Radiola

SERVICE INSTRUCTIONS

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Service an Aid to Sales

Service goes hand in hand with sales. The well-informed Radiola dealer renders service at the time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling.

Obviously this service can best be rendered at point of contact, and therefore dealers who are properly equipped with a knowledge of the design and operation of Radiolas occupy a favourable position to render efficient service.

To assist in promoting this phase of the dealer's business, the A.W.A. Service Section has prepared this booklet containing information which has been compiled from experience with Radiola Dealers' Service problems. It is hoped that these notes, which will be added to from time to time as further data is collected, will prove a practical help in servicing Radiolas.

To simplify reference, the notes have been divided into six sections, as follows:—

1. General information contained in which is data common to all types of Radiolas.
2. General description and testing schedule—Radiola Electric Three.
3. ,, ,, ,, ,, ,, —Radiola Battery Six.
4. ,, ,, ,, ,, ,, —Radiola Battery Seven.
5. ,, ,, ,, ,, ,, —Radiola Electric Seven.
6. ,, ,, ,, ,, ,, —Radiola Duoforte.

General Information

METHODICAL FAULT LOCATION ESSENTIAL.

From a very careful survey it has been found that a very large percentage of faults reported on first installations are due to either the accessories used or to mistakes in installation. There is no doubt that a great deal of unnecessary work will be eliminated when servicing if the investigation is carried out in the following order:—

1. Test the accessory equipment.
2. Make preliminary voltage tests on the Radiola chassis before removing from the cabinet.
3. Remove the chassis from the cabinet for further systematic fault location.

In servicing A.C. operated Radiolas, the important thing to remember is that the A.C. Radiola is essentially the same as its predecessor, the battery operated set, with one major exception—that is, the valves. Therefore when you are called upon to service an electrically operated Radiola, do not begin by tearing it apart, but carry out the fault location in the above sequence by making a start with the equipment used with the set, next carry out preliminary voltage tests with the set in the cabinet, and last of all remove the Chassis and Power Unit from the cabinet.

EQUIPMENT DATA.

VALVES.

Valves are inherently fragile and should be handled with care. Sometimes due to rough usage the internal elements become short circuited, and in such a state are liable to cause serious trouble, even to the extent of causing permanent injury to the Radiola.

It is often found that valve prongs become dirty, causing bad contact in the socket. The prongs should be cleaned with a piece of sand paper. Also it is sometimes found that excessive solder is left on the ends of the valve prongs. This should be cleaned off with a knife or a file.

In inserting valves in the Radiola, care should be taken that a valve of low filament voltage is not inserted in the socket of a valve of higher filament voltage. This is more likely to happen in the case of the A.C. Radiola. For instance, if a UX226 valve (filament voltage 1.5 volts) be inserted in a UX171A valve socket (filament voltage 5 volts) it is obvious that the UX226 valve will be burnt out.

If there is the least suspicion that valves are faulty, they should be tested in a reliable valve tester. If it is impossible to have them thoroughly tested with the proper equipment, the valves should be tested out for performance in a Radiola which is known to be working satisfactorily.

BATTERIES.

The "A" battery should be kept well charged. The battery solution should never be allowed to fall below the top of the plates. Only distilled water should be used to replenish the solution. After charging, carefully wipe any traces of solution from off the battery container, and keep the terminals and connecting strip free from corrosion.

The specific gavity of the electrolyte should be checked carefully with a hydrometer, and unless otherwise specified by the manufacturers, the specific gravity at full charge should be 1250 to 1275.

The terminal voltage test on an "A" battery is not a reliable indication of the state of the battery unless it is taken when the full valve filament load is being taken from the battery, and after at least 30 minutes run at that load.

Exhausted "B" batteries may be the cause of distortion, noisy operation, or uncontrollable oscillation. "B" batteries should be tested with a high resistance D.C. voltmeter, preferably when supplying the full plate current to the Radiola, i.e., when operating a Radiola which is known to be working satisfactorily. Forty-five volt "B" batteries should be replaced when their voltage drops to thirty-five or forty volts.

"C" batteries may also cause distortion, noisy operation or uncontrollable oscillation. The voltage should be tested with a high resistance D.C. voltmeter, and a battery whose voltage is not equal to the rated value should be looked upon with suspicion.

PRELIMINARY VOLTAGE TESTS.

Voltage tests should be made after the equipment is tested and before the chassis is removed from the cabinet. Tests should be made across the valve contacts with all the valves inserted, and the Radiola switched on for operation, but with the selector dial turned to 100 on the scale.

Plate and grid bias voltages in the case of both A.C. and D.C. receivers should be measured with a high resistance voltmeter, i.e., a meter having a resistance of at least 600 ohms per volt. Filament voltages for the D.C. Radiola should be measured with a D.C. low reading voltmeter and the filament voltages for the A.C. Radiola on a low voltage A.C. meter.

The values given under the preliminary voltage test for each Model Radiola must be considered as an average value and a reading approximating that shown should be taken as an indication that the Radiola is working satisfactorily. The reason for this—especially in the case of the electrically operated Radiolas—is that meters having different resistances throw a different load on the circuit being tested and accordingly give different readings. Also in the case of the A.C. set, any variation in the line voltage will make an appreciable difference to these readings and cause them to vary considerably from the values given. It is advisable when making voltage tests on an A.C. Radiola to also measure the line voltage with a reliable A.C. voltmeter.

CONTINUITY TESTS.

In the continuity tests for each type of Radiola, is given a testing schedule which is reasonably complete and which should cover the general faults met in servicing that particular Radiola. However, agents will place themselves in a better position to service Radiolas if, instead of looking upon this as a complete schedule, they consider it rather as a guide to the method. If a study of the testing schedule is made in conjunction with the circuit diagram, the reason for each continuity test will be understood, and further subsidiary continuity tests will be able to be originated, which will be very helpful in localising faults.

Continuity tests should be made with an A.W.A. Radio Service Tester or with a low reading D.C. voltmeter in series with a 4.5 volt dry cell. See Fig. 1.

Fig. 1

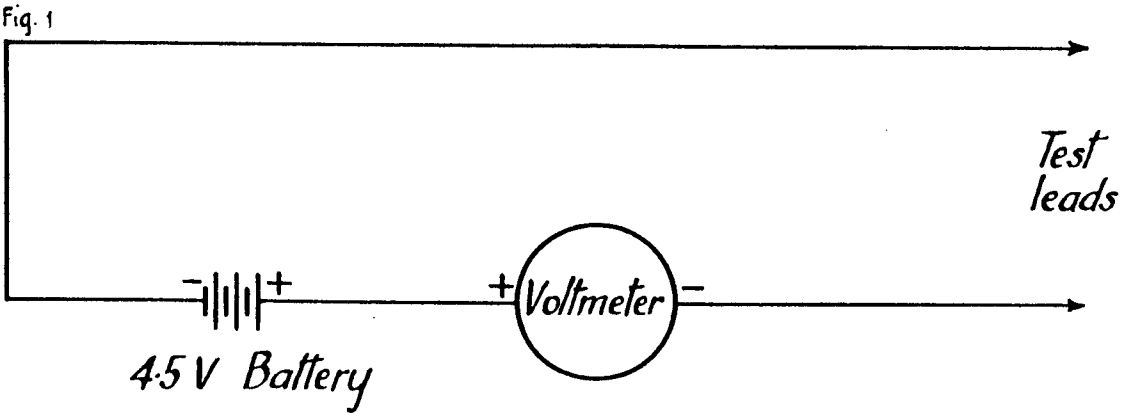


Fig. 1—Continuity Tester.

Remember, when making continuity tests, a deflection on the meter denotes a closed circuit, and no deflection denotes an open circuit. Circuits whose resistances are high will not give deflections as great as those having low resistances. For instance, the deflection obtained across the secondary of an audio transformer will be less than the deflection obtained across the primary. Further, the deflection obtained across the primary of an audio frequency transformer will be less than the deflection obtained across the primary of a radio frequency transformer.

MISCELLANEOUS DATA COMMON TO ALL RADIOLAS.

CHASSIS INSPECTION.

When inspecting the chassis, take particular care not to disarrange the wiring. Each wire—especially those in the radio frequency circuits—has a definite relation to other wires, and if this arrangement is altered to any extent it is quite possible that uncontrollable oscillation will be the result when operating the Radiola.

UNCONTROLLABLE OSCILLATION.

Sometimes a Radiola may oscillate when the volume control is at the maximum volume position. Turning the volume control in a clockwise direction will very often eliminate the oscillation, and give quite satisfactory volume. If this does not control the oscillation, try changing the detector valve, and as a further remedy in the case of an electrically operated Radiola, check the line voltage to see that the valves are not receiving excessive filament voltage.

See page 20 for uncontrollable oscillation in Electric Seven.

FAULTY VOLUME CONTROL.

A loose volume control contact may cause noisy or intermittent operation and should be remedied. If the contact arm is loose, the remedy is to bend it slightly, so that it makes firm contact against the resistance strip. To do this, the leads connecting the volume control should be unsoldered, and the complete rheostat removed from the metal panel by removing the two screws in the front. Take the contact arm off, bend slightly and replace.

BEARING BINDING VARIABLE CONDENSERS.

In several instances this fault has been traced to the leatheroid thrust washer in the "spring end" bearing splitting in half and locking the spindle. The condenser will operate satisfactorily without the washer, therefore, if the pieces of washer are removed, it will be found that the condenser will operate satisfactorily.

BEARINGS BINDING IN SELECTOR DRIVE AND VOLUME CONTROL.

Remove the spindle from the bearing and clean the bearing surface with a piece of fine emery cloth. Clean thoroughly and lubricate with a good grade of oil before replacing. Take particular care that the oil does not run down on to the selector drive friction wheel, for this will cause slipping.

FAULTY BYPASS CONDENSER.

