important factor in the control of hum. For further information on the elimination of hum, see heading on same subject under Part 3 of this Bulletin.

Noise Level

Owing to the extreme sensitivity of these receivers, a great amount of noise may be encountered. This noise level has a fixed ratio to signal strength and would naturally be present in any similar sensitive receiver. The noise in many cases originates locally, and by means of a few prohibitive measures can be substantially reduced. The effective placing of a few 1 mfd. condensers or filtering units, now commercially available, across the line leading to small motors and electrical appliances about the home, will often result in the realizing of better reception.

The Dealer or Service man who is aware of the value that these small installation procedures have will gain the good-will and confidence of their customers.

External Pickup Operation

In the event it is desired to use the Models S-14 and S-21 to amplify and reproduce phonographic music, any good pickup may be connected to an ordinary telephone plug and inserted in the radio jack located in the rear of the socket power unit. Phonograph volume may be controlled by the volume control usually furnished with such equipment. It is important to remember, if this magnetic pickup is used, that the radio cannot be operated until the plug is removed.

PART II—GENERAL SERVICE PROCEDURE

To render the utmost service in the quick repairing or adjusting of any radio, the Service Man should equip himself with a knowledge of the electrical laws and should be familiar with the circuit of receiver in question. (See pages 15to 22 for circuit diagrams.) Also he should have at his disposal a complete set of tools, meters, and other necessary equipment. The value of a set tester, which includes meters for measuring all the voltages applied to tube elements, cannot be underestimated.

With particular reference to the receiver in question, which is divided into two units, a commendable procedure is to first determine in which unit the trouble exists.

With speaker and aerial connected and tubes in place, turn chassis on its back and remove mounting board. In this position it is exposed for almost any test desired to be given. Place a finger on the grid of the first audio frequency tube and touch a well insulated wire, held in the other hand, to the plates of the power tubes. The phase being correct, one of these positions should cause a loud howl from the speaker, indicating a good power unit. If no howl is heard disconnect the bridle from the terminal strip and repeat the test, as a defective radio frequency chassis will hinder the operation of an otherwise good socket power unit. These tests are not positive indications of good or bad units, as it is possible that a socket power unit will howl under the above test conditions and at the same time not be up to the standard of operation.

A brightly lit ballast tube is usually a good indication of a short in the voltage supply system (providing the set does not work, it may be due to a defective ballast tube). This may be further localized by removing the speaker field plug, and if with this plug out the glow reduces to normal, then it is a pretty good indication that the plate or green wire is shorted to ground.

Speakers may be easily checked by placing two working instruments, with their backs together, one of which having the suspicioned speaker, and changing their voice coil connections, so that the speaker in question is supplied by signal energy from the set known to deliver good tone quality.

The continuity test and information contained in Part IV of this Manual, is very simple, and through its use a person of more or less limited experience in the radio field may locate the cause of ordinary trouble.

PART III—GENERAL SERVICE DATA

(1) Miscellaneous Noises

Noise may be caused by loose connection in the antenna or ground circuits. Test by removing both of these connections and note effect. Expanding or contracting of tube elements during the "heating up" period may cause a disturbance. The same is true of a bad weld which may be determined by thumping with forefinger any suspicioned tube, a defect being indicated when the jarring controls or affects the noise. If this has not appreciable effect, remove each tube, beginning with the first radio frequency stage and ending with the power stage, until one is found that will eliminate the noise. This will indicate the position in the circuit where the noise originates. In case it is found to have its source in either the detector or first audio frequency stage, one of the fixed resistances used in their circuits may be noisy. Other sources of noises are leaky condensers, rosin soldered joints, broken-down insulation, and shorted or loose connections.

(2) Oscillation

Any trouble experienced with oscillation can usually be eliminated by reversing the connections to the antenna loading coil. To do this remove the small bakelite panel on which the coil is mounted, after first unsoldering both of its connections. The unit is now in a position so that the two fine wires in the coil can be carefully unsoldered from the terminal lugs and resoldered in the reverse order. Care must be taken so as not to break the wire leading to the inside of the coil as it can not be unwound from that direction.

Oscillation may also be caused by an open tubular radio frequency by-pass condenser. The connections to these parts should be thoroughly inspected. An open condenser may be easily found by connecting with short pieces of buss wire a .5 mfd. condenser, known to be good, across the terminals of any unit to be tested. This should be done when the set is turned on, adjusted to oscillate, and on its back with mounting board removed, so that the testing condenser may be momentarily applied across each of the radio frequency by-pass condensers, a defective condenser being indicated when the test stops or reduces oscillation.

(3) Hum

As previously indicated in a paragraph on the same subject, under Part I, excessive hum is usually due to a gassy or otherwise defective detector tube. Try each of the screen-grid tubes in this socket, using the one that gives best results. In making this test it is advantageous to remove the grid cap after withdrawing the tube and replace it before inserting, as the ear will not be subject to the loud racket resulting when the grid circuit of the tube is open. The hum levels of different tubes can be remembered better when using this method. If a steady 120 cycle hum is heard, the condensers in the plate supply filter should be examined for opens and shorts. With set operating a spark should result when the terminals of any good condenser are shorted. For open circuits try externally connecting a condenser of the same capacity across the terminals of the one under test. If hum decreases the condenser under test is open. The correct connections for the filter choke and condensers are shown in Figure 2, page 7. Also the voltage drop across the choke sections should be as shown, provided there is no abnormal heavy current drain, due to a short in the voltage supply system.

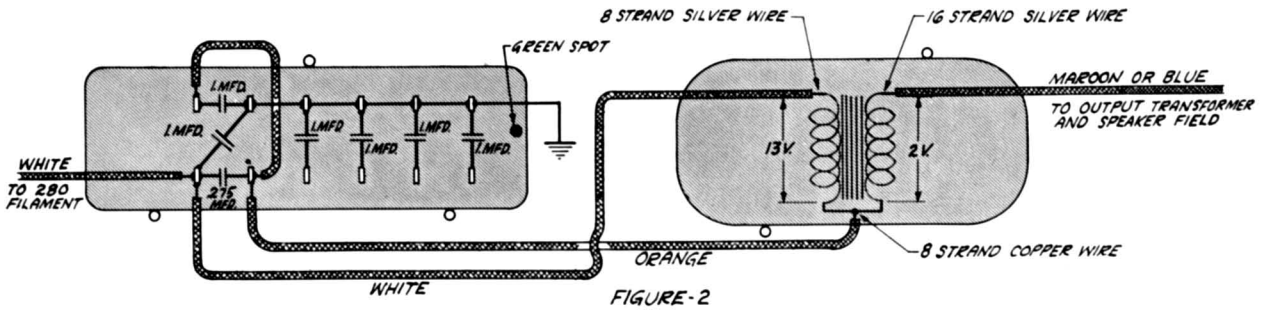


FIGURE-2
CONNECTIONES OF FILTER CHOKE AND CONDENSERS

Hum will result in the Model S-31 if the grounding wires on the induction disc motor and suspension arm are removed. Examine these to see that they are in place. It is possible in some cases where hum is experienced in the record side to make a slight reduction by unclamping the pickup input transformer and reclamping it in the angle found to give less hum. This angle is determined with the set turned on and the switch thrown toward the record position by noting the amount of hum when the transformer is held at various positions.

If the hum is heard only when the station is tuned in, it is probably caused by some peculiar condition existing in the lighting lines, and can usually be eliminated by grounding the ballast tube side of line through a .25 mfd. condenser.

(4) No Signal

A condition existing in the receiver that would cause absolutely no signal at all to be heard would probably be an absolute short or open circuit. If a set tester equipped with suitable meters is available, the various tube circuit voltages may be taken. They should be approximately in accord with the values given in the table below, which may vary with different tubes, line voltages, and meters used in test. If the voltages delivered to any of the tube elements are found to vary greatly from standard, an examination of the voltage supply system, Figure 3, page 8, will probably disclose the cause. The data contained in Part IV of this Bulletin will provide a more complete check on the continuity of the voltage supply system.

VOLTAGE AT SOCKETS

(Volume control at maximum.)