The indication of a fault in these small condensers (.001 and .0002 mf.) located in the audio frequency amplifier, is an intermittent crackling in the loudspeaker reproduction. Any suspicious condenser should have one end disconnected from the circuit and a test made across the condenser with a pair of phones in series with a 90 volt battery. If a sizzling or crackling is heard in the phones the condenser should be replaced.

LINING UP GANG CONDENSERS.

The gang condensers are adjusted to line up correctly before leaving the factory and should not be interfered with unless it is certain that the condensers have been shifted from their original position. To carry out "lining up" accurately it is necessary to have a modulated oscillator (similar to the type incorporated in the A.W.A. Radio Service Tester) and a valve voltmeter to measure the output.

Particulars of the modulated oscillator and valve voltmeter are given in the following sub-sections.

To "line up" the condensers proceed as follows:—

1. With the Radiola out of the cabinet connect it up for normal operation.
2. Couple the oscillator to the Radiola by placing it near the earth lead of the instrument.
3. Set the oscillator condenser to give a note in the loudspeaker when the Radiola Selector is set to about 70 on the scale.
4. Fit a small knob on each of the three outer condensers. Suitable knobs are available from the Company at 1/- per set of three.
5. Replace the loudspeaker by the valve voltmeter and adjust the coupling between the oscillator and Radiola until a suitable deflection is obtained on the milliammeter.
6. Loosen the binding screws in the driving drums of the outer condensers and tune each condenser individually until a maximum reading is obtained on the milliammeter. Probably it will be found necessary to go over this procedure two or three times until the correct alignment is found. Finally tighten up the driving drum grub screws.

Although more accurate "lining up" can be done with the aid of the valve voltmeter, an approximate alignment can be obtained by substituting a pair of phones for the valve voltmeter and adjusting the condensers for maximum audibility in the phones.

MODULATED OSCILLATOR.

A suitable modulated oscillator for "lining up" gang condensers is shown together with the receiver and valve voltmeter, in Fig. 2. The oscillator will cover the wave-range of approximately 200 to 550 metres. The grid condenser and leak modulate the output, the note being dependent on the value of the grid leak. In addition to the use of "lining up" condensers, the oscillator will be found useful for general testing of Radiolas.

VALVE VOLTMETER.

The valve voltmeter referred to in the above section, can be made up according to the circuit shown in Fig. 2.

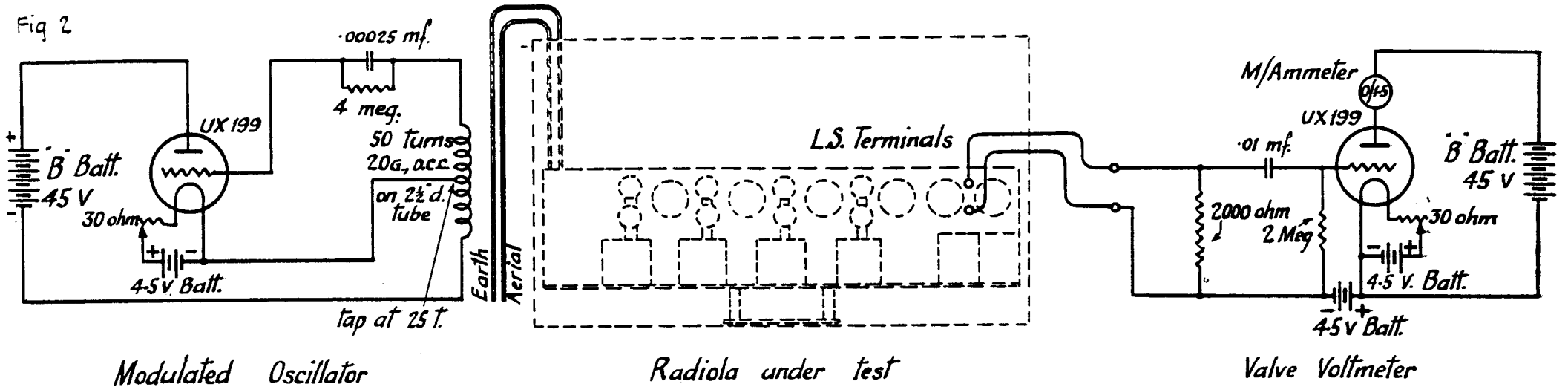


Fig. 2—Modulated Oscillator and Valve Voltmeter.

HUM IN A.C. RADIOLAS.

Very often hum is caused by dirty contact on the valve filament prongs of the detector and audio stages. Working the valve up and down in the socket will generally remove this trouble.

Sometimes hum can be reduced by reversing the plug in the power socket.

Replacing the UY227 detector valve may also eliminate the cause of the hum.

LINE VOLTAGE A.C. RADIOLAS.

The primary of the power transformer of the All Electric Radiolas has three taps to make provision for operating the Radiola on line voltages of 200 volts, 220 volts and 240 volts. If the Radiola is installed on a supply circuit of 240 volts, and it is found that the operation is not satisfactory, an increase of signals will be obtained by moving the selector plug to the 220 volt or 200 volt socket. **However, agents are warned not to do this, for it has the effect of increasing the voltage on the filaments, which will shorten the life of the valves.** Very often the voltage of a supply system is a good deal lower or higher than that which is accepted as its rated voltage. Therefore, it is good practice to test or have tested the voltage at the point where the Radiola is being installed. **Then plug the voltage selector plug into the socket whose marking is the next above the voltmeter reading.**

EARTH CONNECTION.

Permanent earthing conductors should be of stranded copper of cross-section not less than 7/22 covered with 600 megohm grade insulation within 6 ft. of the receiving set. In no case should an A.C. Duoforte or Radiola be installed without a permanent earthing conductor, for when an efficient earth is connected, if the insulation in the Power Unit breaks down to frame, the fuse in the circuit will "blow" and automatically cut off the supply, thereby safeguarding the operator against shock.

REPAIRS TO POWER UNIT.

Replacement of chassis components is a reasonably straightforward job, but in the case of the Power Unit, apart from wiring faults, it is not advisable to endeavour to carry out repairs. If a fault is definitely located in a transformer, choke or condenser unit, the whole Power Unit should be returned to the Company for repairs.

RETURNING CHASSIS AND POWER UNIT.

When returning either chassis or Power Units to the Company, pack in a case with a solid base. Drill four holes corresponding to those in the bottom of the cabinet, and screw the chassis or the Power Unit rigidly to the bottom of the case with the "holding down" screws provided with the set.

RADIOLA INSTRUMENT NUMBER FOR REFERENCE.

When communicating with the Company in connection with Radiolas, make a point of giving the Radiola Instrument Number. This procedure will simplify investigation by the Company's Service Department.

Radiola Electric Three

Model C 53

190-250 volts, 40-60 cycle A.C.

GENERAL DESCRIPTION.

Radiola Electric Three is an electrically operated uni-control receiver comprising a detector and two stages of transformer coupled audio frequency amplification.

The detector is of the orthodox leaky grid type with the grid circuit tuned; the aerial being inductively coupled. Reaction is provided for by a reaction coil wound on the main inductance and controlled by a variable condenser operated through a vernier drive with the knob on the front panel. A Radiotron UY227 is used in this stage; the heater supply for the indirectly heated cathode being obtained from a winding on the power transformer.

A.W.A. "Ideal" transformers are used for the interstage coupling in the audio frequency amplifier which utilises one UX226 and one UX112A Radiotron. The filaments are heated with raw A.C. from additional windings on the power transformer.

The Power Transformer in the Power Unit is rated at approximately 25 watts and carries five separate secondary windings. No. 1 for the heater element of the UY227 detector valve, No. 2 for the filament of the UX226 valve, No. 3 for the UX112A valve and the pilot lamp, No. 4 for the filament of the UX280 rectifier, and No. 5 winding provides the anode supply to the latter valve.

The full smoothed output voltage of the rectifier is applied to the plate of both the audio valves, the plate voltage of the detector being reduced to approximately 50 volts by a resistance (carborundum rod type) in the plate feed lead of that valve. Bias for the audio valves is obtained by a suitable resistance (wire wound) connected between filaments and the negative side of the rectifier, so that the grid becomes negative in potential with respect to the filament.

Fig. 3 shows the schematic Circuit Diagram of the Radiola Electric Three.

FAULT LOCATION.

1. **EQUIPMENT TEST.** Carry out equipment tests on valves. See equipment test in the General Information Section.
2. **PRELIMINARY VOLTAGE TEST.** Before removing the chassis from the cabinet, make the following voltage tests across the valve sockets with all the valves in position and with the loudspeaker connected. No reading points to a fault in the Radiola and the chassis should then be removed for Continuity Tests. Fig. 4 shows the relative positions of the valve contacts, the valves being shown in their correct sequence looking down on the chassis top from the front of the Radiola.

Valve	Measure across	Approximate voltage
No. 1 Detector	F1 & F2	2.2V. A.C.
	P & C	50V. D.C.
No. 2 1st Audio	P & F	165V. D.C.
	G & F	12V. D.C.
	F1 & F2	1.5V. A.C.
No. 3 2nd Audio	P & F	155V. D.C.
	G & F	11V. D.C.
	F1 & F2	4.8V. A.C.
No. 4 Rectifier	F1 & F2	4.8V. A.C.
	P1 & P2	440V. A.C.