Position of Tube	Heater to Cathode Volts	Control Grid to Cathode Volts	Screen-Grid to Cathode Volts	Plate to Cathode Volts	Plate Current Milamps	Filament or Heater Volts
1st, 2nd, 3rd R. F.	—2.5	—2.5	60	135	1.7	2.5
Detector	*—5	*—5	*13	*84	.2	2.5
1st A. F.	—8	*—.27		130	4.5	2.5
Power Stage		—45		245	28	2.5
Rectifier					45 per Plate	5

*Readings may vary considerably depending on resistance of voltimeter used.

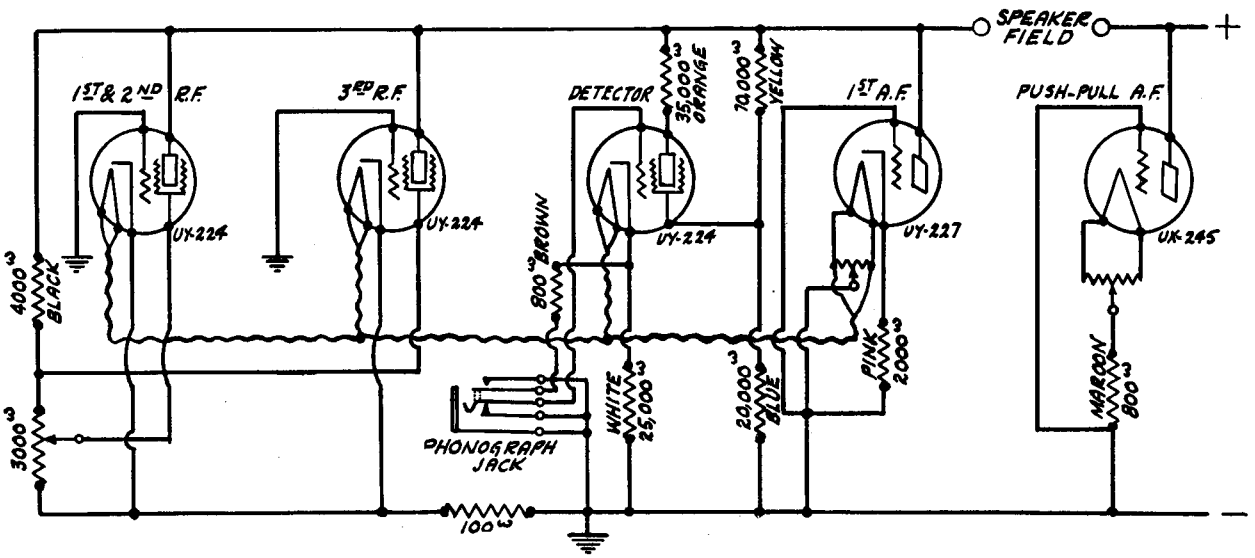
The following are some of the points where short or open circuits may appear:

A. Shorted volume control shaft to ground.
B. Open radio frequency plate coils.
C. Speaker field plug removed.
D. Open antenna loading coil.

In case of no record reproduction, head phones may be used to test the pickup and transformer by connecting them across the output of the transformer terminals, faint reproduction should be heard.

(5) Weak Signals

Following the same procedure as suggested under Heading 4, giving more attention however to the coupling circuit of the tubes; viz., resistance of R. F. plate coils, grid coils, resistance of power tube grid circuits to ground, etc. In some cases it is possible that the condenser gang is out of line. This may be re-aligned using the method outlined under Heading No. 8. Weak or distorted reproduction from the record side of S-31 is probably due to a defective pickup. Examine and adjust as recommended under Heading No. 7.



VOLTAGE SUPPLY SYSTEM
FIGURE-3

(6) Adjustment of Speaker

The major service operation on the dynamic speaker unit is the centering of the voice coil in the air gap, and the following information will no doubt be helpful in making this adjustment. Secure a small sheet of .007-inch thick celluloid, either locally or by writing the Technical Service Division, Muskegon, Michigan, and cut three small strips about 1½ inches by ½ inch. These are to be used as spacers. Next separate the speaker cone and mounting frame from the field portion, so as to get free access to the back of the front mounting plate. See "A" Fig. No. 4. Unloosen the three nuts which secure the metal spider arms to the front mounting plate, (see "B" Fig. No. 4) and insert the three celluloid spacers equal distance around the circle between the voice coil and the front mounting plate. This centers the voice coil with respect to the opening in the front mounting plate and the three nuts which secure the spider arms can now be tightened securely. Remove the bolt and core head from the field core and reassemble the cone mounting frame to the field coil portion. After this has been done and all bolts tightened securely, proceed to replace the core head but do not tighten the securing bolt until the three spacers are placed, as shown in "C" Fig. No. 4, between the core head and the voice coil. This centers the voice coil

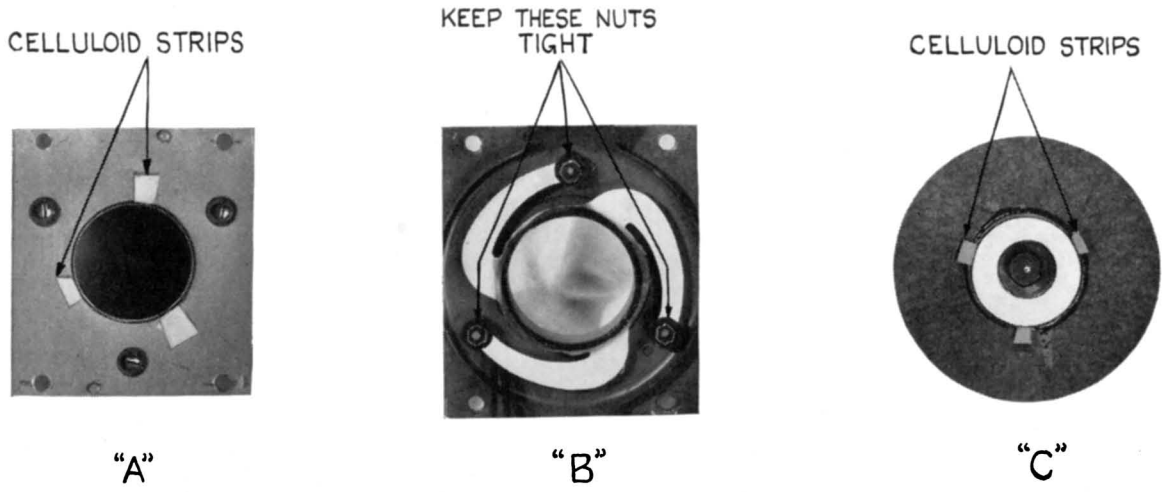


Figure 4

with respect to the core head. Except in extreme cases where the voice coil is actually warped out of round, this adjustment should clear up all cases of trouble due to the voice coil being off center in the air gap. The securing bolt should be tightened with a socket wrench to avoid injuring the voice coil. Always make certain that all bolts and nuts are tight on the speaker, especially the three nuts which hold the metal centering spider to the front mounting plate.

In case of a continuous rattle or buzz, examine the leads which go from the speaker terminal board of the metal spider arms and make certain that these leads are not touching or near the cone parchment.

(7) Magnetic Pickup

The most common difficulty traceable to the pickup is that of distorted reproduction caused by an off centered armature or by the needle being clamped loosely. To test for an off centered armature without resorting to a visual examination, rub the thumb over the needle point, both from left to right and right to left. The noise delivered from the speaker in each case should be approximately the same. Weak or no reproduction may be caused by an open in the pickup coil, shorted turns, or to ground, or by a weak magnet. In replacing this unit it is a good practice to bend out the contact spring leaves slightly so as to insure dependable contact at this point. If it is found that the armature is off center, it may be readjusted, observing the following procedure.

Remove cover and magnet. It is necessary, however, in removing the magnet to first place across its pole pieces a keeper of some magnetic material. This is very important as there are more weak pickups caused indirectly by removing the magnet without a keeper than any other cause. With cover and magnet removed, unloosen the screws securing the rubber damping block holder. Owing to the size of the holes in this holder, it has considerable play and may be secured in a position found to hold the armature at center between the pole pieces. The screws holding the damping block being tight, the magnet and cover may be replaced.

The resistance of the pickup coil is usually about 13 ohms. (B 2.7 on the continuity test.) This resistance varying over 25% on a weak pickup would indicate some shorted turns. A short to case at the proper point will cause weak or no reproduction as the suspension arm and one side of the pickup leads are normally connected to ground.

In replacing the pickup coil, it is necessary in dissembling to place a keeper across the magnet as previously explained. Care should be taken against forcing the coil between

the pole pieces as the enamel insulation might be injured causing a short. Fish paper, as included in the original assembly, should be used for protection and for additional insulation.

In the reassembling of the pole pieces, care should be taken to see that they represent a flat surface to the poles of the magnet so as to provide the least possible reluctance to the magnetic path.

(8) Adjusting Trimmers on Condenser Gang

This adjustment should be made only to improve the reception from a weak set, and then when other methods have failed, as these trimmers are adjusted before leaving the factory to a greater precision of setting than it is possible to make in the field. To make this adjustment tune in a weak station as near the 1500 kilocycle end of dial as possible, and with lock nuts loose, adjust the four screws to give the loudest signal. With this adjustment completed, the lock nuts should be tightened. One factor to observe when making this operation is not to continually increase the capacity of the trimming condensers, as the high frequency tuning limit of the set will be lowered.

Also, it is well to inspect the rotor plates to insure equal spacing from the stator. In some instances where no suitable signal is available at the above mentioned point on the wave band, it is feasible to have it supplied by a local oscillator, which for this purpose should be well shielded so as not to emit too strong a signal.

(9) Adjustments on Drive Cable

Slippage of the condenser drive cable on the small drive pulley is usually due to the condenser shaft turning hard instead of slackness in the cable, which might be assumed. To correct this difficulty, a small amount of light oil may be applied with a straw to the main condenser bearing. Also the two guide pulleys and the drive pulley shaft should receive an application. Caution should be used to prevent any oil getting on the cable. The slack in the cable may be taken up by the adjustment provided on the tuning dial for that purpose.

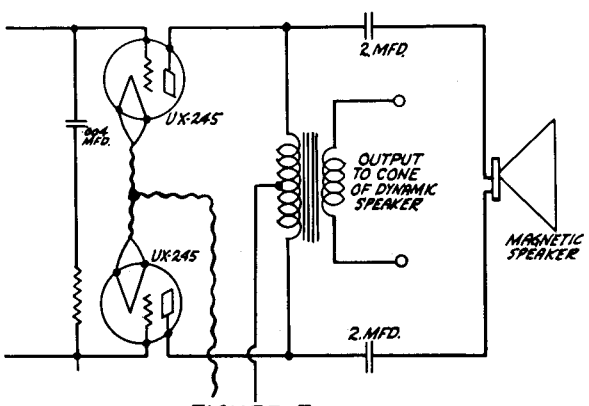


FIGURE-5
METHOD OF CONNECTING MAGNETIC SPEAKERS

(10) Additional Speakers

An additional dynamic speaker cannot very well be connected to these models, unless it has its own field supply, in which case the voice coils should be connected in series. The wire used for this circuit should be as large as possible. Magnetic speakers may be connected as shown in Figure 5.

The condensers used are for insulating purposes only, and may be eliminated if all parts of the circuit are well insulated otherwise.

(11) Induction Disc Motor

Should the induction disc motor become noisy, it usually is due to one of the following reasons:

(a) Lack of oil. See method for oiling in instruction book.

(b) Governor bearing loose. To tighten loosen set screw, push bearing gently toward center of motor, and tighten screw. Do not force bearing for it may bind the governor shaft.

(c) Defective spring in governor. Either bent or broken, it should be replaced.

Hum from motor is due to either loose laminations or a loose coil on its core. In case of loose laminations, it should be clamped by tightening the retaining bolts. A loose coil may be tightened by driving between it and its core a small soft wood wedge. Hum caused by a loose coil may be detected by placing a finger on each until one is found that will stop the hum.

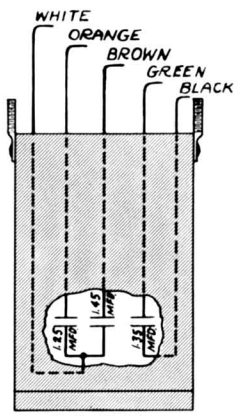
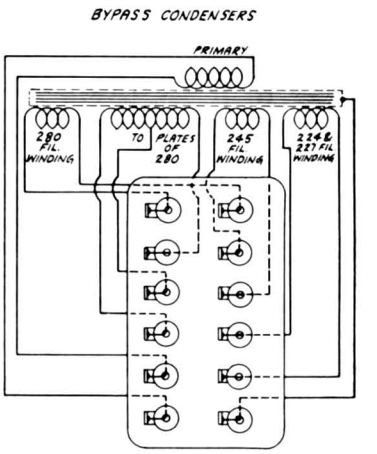


FIGURE 6
CONNECTIONS OF 25 CYCLE ADDED FILTER CONDENSERS



INTERNAL CONNECTIONS OF POWER TRANSFORMER
FIGURE-7

(12) Replacing Parts

The actual wiring diagrams found in the last pages of this Bulletin will be found helpful in replacing parts. The color code given is that which was standard at the time this Bulletin went to the printers. It is possible, but improbable, that any changes will be made.

(13) Adjusting Tuning Dial Escutcheon

If it is found that stations do not come in where indicated by the escutcheon pointer on the tuning dial, it will be found easy to correct this error by removing the escutcheon and shifting it to a position that indicates correctly the frequency of a station to which the set is tuned when the escutcheon is remounted.

(14) Test for the Screen-Grid Tube

While it is desirable to test these tubes for mutual conductance, it is not absolutely necessary. A simple test that is sufficient may be made by measuring the emission with the plate and both grids connected together. About 60 volts may be used, which should be applied through a 1,000 ohm current limiting resistor. A 0 to 60 milliammeter is suitable for a meter in this test. The above test is not complete and should be followed by one to check for shorted elements. If requested, we will be pleased to furnish additional information on tube tests.

PART IV—CONTINUITY TEST

The continuity test following may be made with a pair of head-phones and a battery connected in series, or by a meter and battery. It is recommended, however, that some type of ohm-meter be used for this purpose in order that a more accurate check may be secured of the resistance encountered in the various circuits. A very simple type of ohm-meter is shown in Figure 8, page 12. It is recommended, if some other type is not already available, that the technician construct for his own use one of these instruments. This device has a double range, is very economical to make, and can be so constructed as to be readily portable. Below is given a table showing the relation between the reading on milliammeter and the actual resistance value.

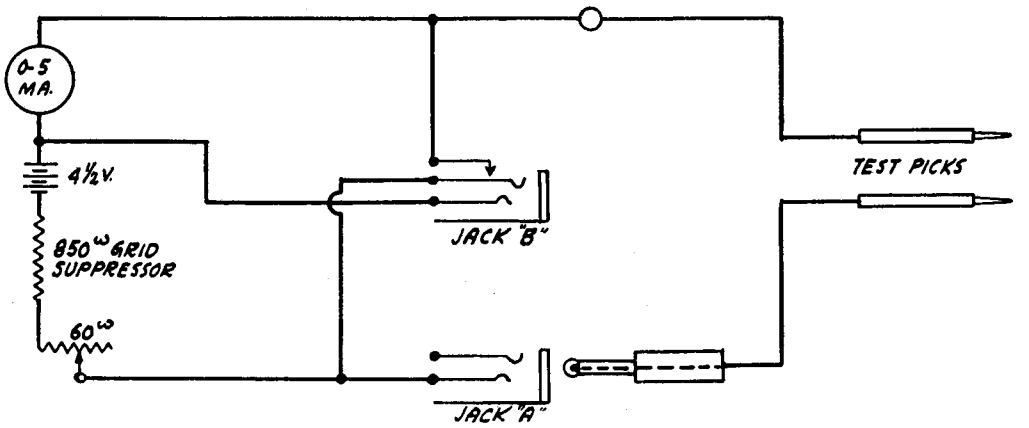


Figure 8

COMPARISON BETWEEN RESISTANCE VALUES AND METER READING

Plug in Jack "A" Position

Reading Ma.	Ohms	Reading Ma.	Ohms	Reading Ma.	Ohms
0	Infinity	1.7	1,747	3.4	423
0.1	36,000	1.8	1,600	3.5	385
0.2	26,600	1.9	1,468	3.6	350
0.3	14,100	2.	1,350	3.7	316
0.4	10,350	2.1	1,242	3.8	284
0.5	8,100	2.2	1,145	3.9	253
0.6	6,600	2.3	1,056	4	225
0.7	5,529	2.4	975	4.1	198
0.8	4,725	2.5	900	4.2	171
0.9	4,100	2.6	830	4.3	146
1	3,600	2.7	766	4.4	122
1.1	3,191	2.8	707	4.5	100
1.2	2,850	2.9	651	4.6	78
1.3	2,562	3	600	4.7	57
1.4	2,314	3.1	551	4.8	37
1.5	2,100	3.2	518	4.9	18
1.6	1,913	3.3	460	5	Zero