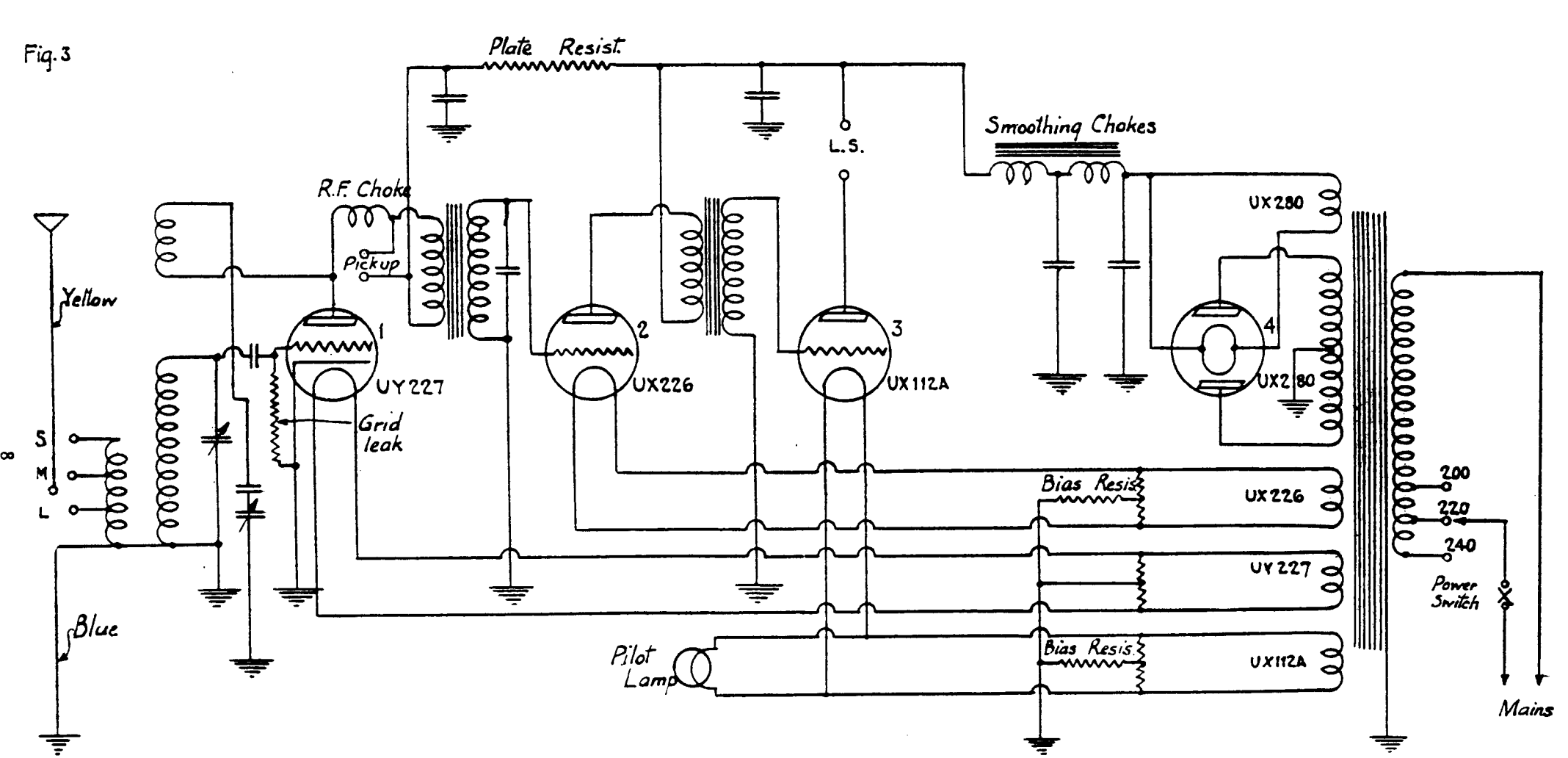


Fig. 3—Schematic Circuit Diagram of Radiola Electric Three.

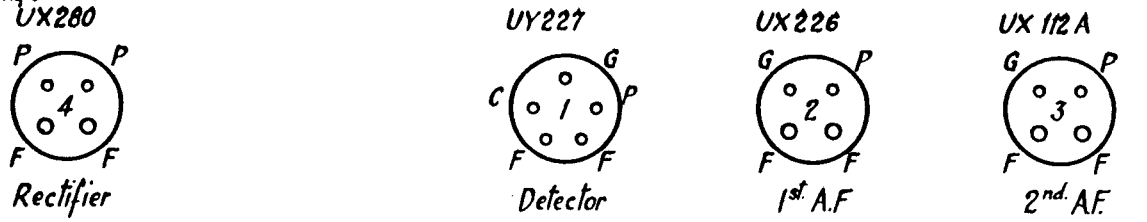


Fig. 4—Valve Sequence and Position of Valve Contacts—Radiola Electric Three.

REMOVING CHASSIS FROM CABINET.

After making the above tests, if it is found necessary to remove the chassis from the cabinet, proceed as follows:—

Remove valves.

Loosen the grub screws in the selector and intensifier control knobs and slip off knobs.

Remove the round knurled nut from the front of the power switch and push switch through the hole.

With the cabinet on its side remove the five "holding down" screws from underneath the bottom of the cabinet.

Remove the chassis from the cabinet by sliding back.

CONTINUITY TESTS.

With the chassis removed, make the following continuity tests with some form of reliable continuity tester. Tests made across the points shown in Column 1 should give the effect shown in Column 2. If this effect is not obtained, Column 3 gives the probable cause of the fault.

Test between	Correct effect	Incorrect effect caused by
Chassis frame and aerial tappings in turn.	Closed circuit.	Broken connection or open circuit in primary of R.F. coil.
Chassis frame and fixed plates of tuning condenser.	Closed circuit.	Broken connection or open circuit in secondary of R.F. coil.
P contact (UY227) and coil side of fixed reaction condenser.	Closed circuit.	Broken connection or open circuit in reaction coil.
Chassis frame and G contact (UX226).	Closed circuit.	Broken connection or open circuit in secondary of 1st audio transformer.
P contact (UX226) and red L.S. pin socket.	Closed circuit.	Broken connection or open circuit in primary of 2nd audio transformer.
Frame and G contact (UX112A).	Closed circuit.	Broken connection or open circuit in secondary of 2nd audio transformer.
P contact and red L.S. pin socket with loudspeaker connected.	Closed circuit.	Broken L.S. cord or open circuit in loudspeaker.
Red L.S. pin socket and F contact (UX280).	Closed circuit.	Broken connection or fault in power unit.
Chassis frame and each filament contact (UX112A).	Closed circuit.	Open circuit bias resistance.
Chassis frame and each filament contact (UX226).	Closed circuit.	Open circuit in bias resistance.
Frame to 200, 220 and 240 volt sockets in turn.	Open circuit.	Power unit fault or power flex bared and touching frame of chassis.

Radiola Battery Six

Model C 54

GENERAL DESCRIPTION.

The A.W.A. Radiola Battery Six is a six valve receiver utilising a three stage radio frequency amplifier, a detector, and a two stage transformer coupled audio frequency amplifier.

The grid circuits of the three R.F. valves and detector are tuned by a four condenser "gang" system, enabling the tuning to be carried out by a single selector control. The plates of the first condenser are specially shaped to compensate for the detuning effect of the aerial on the first tuned circuit. The aerial compensator (a small vernier condenser connected in parallel with the first tuning condenser) takes care of wide variations in aerial capacity and enables the first tuned circuit to be brought into resonance with the other three circuits. The aerial is inductively coupled to the grid circuit of the first valve, two taps being brought out for large and small aerials.

No neutralising condensers are employed. The R.F. transformers have a very restricted field, thus minimising feed back, and the grid resistances in the tuned radio frequency stages effectively prevent any tendency to self-oscillation.

The volume control regulates the input grid voltage to the detector valve by reducing the amplification in the radio frequency stages. As will be seen from the circuit diagram, this control is in the form of a filament resistance in the radio frequency valves.

The detector is of the orthodox leaky grid type with the grid return connected through the grid leak to +A.

The audio frequency interstage coupling utilises A.W.A. Ideal Transformers, having high impedance primaries and a flat overall amplification characteristic. The Marconi DEP410 power valve in the last stage still further improves the quality of reproduction.

The valve sequence shown should be adhered to, especially in the case of the first four valves, for if valves of different type are used in these stages, it is quite probable that the inter-electrode capacities will differ and throw the "gang tuning" out of line. The DEP410 valve in the sixth stage should not be substituted by a general purpose valve of the DEL410 standard, for a marked falling off in quality will be noticeable.

In Fig. 5 is shown the theoretical circuit arrangement of Radiola Battery Six.

FAULT LOCATION.

1. **EQUIPMENT TESTS.** Carry out equipment tests on all valves and batteries. See Equipment Tests in General Information Section. Check very carefully the battery connections.

2. **PRELIMINARY VOLTAGE TEST.** Before removing the chassis from the cabinet make the following voltage tests across the valve sockets with all the valves in position and with the loudspeaker connected. No reading points to a fault in the Radiola. Fig. 6 shows the relative positions of the valve contacts, the valves being shown in their correct sequence looking down on the chassis top from the front of the Radiola.

Valve	Measure across	Approximate Voltage
1, 2 and 3 R.F. Amplifiers	+F & —F each valve	4 volts with volume control in maximum position.
	P & —A	90V.
	*G & —A	1.5V.
No. 4 Detector	+F & —F	4V.
	P & —A	45V.
No. 5 1st Audio	+F & —F	4V.
	P & —A	88V.
	*G & —A	1.5V.
No. 7 2nd Audio	+F & —F	4V.
	P & —A	85V.
	*G & —A	6V.

*Meter should deflect in normal direction when the + lead of the meter is connected to the —A contact.