Plug in Jack "B" Position

Reading Ma.	Ohms	Reading Ma.	Ohms	Reading Ma.	Ohms
0	0	2.7	13	3.8	37
0.5	1	2.8	14	3.9	42
0.8	2	2.9	15	4.0	47
1.1	3	2.9	16	4.1	54
1.3	4	3.0	17	4.2	63
1.6	5	3.0	18	4.3	74
1.8	6	3.1	19	4.4	90
2	7	3.2	20	4.5	110
2.1	8	3.3	23	4.6	140
2.2	9	3.4	25	4.7	210
2.4	10	3.5	27	4.8	370
2.5	11	3.6	30	4.9	1000
2.6	12	3.7	33	5.0	Infinity

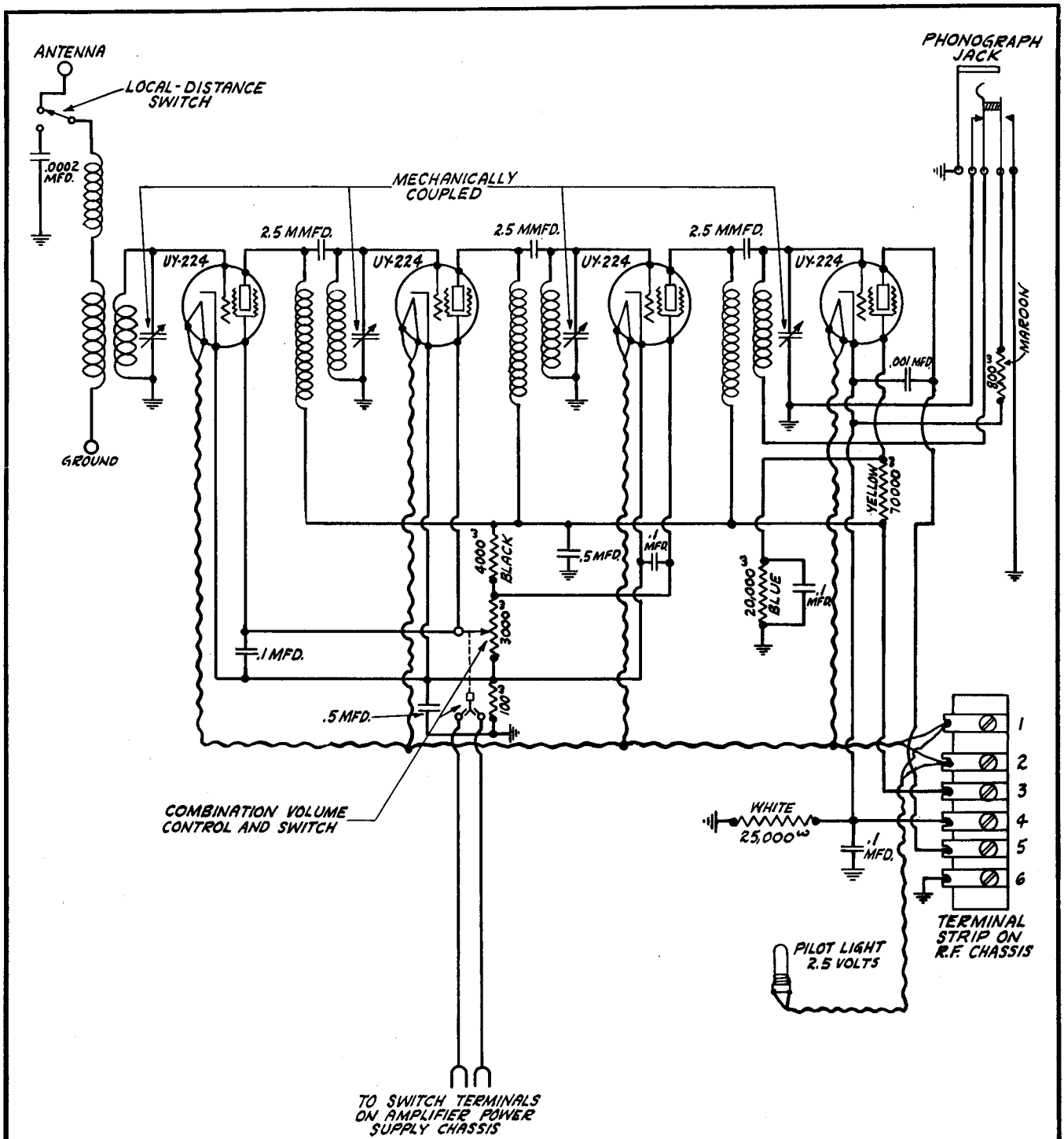
CONTINUITY TEST CHART

Test No.	Under Test	Test Positions	Correct Effect	Probable Incorrect Effect	Caused By
1	R. F. Grid Circuits	Ground to 1st, 2nd and 3rd grid caps	Closed thru 4Ω (B1.3)	Open or shorted	Open in flexible lead Open in R. F. coil Bent condenser plate
2	Detector Grid circuit	Ground to detector grid cap	Closed thru 4Ω (B1.3)	Open Shorted	Open in flexible lead Defective phonograph jack Open in R. F. coil Bent condenser plate
3	1st A. F. grid circuit	Ground to 1st A. F. socket grid contact	Closed thru 1 meg (A0)	Shorted thru 165,000 Ω (A.02)	Shorted .01 mfd. coupling condenser
4	Power tube grid circuits	Ground to alternate power tube socket grid contacts	Closed thru 6000 Ω (A0.7)	Shorted Open	Filter resistance lead touching hum potentiometer frame Shorted .004 cond. Open transformer winding
5	Antenna circuit	Ground to ant. post (switch set for distance)	Closed thru 30 Ω (B3.6)	Closed thru 5Ω (B1.6) Open	Shorted antenna loading coil Open antenna loading coil Open transformer primary Defective switch
6	Antenna circuit	Ground to high side ant. primary coil	Closed thru 5Ω (B1.6)	Open	Open primary
7	Antenna circuit	Ground to ant. post (switch set for local)	Open	Closed thru 30Ω (B3.6)	Defective switch
8	Phonograph jack	Ground to cathode contact of detector socket (open plug inserted in jack)	Closed thru 800Ω (A3.3)	Closed thru 25,000Ω (A0.17)	Open connection or defective jack
9	Phonograph jack	Ground to grid cap of detector (open plug inserted in jack)	Open	Closed thru 4Ω (B1.3)	Defective jack
10	Radio Frequency plate circuit	Ground to 1st, 2nd and 3rd R. F. socket plate contacts (Volume control at maximum)	Closed thru 7000Ω (A0.6)	Closed thru 60Ω (B4.2) Closed thru 4100Ω (A0.9) Closed thru 100,000Ω (A0)	Shorted .5 mfd. by-pass condenser R. F. choke lug shorted to antenna wire shielding Shorted coupling condenser Shorted screen-grid by-pass condenser Open volume control Open 100Ω grid bias resistor
11	Detector plate circuit	Ground to detector plate	Closed thru 165,000Ω (A0.02)	Closed thru 25,000Ω (A.17)	Shorted .001 mfd. by-pass condenser
12	1st A. F. plate circuit	Ground to plate contact 1st A. F. tube	Closed thru 9800Ω (A0.4)	Closed thru 2700Ω (A1.3) Short Open	Shorted condenser in filter block Shorted .5 mfd. condenser in radio chassis Plate connections touching potentiometer frame Open primary in transformer Open volume control Open 100Ω grid bias resistor

CONTINUITY TEST CHART—*Continued*

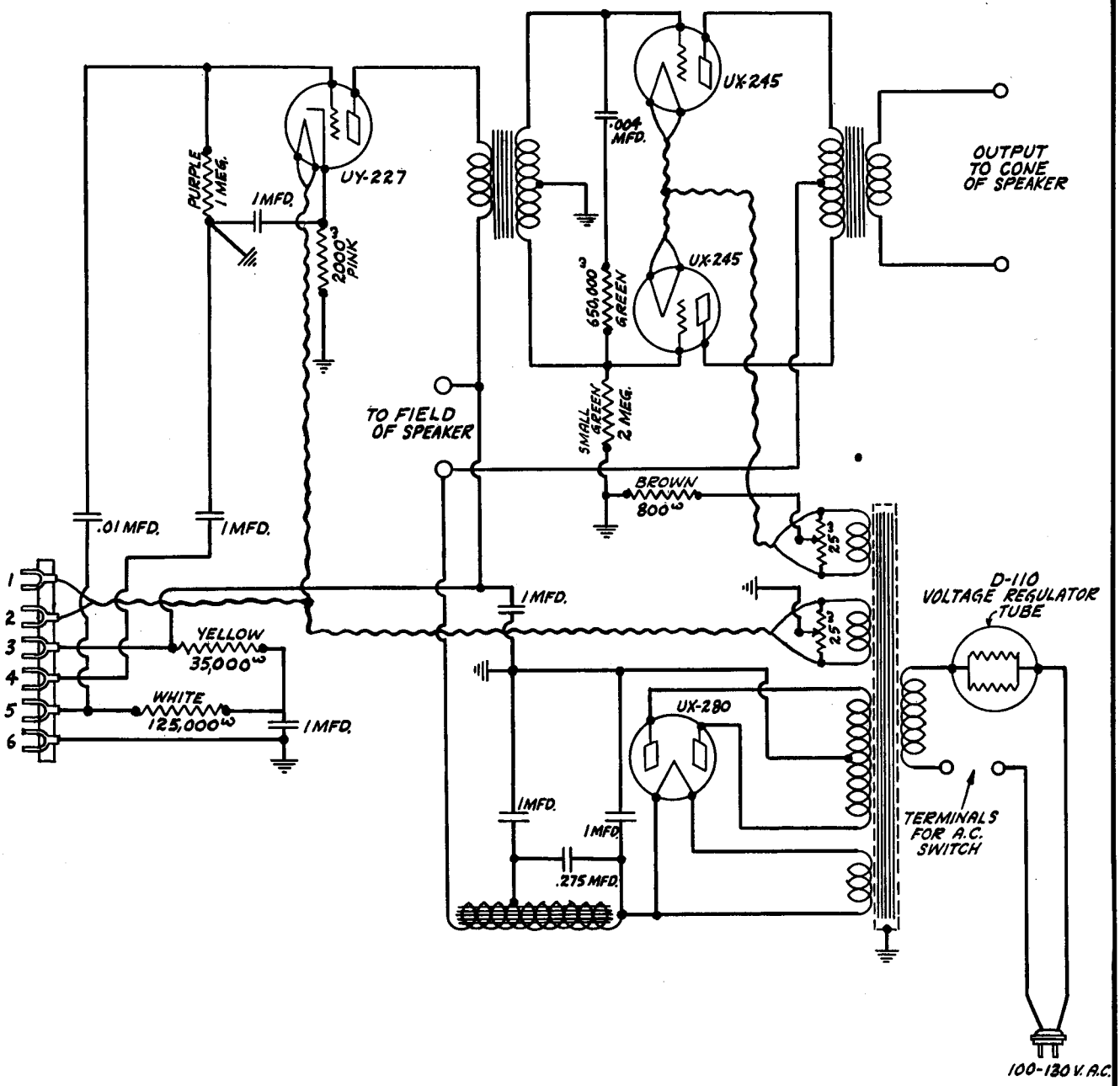
Test No.	Under Test	Test Positions	Correct Effect	Probable Incorrect Effect	Caused By
13	Power tube plate circuit	Ground to alternate power tube socket plate contacts	Closed thru 12,300Ω (A0.3)	Open Closed thru 600Ω (A3.0) 750Ω (A3.3) 5200Ω (A0.7)	Open field coil Open primary windings Shorted condensers in filter block
14	Screen-grid circuits	Ground to 1st, 2nd and 3rd R. F. socket grid contacts (Volume control at max.)	Closed thru 3100Ω (A1.2)	Short Closed thru 100Ω (A4.5)	Grounded volume control Shorted.1 mfd. by-pass. cond.
15		Ground to 1st and 2nd R. F. socket grid contacts (Volume control at minimum	Closed thru 100Ω (A4.5)	Closed thru 100,000Ω (A.05) Short	Open 100Ω grid bias resistor Defective volume control Shorted .5 mfd. cathode by-pass condenser Grounded volume control
16	Detector Screen-grid circuit	Ground to detector socket grid contact	Closed thru 17,000Ω (A0.25)	Short	Shorted .1 by-pass condenser
17	R. F. return circuit	Ground to 1st, 2nd and 3rd R. F. socket cathode contacts	Closed thru 100Ω (A4.5)	Short Closed thru 100,000Ω (A.05)	Shorted .5 mfd. cathode by-pass condenser Open 100Ω resistor
18	Detector return circuit	Ground to detector socket cathode contact	Closed thru 25,000Ω (A.17)	Short Closed thru 800Ω(A2.7)	Shorted .1 mfd. by-pass cond. Defective phonograph jack
19	1st A. F. return circuit	Ground to 1st A. F. socket cathode contact	Closed thru 2000Ω(A1.5)	Short	Shorted condenser in filter block
20	Power tube return	Ground to filament contact both power tube sockets	Closed thru 800Ω (A2.7)	Short	Grounded hum potentiometer Grounded filament winding on power transformer
21	Plate supply	Ground to rectifier socket filament contact	Closed thru 11,000Ω (A.37)	Short Closed thru 150Ω (A4.3) Open	Shorted 1st condenser in filter Shorted 2d condenser in filter Open choke coil Open field coil
22	High voltage secondary of power trans.	Ground to alternate rectifier socket plate contacts	Closed thru 250Ω (A3.9)	Open	Open high voltage secondary winding
23	Primary of power trans.	Ground to side of primary winding	Open	Short	Grounded power switch Grounded transform.primary
24	Speaker field	Across terminals of plug	Closed thru 4750Ω(A0.8)	Open Short	Open field coil Shorted field coil
25	Choke coil	Rectifier filament to blue or maroon wire on field	Closed thru 160Ω(A4.2)	Closed thru 20Ω (B3.2)	Shorted .275 cond. in block

Note—Numbers in italics are readings taken with the continuity tester described on page 11 of this bulletin. The letters "A" and "B" preceding the numbers indicate the position of the plug in tester when reading was taken.