Fig. 5

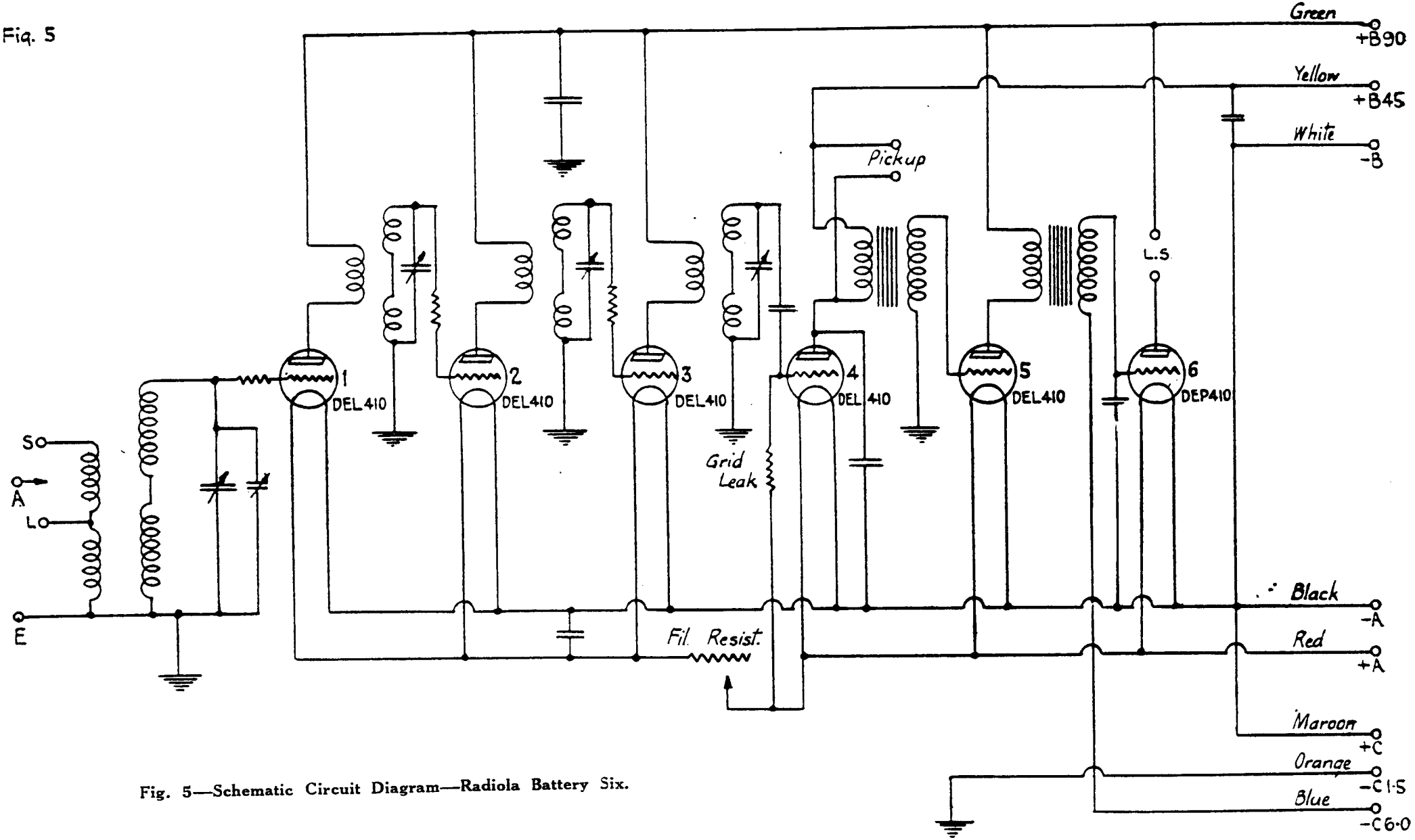


Fig. 5—Schematic Circuit Diagram—Radiola Battery Six.

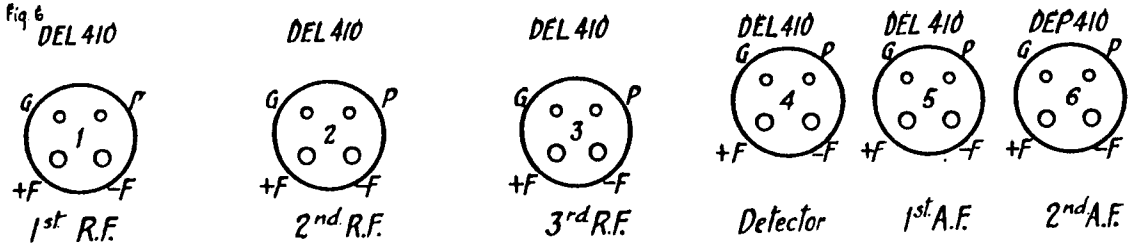


Fig. 6—Valve Sequence and Position of Valve Contacts—Radiola Battery Six.

REMOVING CHASSIS FROM CABINET.

After making the above tests, if it is found necessary to remove the chassis from the cabinet, proceed as follows:—

Remove batteries and valves.

Loosen the grub screws in the knobs and slip off knobs.

Remove the round knurled nut from the front of the battery switch and push battery switch through the hole in switch escutcheon plate.

With the cabinet on its side remove the five holding down screws from underneath the bottom of the cabinet.

Remove the chassis from the cabinet by sliding back and lifting out.

CONTINUITY TESTS.

With the chassis removed, make the following continuity tests with some form of reliable continuity tester. Tests made across the points shown in Column 1 should give the effect shown in Column 2. If this effect is not obtained, Column 3 gives the probable cause of the fault.

Test between	Correct effect.	Incorrect effect caused by
+B90 (green) battery lead and P contacts of valves 1, 2 & 3 in turn.	Closed circuit.	Broken lead or open circuit in primary of R.F. transformer.
+B90 battery lead and chassis frame.	Open circuit.	Short to frame in wiring or short to case in primary of 2nd audio transformer.
+B90 battery lead and P contact, No. 5 valve.	Closed circuit.	Broken lead or open circuit in primary of 2nd audio.
+B90 battery lead and P contact, No. 6 valve.	Closed circuit.	Broken connection or open circuit in loudspeaker or its connections.
+B45 (yellow) battery lead and P contact, No. 4 valve.	Closed circuit.	Broken connection or open circuit, primary 1st audio transformer.
+B45 battery lead and frame of chassis.	Open circuit.	Short to frame in wiring or short to case in primary of 1st audio.
—A (black) battery lead and —F contact, each valve in turn.	Closed circuit.	Broken connection.
+A (red) battery lead and +F contacts in each valve in turn (battery switch closed).	Closed circuit.	Broken connection.
—C1.5 (orange) battery lead and G contacts in valves 1, 2 and 3.	Closed circuit.	Broken connection or open circuit in secondary of R.F. transformer or in grid resistor.
—C1.5 battery lead and G contact, valve 5.	Closed circuit.	Broken connection or open circuit in secondary of 1st audio transformer.
—C6 (blue) battery lead and G contact, valve 6.	Closed circuit.	Broken connection or open circuit in secondary of 2nd audio transformer.
S & L aerial taps to frame.	Closed circuit.	Open circuit in primary of first R.F. coil.

Radiola Battery Seven

Model C 57

GENERAL DESCRIPTION.

The A.W.A. Radiola Battery Seven is a seven valve receiver utilising a four stage R.F. amplifier, a detector and a two stage transformer coupled audio frequency amplifier.

The grid circuits of the second, third and fourth and detector stages are tuned by a four condenser gang control, the first R.F. or aerial circuit being of the aperiodic type.

The R.F. transformers have a very restricted field, therefore no neutralising condensers are necessary and the grid resistances in the R.F. stages effectively prevent any tendency to self-oscillation.

The volume control regulates the input grid voltage to the detector valve by reducing the amplification in the radio frequency stages. As will be seen from the circuit, this control is in the form of a filament resistance in the radio frequency valves.

The detector is of the leaky grid type with the grid return connected through the grid leak to +A.

A.W.A. Ideal Transformers are used in the audio frequency amplifier, which, together with the Marconi DEP410 power valve in the last stage, ensures fidelity of reproduction at ample volume.

In the Battery Seven a plate voltage for the DEP valve of 135 volts at the correct bias, is provided for as standard equipment. The Radiola will operate satisfactorily at 90 volts, but the maximum undistorted output is slightly lowered.

The outstanding features of the Radiola Battery Seven are simplicity of operation, super sensitivity and high undistorted output.

Fig. 7 shows the schematic circuit diagram of the Radiola Battery Seven.

FAULT LOCATION.

1. **EQUIPMENT TESTS.** Carry out equipment tests on all valves and batteries. See Equipment Tests in General Information Section. Check very carefully the battery connections.
2. **PRELIMINARY VOLTAGE TEST.** Before removing the chassis from the cabinet make the following voltage tests across the valve sockets with all the valves in position and with the loudspeaker connected. No reading points to a fault in the Radiola. Fig. 6 shows the relative positions of the valve contacts, the valves being shown in their correct sequence looking down on the chassis top from the front of the Radiola.

Valve	Measure across	Approximate voltage
1, 2, 3 & 4 R.F. Amplifiers	+F & —F	4 volts with volume control in maximum position
	P & —A	90 volts
	*G & —A	1.5 volts
No. 5 Detector	+F & —F	4 volts
	P & —A	45 volts
No. 6 1st Audio	+F & —F	4 volts
	P & —A	88 volts
	*G & —A	1.5 volts
No. 7 2nd Audio	+F & —F	4 volts
	P & —A	125 volts
	*G & —A	10.5 volts

*Meter should deflect in normal direction when the + lead of the meter is connected to the —A contact.