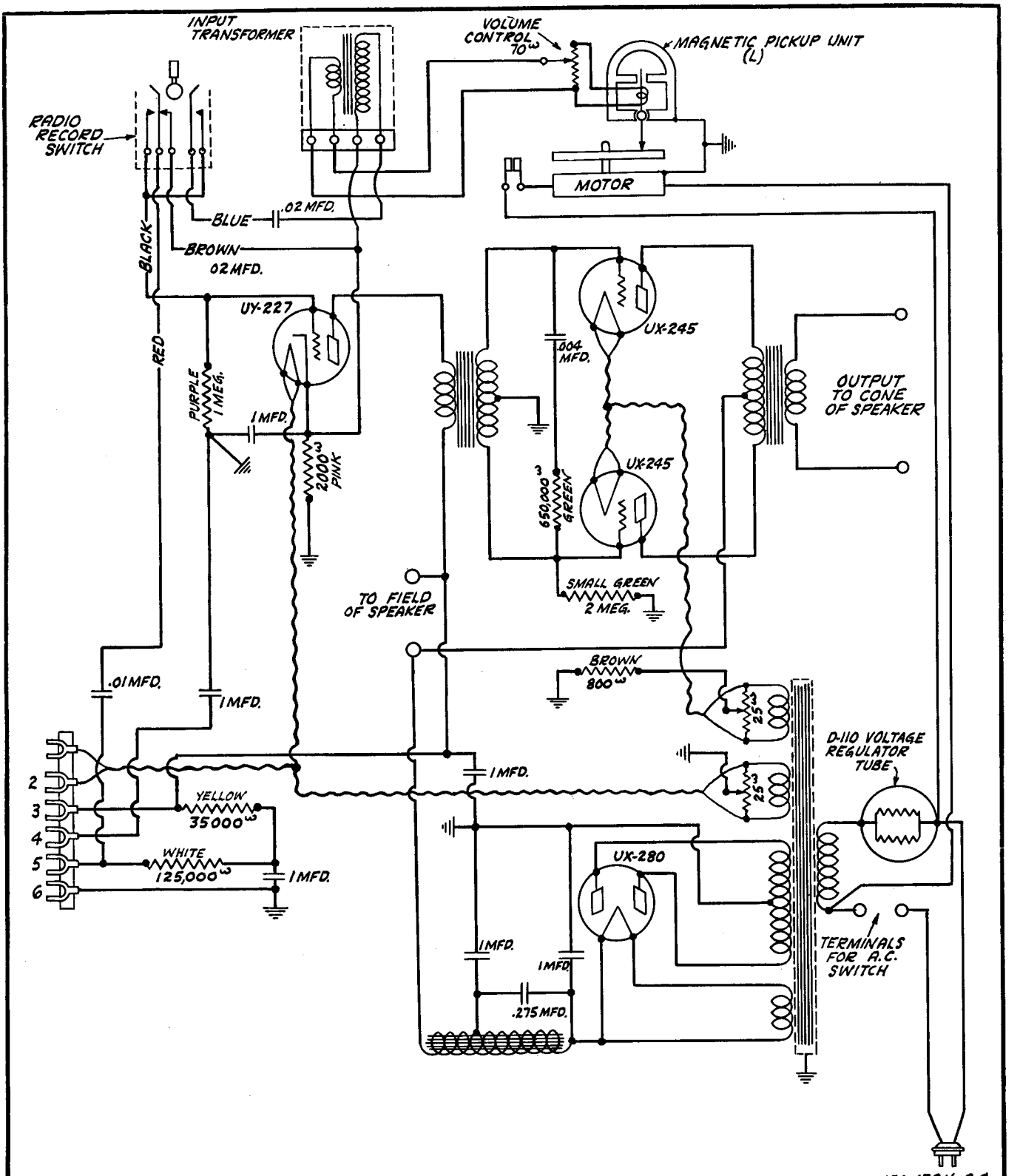
SCHEMATIC CIRCUIT OF RADIO CHASSIS

7003



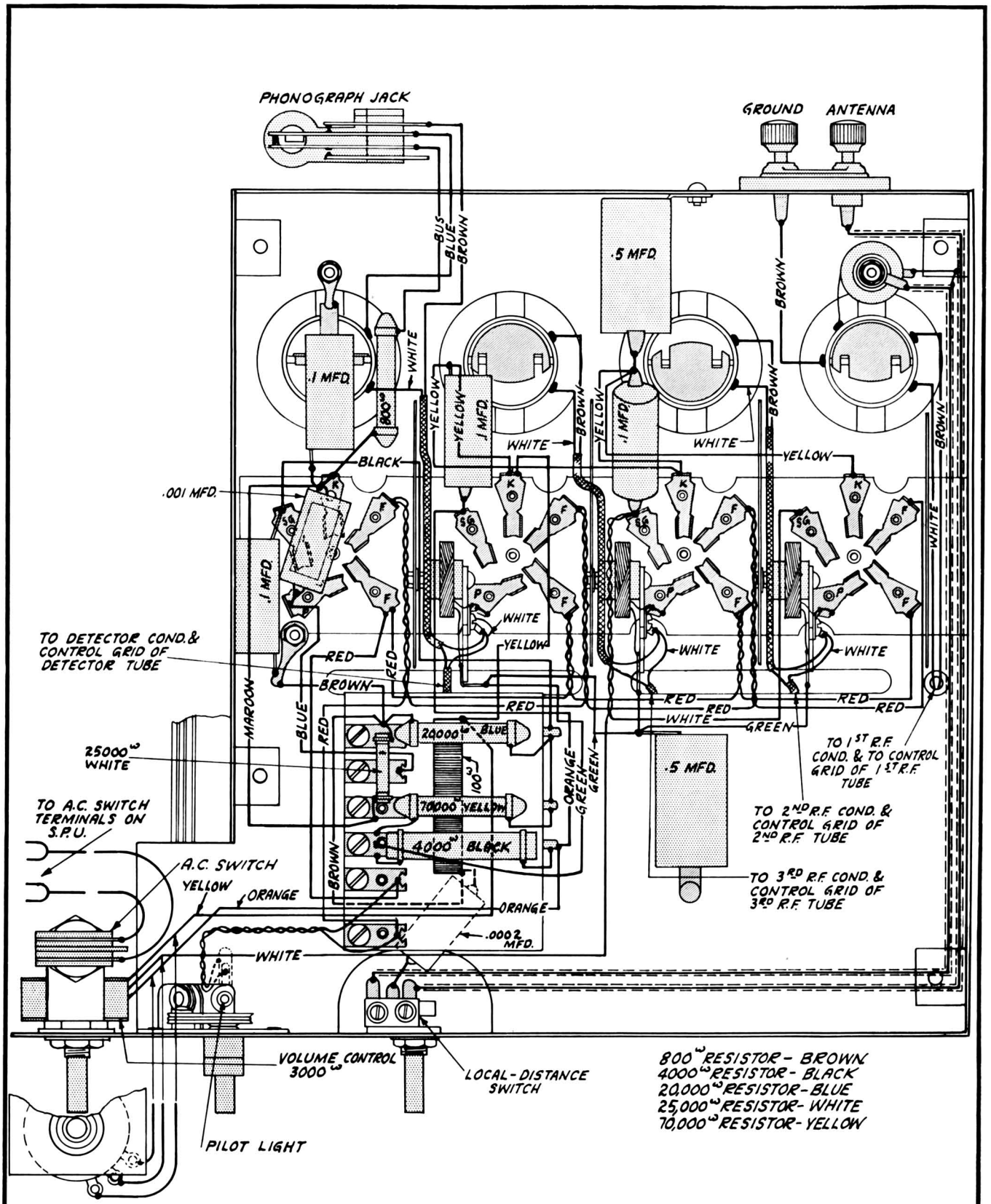
SCHEMATIC CIRCUIT OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS USED ON STRAIGHT RADIO-60 CYCLE