Fig. 7

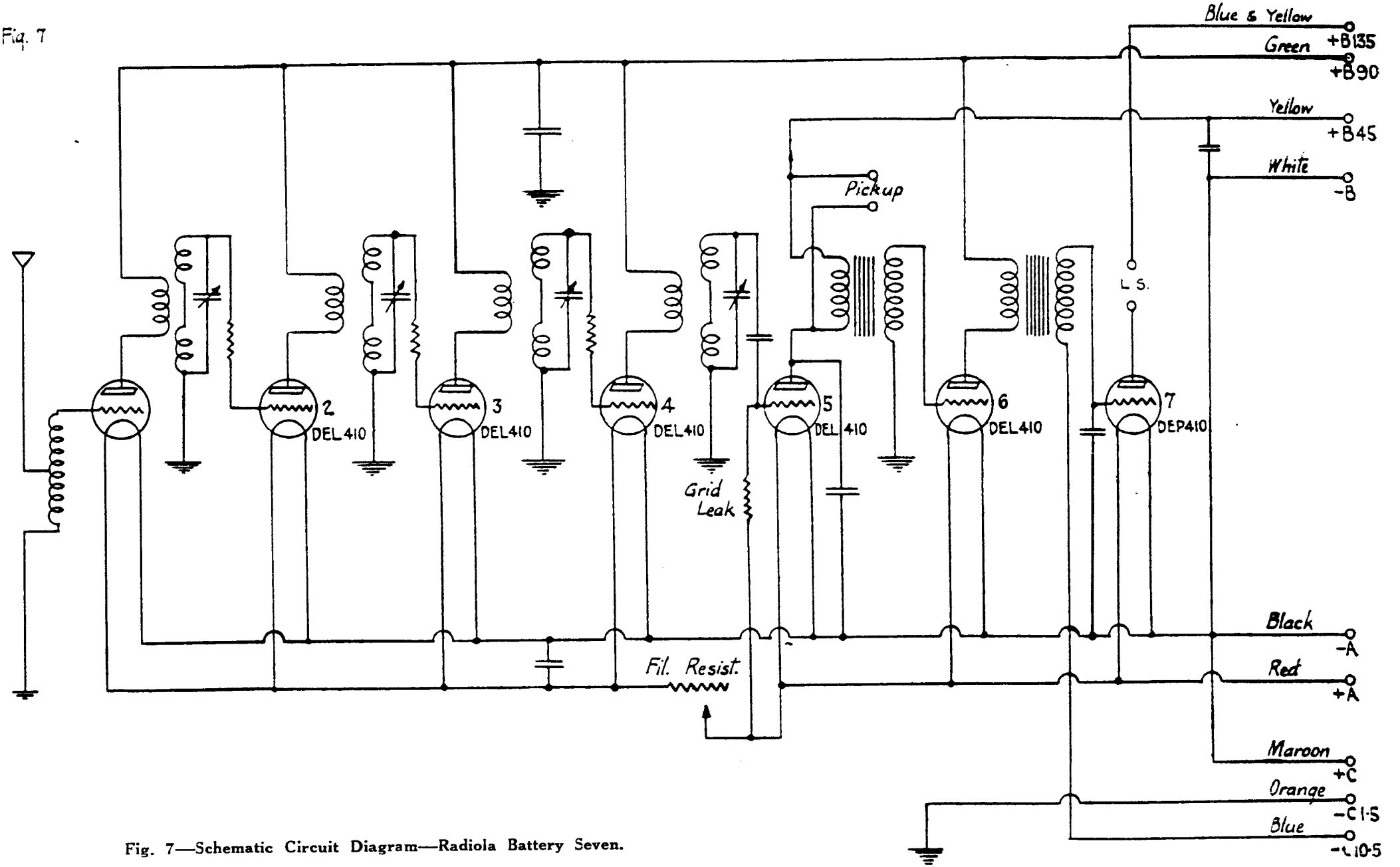


Fig. 7—Schematic Circuit Diagram—Radiola Battery Seven.

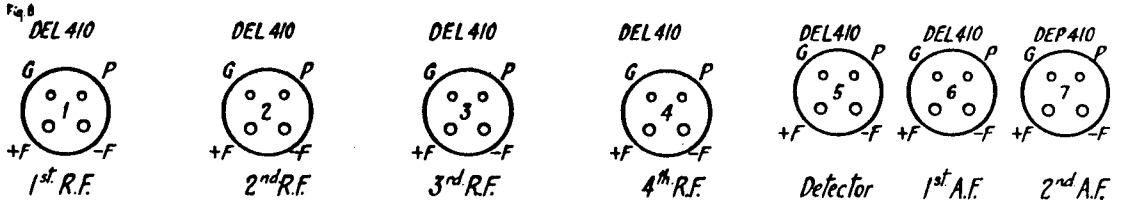


Fig. 8—Valve Sequence and Position of Valve Contacts—Radiola Battery Seven.

REMOVING CHASSIS FROM CABINET.

After making the above tests, if it is found necessary to remove the chassis from the cabinet, proceed as follows:—

Remove batteries and valves.

Loosen the grub screw in the knob and slip off knob.

Remove the round knurled nuts from the battery switch and push the switch through the hole in the escutcheon plate.

With the cabinet on its side remove the five holding down screws from underneath the bottom of the cabinet.

Remove the chassis from the cabinet by sliding back and lifting out.

CONTINUITY TESTS.

With the chassis removed make the following continuity tests with some form of reliable continuity tester. Tests made across the points shown in Column 1 should give the effect shown in Column 2. If this effect is not obtained, Column 3 gives the probable cause of the fault.

Test between	Correct effect.	Incorrect effect caused by
+B135 (blue yellow) battery lead and P contact, valve 7.	Closed circuit.	Broken connection or open circuit in loudspeaker or its connections.
+B90 (green) battery lead and P contacts, valves 1, 2, 3 and 4 in turn.	Closed circuit.	Broken lead or open circuit in primary of R.F. transformer.
+B90 battery lead and P contact, No. 6 valve.	Closed circuit.	Broken lead or open circuit in primary of 1st audio transformer.
+B90 battery lead and frame.	Open circuit.	Short to frame in wiring or short to case in primary of 2nd audio transformer.
+B45 (yellow) battery lead and P contact, valve 5.	Closed circuit.	Broken connection or open circuit in primary of 1st audio transformer.
+B45 battery lead and chassis frame.	Open circuit.	Short to frame in wiring or short to case in primary of 1st audio transformer.
+A (black) battery lead and +F contact, each valve in turn (switch closed).	Closed circuit.	Broken connection.
—A (red) battery lead and —F contact, each valve in turn.	Closed circuit.	Broken connection.
—C1.5 (orange) battery lead and G contacts in valves 1, 2, 3 and 4 in turn.	Closed circuit.	Broken connection or open circuit in secondary of R.F. transformer or in grid resistor.
—C1.5 battery lead and G contact, valve 6.	Closed circuit.	Broken connection or open circuit in secondary of 1st audio transformer.
—C10.5 battery lead and G contact, valve 7.	Closed circuit.	Broken connection or open circuit in secondary of 2nd audio transformer.

Radiola Electric Seven

Model C 55

190-250 volts, 40-60 cycle A.C.

GENERAL DESCRIPTION.

Radiola Electric Seven is an electrically operated single control receiver comprising four stages of radio frequency amplification, a detector and two transformer coupled stages of audio frequency amplification.

The general principles of the Radiola Electric Seven are very similar to those of the Battery Seven, with the exception of the modification necessary to operate the Radiola from the power mains.

The grid circuits of second, third, fourth and detector stages are tuned by a four condenser gang control, the first radio frequency or aerial circuit being of the aperiodic type.

No neutralising condensers are employed. The restricted field of the radio frequency transformers minimises feed back, and the grid resistors on the tuned radio frequency stages effectively prevent any tendency to self-oscillation.

The volume control is in the form of a potentiometer connected across a section of the aperiodic aerial coil and its function is to regulate the input grid voltage to the first radio frequency valve. A finer adjustment of volume is provided for on strong local stations by the "Local-Distant" switch, which on the local side reduces the energy transfer in the second R.F. transformer.

A.C. valves of the UX226 Radiotron type are used in the radio frequency amplifier, the filaments being heated by raw A.C. at 1.5 volts; each valve taking approximately 1 amp. The filament supply for the valves, as well as that for the sixth stage, is obtained from a separate winding on the power transformer in the power unit.

The detector is of the orthodox leaky grid type, utilising a suitable grid condenser and grid leak. A Radiotron UY227 (5 prong) is used in this stage. This is an indirectly heated cathode valve having a separate heater element which heats the tubular cathode. The heater supply is obtained from another separate winding on the power transformer, the current consumption being approximately 1.75 amperes at 2.25 volts.

A.W.A. "Ideal" distortionless transformers are used for the interstage coupling in the audio frequency amplifier. A Radiotron UX226 is used in the first audio stage and a power Radiotron UX171A in the last stage supplies the output through an "Ideal" output choke to the loudspeaker. A third filament winding on the power transformer in the power unit supplies raw A.C. at 4.8 volts to the UX171A valve. This winding also supplies current to the dial illuminating lamp. Besides supplying raw A.C. for the filament supply of the receiver, the power unit provides the plate voltages and grid biasing voltages for the receiver. A plate voltage of 170 volts in conjunction with a negative grid bias of 13 volts is supplied to the four radio frequency valves and 150 volts plate at approximately —13 grid to the first audio valve. The detector receives 50 volts plate supply without grid bias. The last audio stage receives the maximum output voltage of the power unit with the correct grid bias to provide ample loudspeaker output.

The power transformer in the power unit is rated at approximately 50 watts, and carries five separate secondary windings. No. 1 winding supplies the filament current to the five UX226 valves, No. 2 winding the filament current to the UY227 detector valve, No. 3 winding the filament current for the UX171A power valve, No. 5 winding the filament current to the UX280 rectifying valve, and No. 4 winding provides the plate supply to the latter valve.

The output of the rectifier is in the form of a series of positive loops, which are "smoothed out" by a filter system of chokes and condensers to a practically constant D.C. supply. The full voltage of the smoothed output is applied to the plate of the 171A valve and the voltage for the first audio detector and radio frequency stages is reduced by connecting in the plate feed leads resistances which give the desired voltage drop. The anode resistances (carborundum rod resistances) for the first audio and detector are located in the power unit, and the anode resistance (wire wound) for the radio frequency valves, on the right front of the receiver chassis.