7004



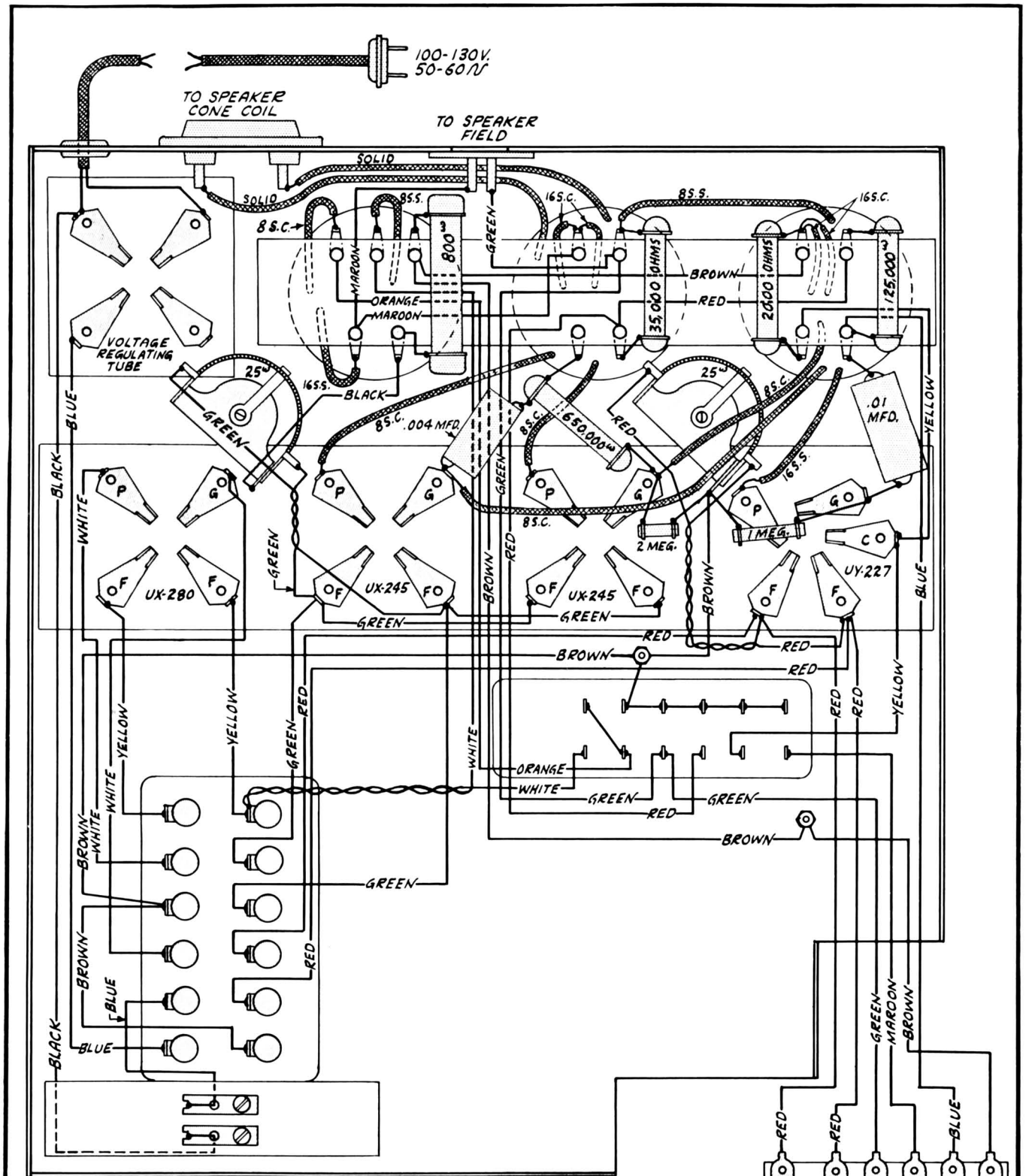
SCHEMATIC CIRCUIT OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS
USED ON COMBINATION - 60 CYCLE

6082



SCHEMATIC CIRCUIT OF RADIO CHASSIS USING UY-224 TUBES

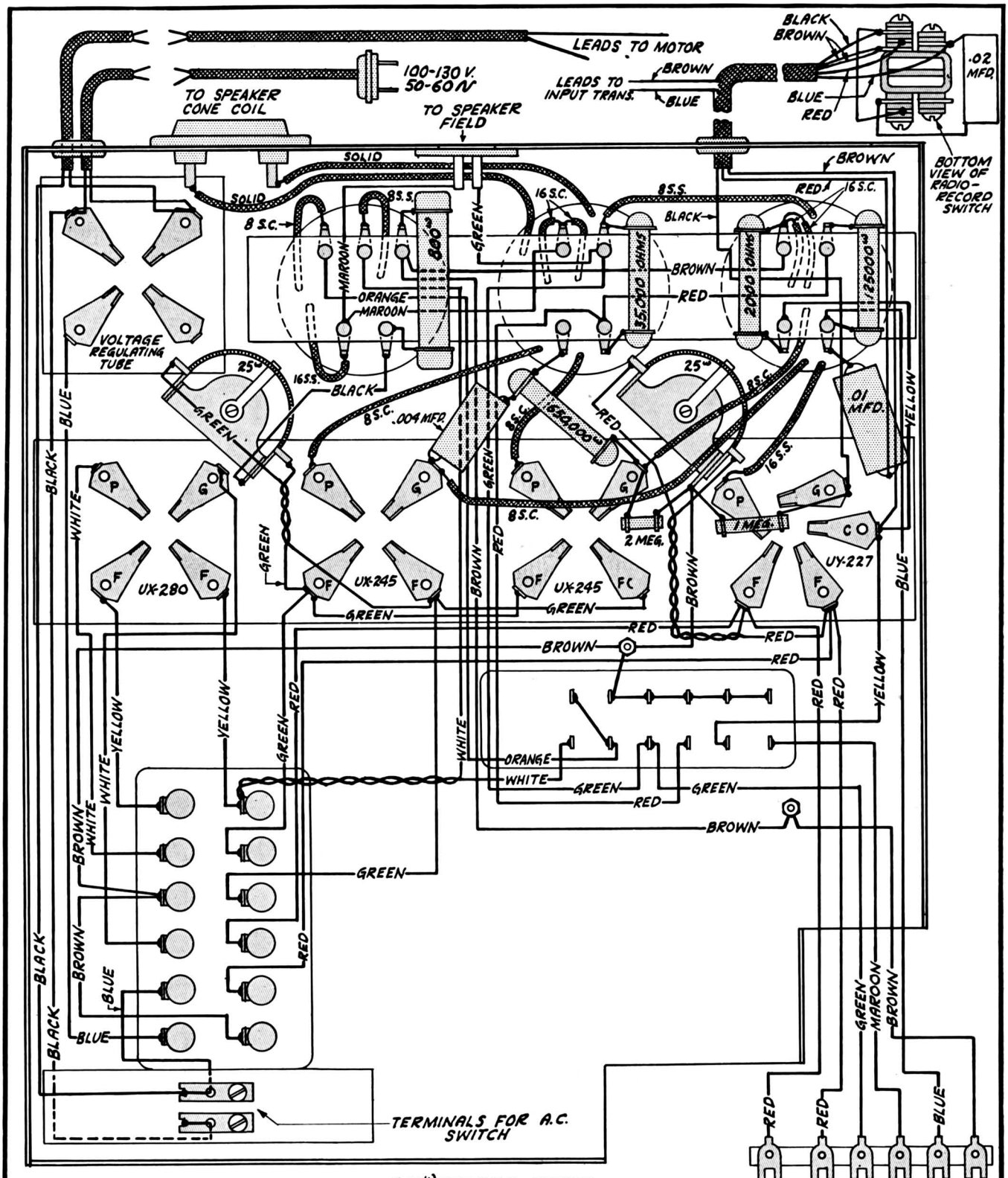
7008



#8S.C. = #8 STRAND COPPER WIRE
8S.S. = #8 STRAND SILVER WIRE
16S.C. = #16 STRAND COPPER WIRE
16S.S. = #16 STRAND SILVER WIRE

800Ω RESISTOR - BROWN
2000Ω RESISTOR - PINK
35,000Ω RESISTOR - ORANGE
125,000Ω RESISTOR - WHITE
650,000Ω RESISTOR - GREEN
1 MEG. RESISTOR - PURPLE
2 MEG. RESISTOR - LIGHT GREEN

ACTUAL WIRING DIAGRAM OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS **7005**