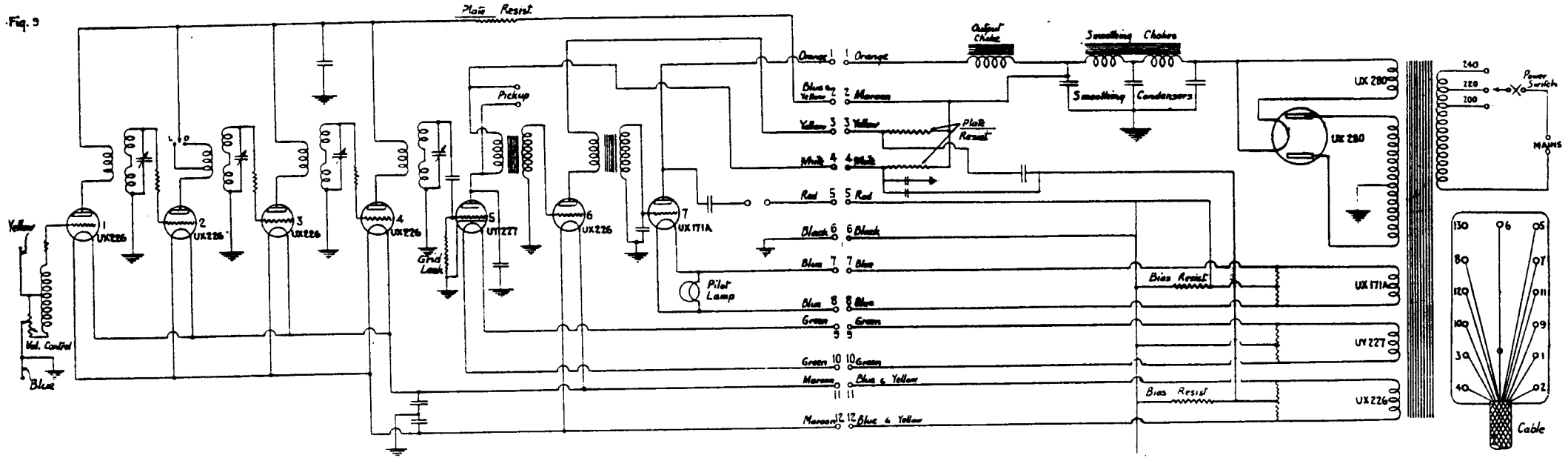


Fig. 9—Schematic Circuit Diagram—Radiola Electric Seven.

The grid bias for radio frequency and audio frequency valves is obtained by connecting suitable resistances between the negative lead of the rectifier and the centre point of the resistor across the filament supply of the valves to be biased. This resistance carries the plate to filament current, and since the grid of each valve is connected to frame the plate to filament current flowing through the resistance produces a voltage drop, making the grid of the valve negative in potential relative to the potential of the filament. These resistances (wire wound) are located under the power unit terminal assembly.

Inset at the lower right hand corner of the power unit circuit diagram is shown the power unit terminal assembly with the terminals numbered to correspond with the circuit diagram numbers. The terminals are in their correct relative position looking down into the power unit from the front of the Radiola.

FAULT LOCATION.

1. **EQUIPMENT TESTS.** Carry out equipment tests on valves. See equipment test in the General Information section.

2. **PRELIMINARY VOLTAGE TEST.** Before removing the chassis from the cabinet make the following voltage tests across the valve sockets with all the valves in position and with the loudspeaker connected. No reading points to a fault in the Radiola and the chassis should then be removed for Continuity Tests. Fig. 10 shows the relative positions of the valve contacts, the valves being shown in their correct sequence looking down on the chassis top from the top of the Radiola.

Valve.	Measure across.	Approximate voltage.
1, 2, 3 & 4 R.F. Amplifiers ..	F1 & F2	1.5V. A.C.
	P & F	165V. D.C.
	G & F	13V. D.C.
No. 5 Detector	F1 & F2	2.2V. A.C.
	P & C	50V. D.C.
No. 6 1st Audio	F1 & F2	1.55V. A.C.
	P & F	150V. D.C.
	G & F	13V. D.C.
No. 7 2nd Audio	F1 & F2	4.8V. A.C.
	P & F	175V. D.C.
	G & F	45V. D.C.

A further check can be made on the power unit terminal board. The readings at normal line voltage with all the valves in position should be approximately as follows:—

Measure across terminals.	Approximate voltage.
9—10	2.25V. A.C.
11—12	1.65V. A.C.
7—8	4.8V. A.C.
5—1	175V. D.C.
6—5	45V. D.C.
6—4	50V. D.C.
13—3	150V. D.C.
13—6	13V. D.C.

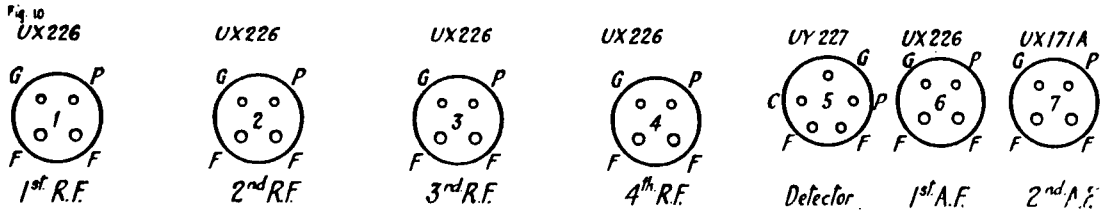


Fig. 10—Valve Sequence and Position of Valve Contacts—Radiola Electric Seven.

REMOVING POWER UNIT FROM CABINET.

Remove lid.

Unscrew nuts from terminals 1 to 13 on power unit terminal assembly.

Lift the bakelite plate attached to the cable from off the top of the terminal plate.

Remove the four screws under the bottom of the cabinet holding the power unit down, and the two holding screws passing through the back of the cabinet.

Unscrew the knurled nut from off the power switch and push the switch through the hole and pull it through the bottom of the cabinet.

Lift the power unit out, pulling the switch and adaptor through the holes provided.

REMOVING CHASSIS FROM CABINET.

Remove valves.

Loosen the grub screw in the knob and slip off knob.

Remove the round knurled nut from the front of the "Local-Distant" switch and push switch through the hole in the escutcheon plate.

With the cabinet on its side remove the five holding down screws from underneath the bottom of the cabinet.

Remove the chassis from the cabinet by sliding back and lifting out.

CONTINUITY TESTS.

With the chassis removed make the following continuity tests with some form of reliable continuity tester. Tests made across the points shown in Column 1 should give the effect shown in Column 2. If this effect is not obtained Column 3 gives the probable cause of the fault.

Test between.	Correct effect.	Incorrect effect caused by
CHASSIS.		
No. 6 terminal & chassis frame.	Closed circuit.	Broken connection.
No. 6 terminal & G contact valve 1.	Closed circuit.	Open circuit in volume control, aperiodic coil or grid resistor.
No. 6 terminal & G contact valves 2, 3 & 4.	Closed circuit.	Open circuit in secondary R.F. coil or grid resistor.
No. 6 terminal and the fixed plates of the 4th gang condenser.	Closed circuit.	Open circuit in the secondary of the 4th R.F. transformer.
No. 6 terminal and G contact valve 6.	Closed circuit.	Open circuit in the secondary of the first audio transformer.
No 6 terminal and the G contact valve 7.	Closed circuit.	Open circuit secondary second audio transformer.
No 2 terminal and chassis frame.	Open circuit.	Short circuit to frame in wiring or short circuit to frame in anode resistance or bypass condenser.
No. 2 terminal and P contacts of valves 1, 2, 3 & 4.	Closed circuit.	Open circuit anode resistance on chassis front or primary R.F. transformer.
Terminal 1 and P contacts valve 7.	Closed circuit.	Broken connection.
Terminal 1 and frame.	Open circuit.	Short circuit in wiring to frame or broken down output condenser.
Terminal 4 and P contact valve 5.	Closed circuit.	Broken lead or open circuit in primary of 1st audio transformer.
Terminal 4 and chassis frame.	Open circuit.	Short circuit in wiring to frame or broken down bypass condenser or short to case in primary of first audio transformer.
Terminal 3 and P contact valve 6.	Closed circuit.	Broken lead or open circuit in primary of 2nd audio transformer.
Terminal 3 and frame of chassis.	Open circuit.	Short circuit in wiring to frame or short to case in the primary of second audio transformer.
POWER UNIT.		
No. 6 terminal and frame of power unit.	Closed circuit.	Broken connection.
No. 1 terminal and filament contact UX280 rectifier.	Closed circuit.	Open circuit output choke or smoothing choke.
Terminal 5 and terminal 6.	Closed circuit.	Broken connection or faulty bias resistor.
Terminal 6 and terminal 11.	Closed circuit.	Broken connection or faulty bias resistance.
P1 and P2 UX280 rectifier.	Closed circuit.	Broken connection or open circuit in secondary of power transformer.
Power leads with adaptor disconnected from supply and power switch closed.	Closed circuit.	Broken connection or faulty power switch or open circuit primary of power transformer.

MISCELLANEOUS FAULTS, ELECTRIC SEVEN.

UNCONTROLLABLE OSCILLATION.

The sensitivity of the Radiola Electric Seven is dependent to a great extent on the "feed back" in the R.F. amplifier. In early production the factor of safety allowed was not sufficiently great to compensate for the high line voltage in some districts, and Radiolas oscillated when installed. This uncontrollable oscillation can be eliminated by the following alterations:—

1. Oscillation occurring on the upper end of the selector scale: Replace the third (from the R.F. end) ½ mf. condenser by a 1 mf. condenser.
2. Oscillation occurring on the lower end of the selector scale: Replace the second and third grid damping resistances by 800 ohm. resistors.

Duoforte

GENERAL DESCRIPTION.

The A.W.A. Duoforte is an electrically operated combined Radiola and Phonograph designed to operate on any alternating current circuit within the limits of 40 to 60 cycles and 190 to 250 volts.

The Electric Phonograph consists of a record turntable driven by a noiseless disc type induction motor, and a high grade electric pickup, together with volume and speed controls.

The Radiola consists of a four stage radio frequency amplifier and detector equal in all respects to the first five valves of the A.W.A. Radiola Electric Seven.

The change-over from Phonograph to Radiola is carried out quickly by the change-over switch located in the Phonograph compartment. The Radiola and Phonograph each delivers energy to a common power amplifier unit housed in the loudspeaker compartment, the output of which is fed to the dynamic loudspeaker.

The power amplifier unit consists essentially of a double wave rectifier utilizing a UX280 valve with its accompanying power transformer, and a two stage audio amplifier, the first stage utilizing a UX226 valve and the last stage two UX171A valves arranged in "Push Pull."

The outstanding feature of the amplifier is the fidelity of reproduction which has been made possible by the use of the very highest grade of components. The interstage coupling utilizes special "Ideal" transformers in which has been used a new magnetic material having a very high permeability, thus ensuring a very high primary impedance.

The power transformer in the power amplifier unit is rated at approximately 70 watts and carries six separate secondary windings. No. 1 winding supplies the filament current to the four UX226 valves in the Radiola, No. 2 winding the filament current to the UY227 valve in the Radiola, No. 3 winding the filament current to the UX226 valve in the power amplifier unit, No. 4 winding the filament current to the two UX171A valves in the power amplifier unit, No. 5 winding the filament current to the rectifying valve, and No. 6 winding provides the plate supply to the latter valve.

The rectifier, as will be seen from the diagram, consists of a UX280 rectifier deriving power from the main power transformer. Current is taken at the full smoothed rectifier voltage for the plate supply of the two UX171A valves. The plate supply for the UX226 in the Radiola and audio amplifier is reduced to the desired value by the drop in the smoothing choke and resistor (A to B). The voltage for the detector plate is further reduced by the resistance connected to point "C" in the plate feed lead. Between points A and E is connected a loading resistance, the current through which, together with the total valve plate load, supplies the magnetizing current for the loudspeaker winding.

The filaments of the 4 UX226 valves in the Radiola and the UX226 valve in the power amplifier connect (through their mid point resistors) to point D. The grids of these valves connect to point E and the drop in voltage across the resistor section D-E provides the negative potential for the grid bias (approximately 12 volts). In the case of the 171A valve the plate to filament current returns to the negative side of the rectifier through the 171A bias resistance to point E. Since the grids of the 171A valves are connected to point E (through the frame) the drop in voltage produced by the plate to filament current flowing through the bias resistance supplies the necessary negative potential for biasing those valves.

When being used as an electric phonograph, the pickup supplies energy to the primary of the first interstage transformer in the power amplifier unit, the output of which is amplified in the two stage amplifier, and finally the magnified power operates the dynamic loudspeaker.

The first group of Duofortes manufactured were fitted up for the anode bend type of detector. Duofortes from later production were modified in the detector circuit, the leaky grid type of detector being used. Instruments which have padded loudspeaker compartments are fitted up for Anode Bend Detection, and those without the padding are arranged for Leaky Grid Detection.

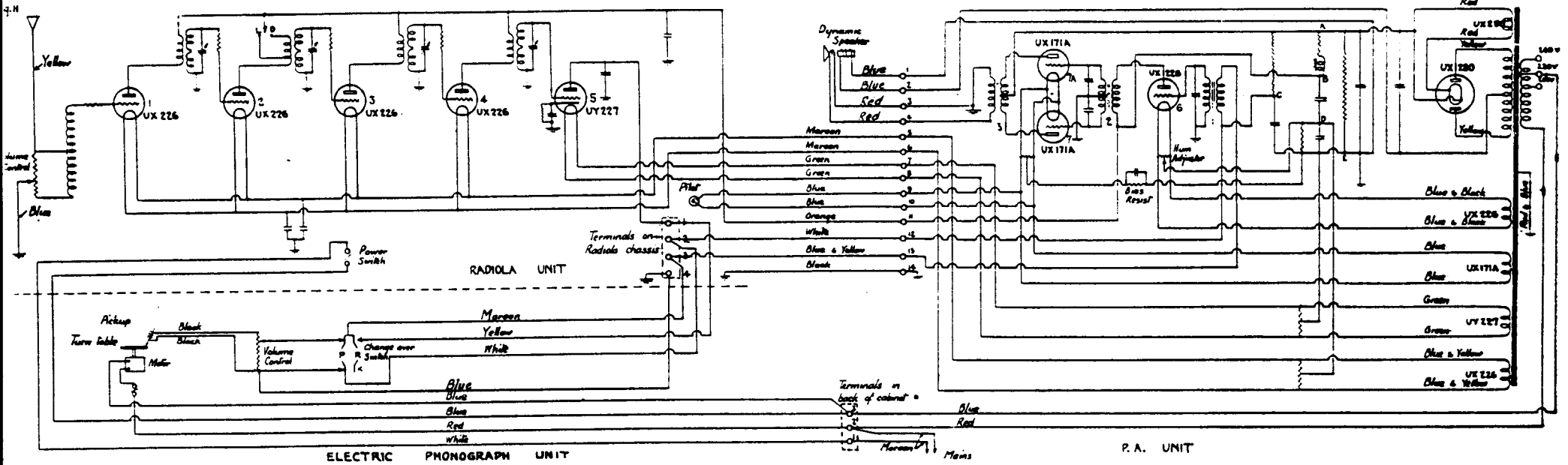


Fig. 11—Schematic Circuit Diagram A.W.A. Duoforte (Anode Bend).

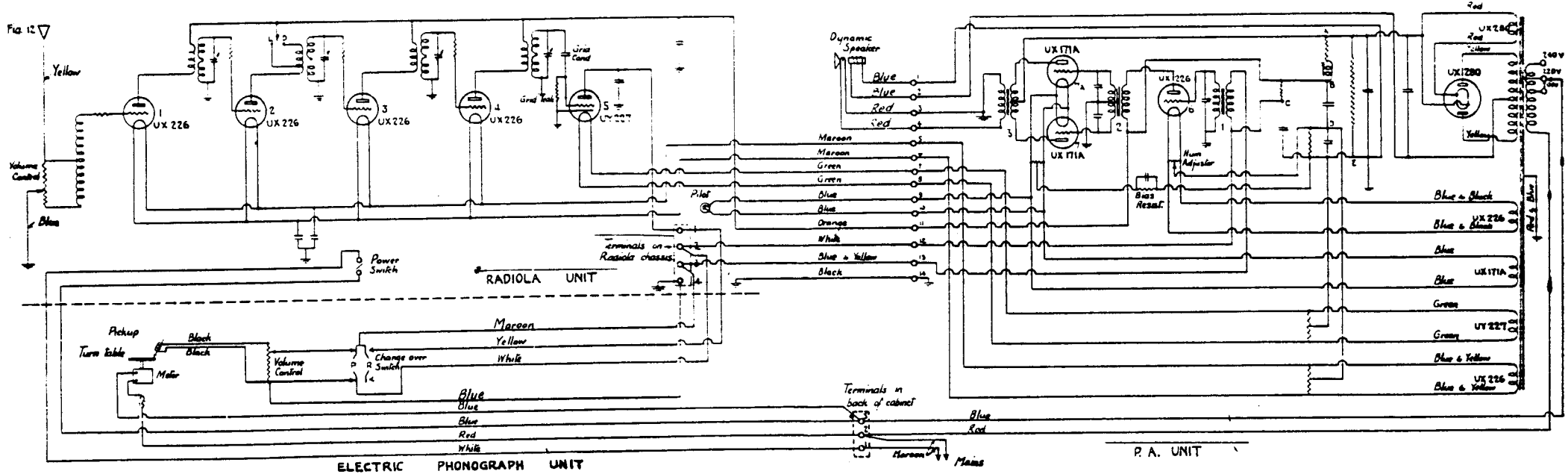


Fig. 12—Schematic Circuit Diagram A.W.A. Duoforte (Leaky Grid).

FAULT LOCATION.

1. **EQUIPMENT TEST.** Carry out equipment tests on valves. See equipment test in the General Information Section.

2. **PRELIMINARY VOLTAGE TEST.** Before removing the chassis from the cabinet make the following voltage tests across the valve sockets with all the valves in position and with the loudspeaker connected. No reading points to a fault in the Radiola and the chassis should then be removed for Continuity Tests. Fig. 13 shows the relative positions of the valve contacts in the Duoforte. The valves in the Radiola chassis are shown in their correct sequence looking down on to the chassis from the front of the Duoforte, and the valves in the power amplifier unit are shown in their correct sequence looking down on to the unit from the back of the Duoforte.

Valve.	Measure across.	Approximate voltage.
RADIOLA.		
1, 2, 3 & 4 R.F. Amplifiers ..	F1 & F2	1.45V. A.C.
	P & F	160V. D.C.
	G & F	12V. D.C.
5 Detector (anode bend type)	F1 & F2	2.2V. A.C.
	P & C	90V. D.C.
	G & C	10V. D.C.
5 Detector (leaky grid type) ..	P & C	45V. D.C.
	F1 & F2	2.2V. A.C.
POWER AMPLIFIER.		
6 1st Audio	P & F	160V. D.C.
	F1 & F2	1.5V. A.C.
	G & F	12V. D.C.
7 and 7A 2nd stage Audios ..	F1 & F2	4.8V. A.C.
	P & F	180V. D.C.
	G & F	40V. D.C.

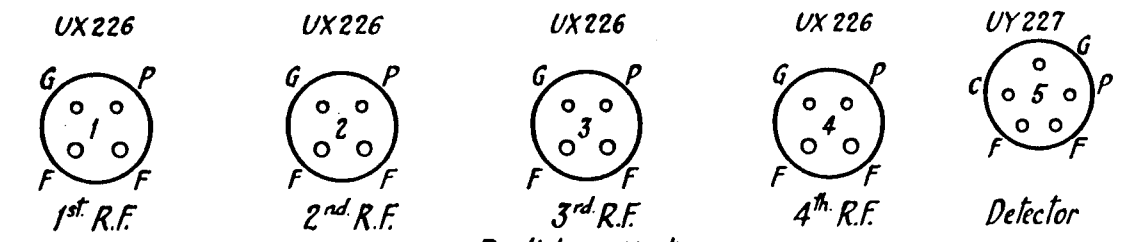


Fig. 13

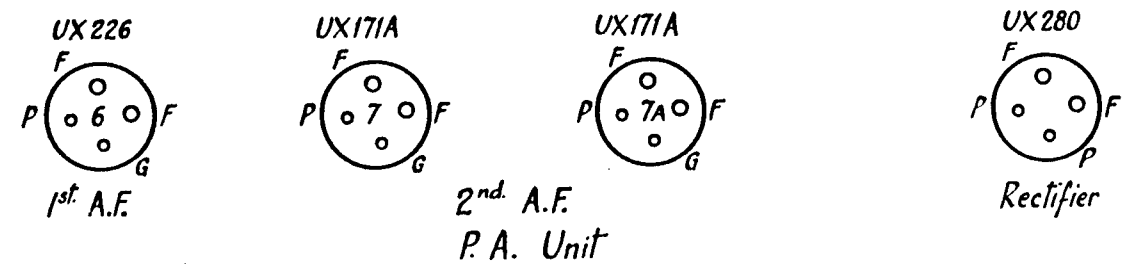


Fig. 13—Valve Sequence and Position of Valve Contacts in A.W.A. Duoforte.