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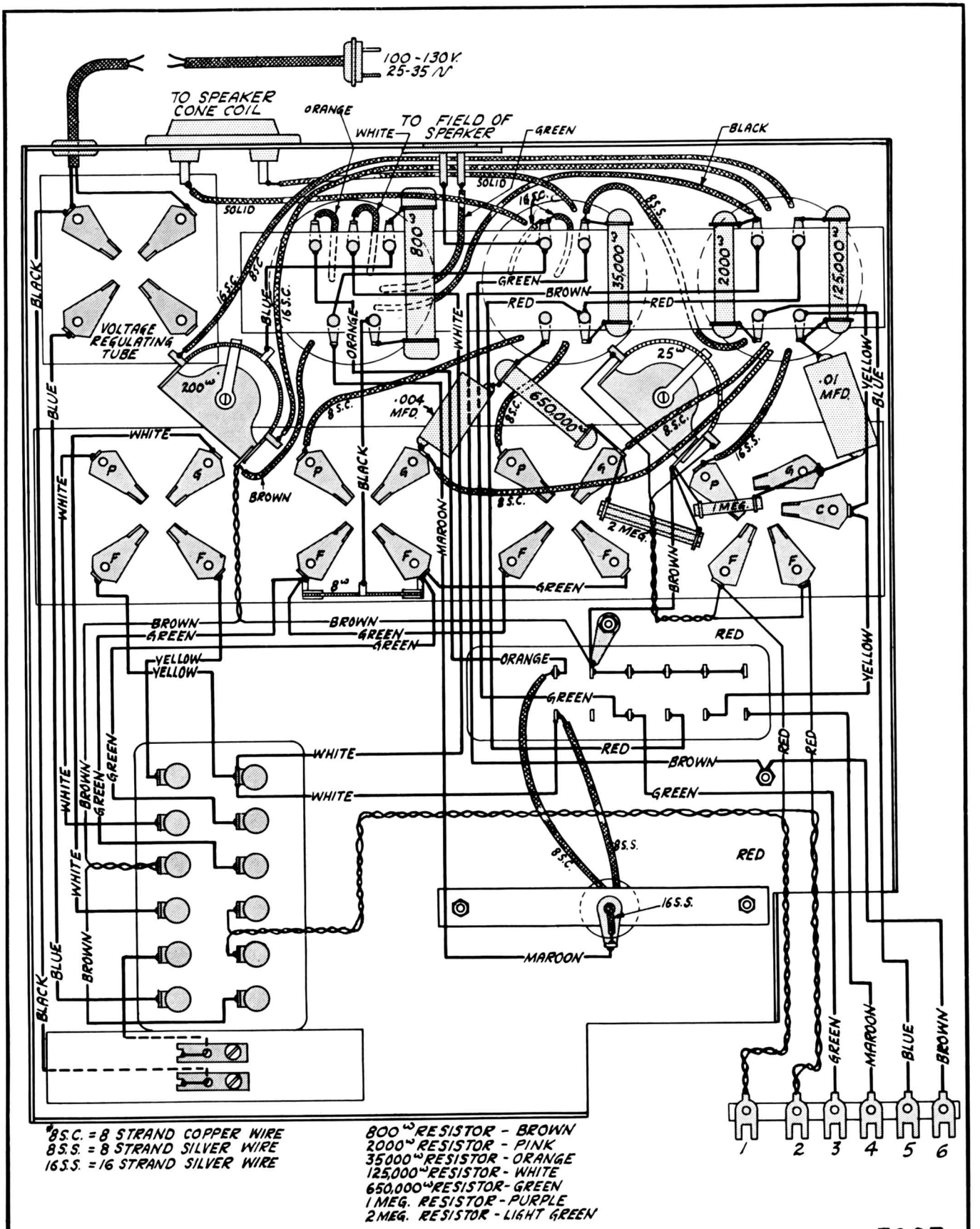
35000 Ω RESISTOR - ORANGE
125,000 Ω RESISTOR - WHITE
650,000 Ω RESISTOR - GREEN
1 MEG. RESISTOR - PURPLE
2 MEG. RESISTOR - GREEN

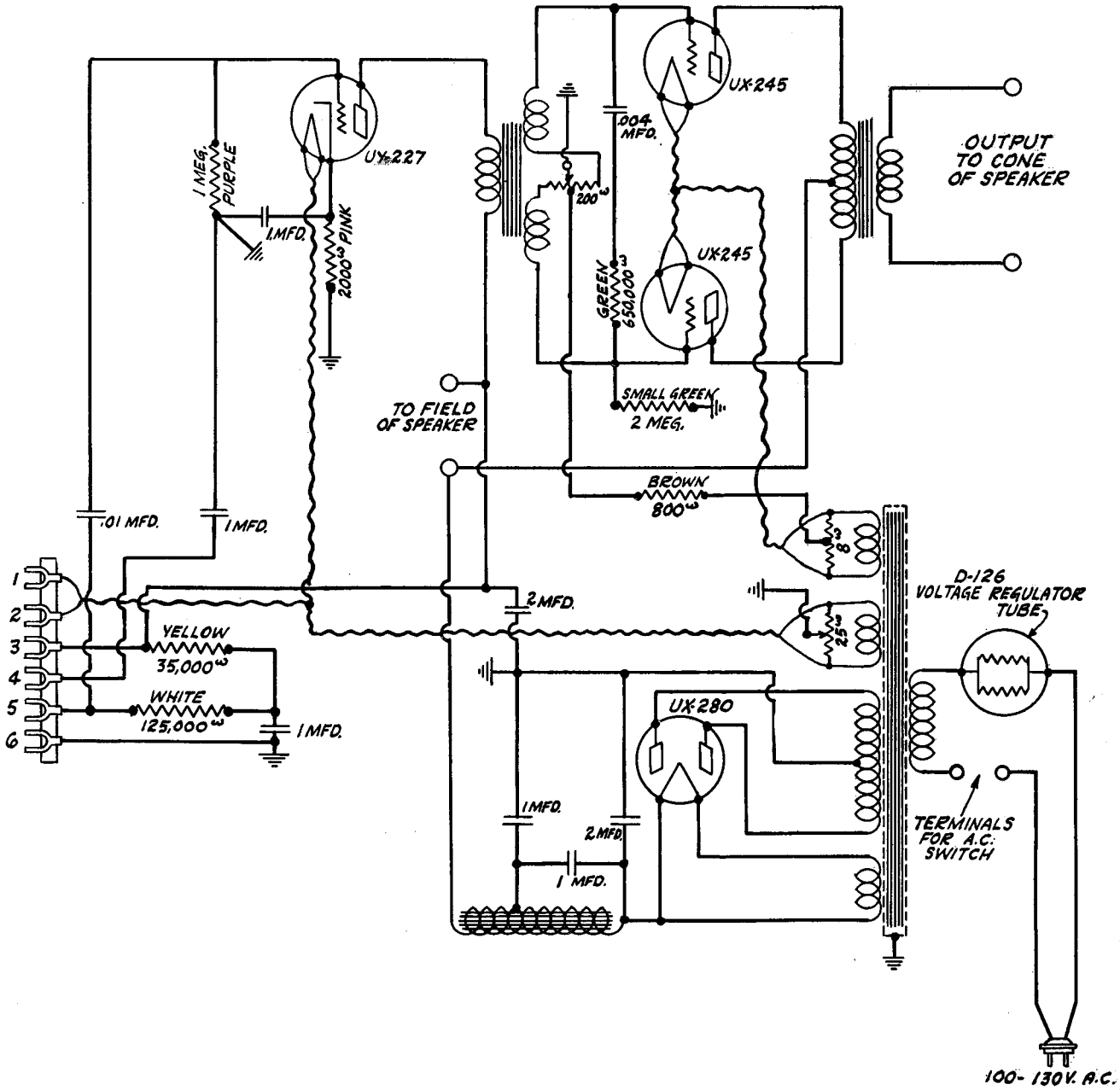
ACTUAL WIRING DIAGRAM OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS USED S-31 COMBINATION **6083**



*8S.C. = 8 STRAND COPPER WIRE
8S.S. = 8 STRAND SILVER WIRE
16S.S. = 16 STRAND SILVER WIRE

800 ω RESISTOR - BROWN
2000 ω RESISTOR - PINK
35000 ω RESISTOR - ORANGE
125,000 ω RESISTOR - WHITE
650,000 ω RESISTOR - GREEN
1 MEG. RESISTOR - PURPLE
2 MEG. RESISTOR - LIGHT GREEN

ACTUAL WIRING DIAGRAM OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS 25 CYCLE 7007



SCHEMATIC CIRCUIT OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS USED ON STRAIGHT RADIO - 25 CYCLE

7006

MEMORANDUM

MEMORANDUM

WARRANTY

We warrant each new Radio, Panatrope and Panatrope with Radio sold by our Authorized Brunswick Dealer to be free from any defects in material or workmanship.

We will repair or replace at our Branch Service Stations or at our Distributors' Service Stations any part or parts thereof (excepting tubes) which shall be submitted to us for examination, and which our examination shall disclose to our satisfaction to have been thus defective, provided the postcard section of this Warranty tag is filled in and mailed by the Dealer to the Brunswick Branch or Distributor which serves him. Our obligations under this Warranty are limited to a period of ninety days from date of delivery to the customer.

This Warranty shall be void if, in our judgment, the alleged defective parts shall have been subjected to misuse, mishandling, negligence or accident.

This Warranty is expressed in lieu of all other Warranties, expressed or implied, and all other obligations or liabilities. We neither assume nor authorize any person or company to assume for us, any other liability or obligation in connection with the sale of this instrument.

The Brunswick-Balke-Collender Co.

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