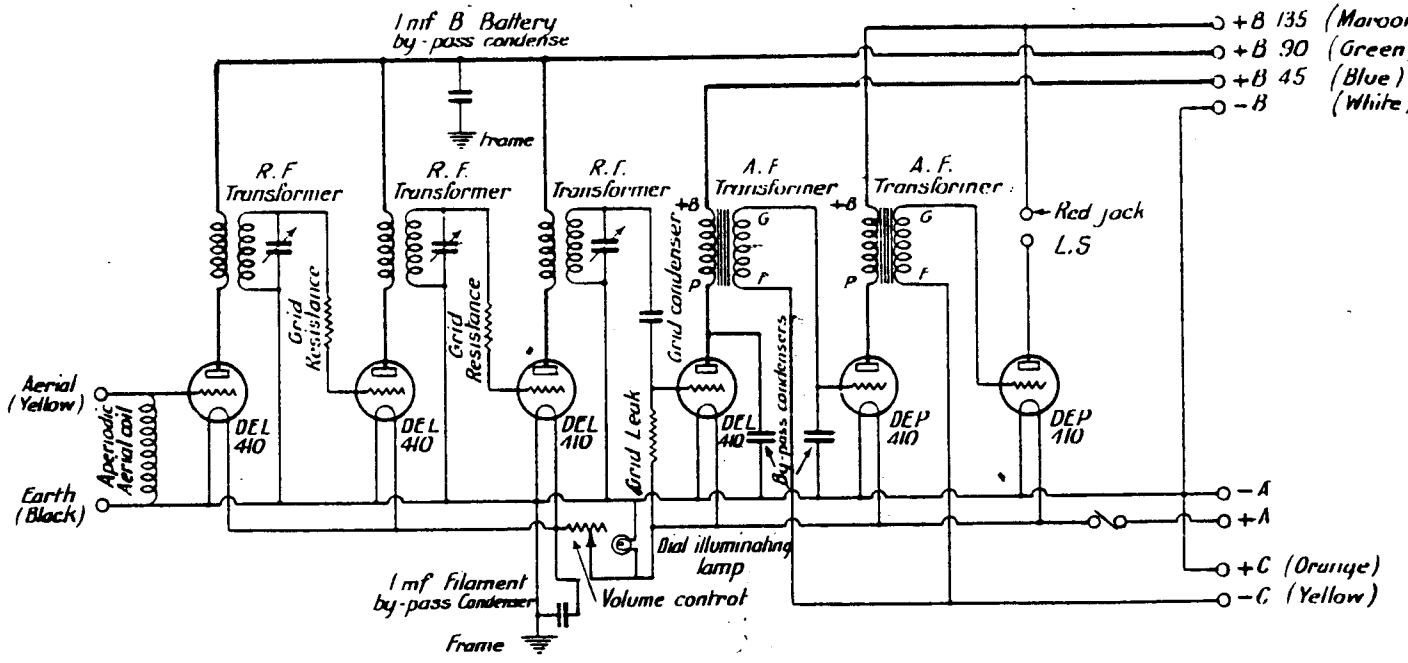
A further check can be made on the power unit terminal strip. The readings at normal line voltage with all the valves in position should be approximately as follows:—

Measure across terminals.	Approximate voltage.
1—2	60V. D.C.
5—6	1.55V. A.C.
7—8	2-2.25V. A.C.
9—10	4-8V. A.C.
5—11	160V. D.C.
14—5	12V. D.C.
Leaky grid type. 14—12	45V. D.C.
Anode bend type. 14—12	100V. D.C.

CONTINUITY TESTS.

With the chassis removed make the following continuity tests with some form of reliable continuity tester. Tests made across the points shown in Column 1 should give the effect shown in Column 2. If this effect is not obtained Column 3 gives the probable cause of the fault.

Test between	Correct effect.	Incorrect effect caused by
RADIOLA CHASSIS.		
No. 14 terminal and chassis frame.	Closed circuit.	Broken connection.
Chassis frame and G contact Valve 1.	Closed circuit.	Open circuit in volume control or aperiodic coil or grid resistor.
Chassis frame and G contacts valves 2, 3, & 4.	Closed circuit.	Open circuit in secondary of R.F. coil or grid resistor.
Chassis frame and fixed plates of 4th gang condenser.	Closed circuit.	Open circuit in secondary of 4th R.F. transformer.
No. 11 terminal and chassis frame.	Open circuit.	Short circuit in wiring to frame or short circuit in bypass condenser.
No. 11 terminal to P contacts valves 1, 2, 3 & 4.	Closed circuit.	Broken connection or open circuit primary R.F. condenser.
No. 13 terminal and P contact valve 5 with "P-R" switch on "R" position.	Closed circuit.	Broken connection or faulty contact "P-R" switch.
No. 13 terminal and chassis frame.	Open circuit.	Short circuit in wiring to frame or broken down bypass condenser.
POWER AMPLIFIER UNIT.		
No. 14 terminal and frame of power amplifier unit.	Closed circuit.	Broken connection.
No. 13 terminal and No. 12 terminal.	Closed circuit.	Broken connection or open circuit in the primary of the first audio transformer.
No. 11 terminal and P contact valve 6.	Closed circuit.	Broken connection or open circuit in primary second audio transformer.
Filament contact rectifier valve and plate contact valves 7 and 7A.	Closed circuit.	Broken connection or open circuit in section of primary output transformer.
Power amplifier unit frame and G contact valve 6.	Correct circuit.	Broken connection or open circuit secondary 1st audio transformer.
Power amplifier unit frame and G contacts valves 7 and 7A.	Closed circuit.	Broken connection or open circuit in section of secondary 2nd audio transformer.
Power amplifier unit frame and No. 4 terminal. (Disconnect moving coil leads of loudspeaker.)	Closed circuit.	Broken connection or open circuit in secondary of output transformer.
Terminal 1 and terminal 2.	Closed circuit.	Broken connection or open circuit in field coil loudspeaker.
Terminal 2 and power amplifier unit frame (loudspeaker field disconnected)	Open circuit.	Short circuit in wiring to frame or short circuit to frame in secondary of power transformer.
240V. socket and power amplifier unit frame.	Open circuit.	Short circuit in wiring or primary of power transformer to frame.
ELECTRIC PHONOGRAPH.		
No. 12 terminal to No. 13 terminal. ("P-R" switch on "P" side.)	Closed circuit.	Broken connection or open circuit in volume control and pickup coil or faulty contact in "P-R" switch.
Terminal 1 and terminal 2 on mains terminal board. (Close Radiola power switch and turntable cut-out.)	Closed circuit.	Broken connection or open circuit in motor windings or faulty contact in switches.


1 mf B Battery
by-pass condense
+B 135 (Maroon)
+B 90 (Green)
+B 45 (Blue)
-B (White)
frame
R.F. Transformer
R.F. Transformer
R.F. Transformer
A.F. Transformer
A.F. Transformer
Red jack
L.S
Grid Resistance
Grid Resistance
Grid condenser
Grid Leak
By-pass condensers
Aerial (Yellow)
Aperiodic Aerial coil
Earth (Black)
DEL 410
DEL 410
DEL 410
DEL 410
DEP 410
DEP 410
-A
+A
+C (Orange)
-C (Yellow)
Dial illuminating lamp
Volume control
1 mf Filament by-pass Condenser
Frame

INSTRUCTIONS FOR ALTERING STRAIGHT SIX B RECEIVER TO SUPPLY EXTRA BIAS.

To alter B.O. Straight Six Receivers to modified type using extra bias proceed as follows:-

(1) Remove chassis from cabinet and turn it upside-down with back of instrument towards you. The battery cable strip will then be on the right hand side.

(2) Remove the Round Headed 5BA Screw (nearest back of instrument) that holds strip to Frame and clean the Duco from where screw head rests. Replace screw and before putting back the 5BA nut put on a tag, to which several leads will later be soldered.

(3) Remove "Orange" and "Earth" leads from tag to which they are at present soldered and connect them to the new one.

(4) Remove the common lead joining terminals marked "F" on audio transformers and solder the "Yellow" one to "F" terminal of audio farthest from you. The "F" terminal of remaining audio to be connected to tag holding "Orange" and "Earth" leads.

5) One side of each of the large by-pass condensers and of one of small fixed condensers (directly below "Green" wire that controls oscillations) are connected together and then another lead taken to Filament of valve socket; remove this last mentioned short lead altogether.

(6) Unsolder the wire that runs from x B terminal of audio furthest away from you where it joins the "Red" Loud Speaker contact and solder it to tag on terminal strip at present holding the "Green" lead from Battery Cable, leaving the "Maroon" one only connected to "Red" Loud Speaker contact.

(7) (A) Unsolder the wire at present attached to tag on Pilot lamp and then by undoing the two 5BA Screws remove Lamp attachment from Frame.

(B) Next place the insulated washer supplied between lamp socket and bracket, this being accomplished by removing Pilot lamp and unscrewing the screw that serves as centre contact and placing the extra insulating washer so that there will be one above and below metal bracket.