Radiola

SERVICE MANUAL
1936

Amalgamated Wireless
(Australasia) Ltd.

INTRODUCTION . . .

Service is basic in a sound sales policy. Apart from the service rendered by the Radiola dealer at the time of sale regarding proper installation and upkeep, subsequent service and repair may be required, due to deterioration or mishandling.

To render this service efficiently, it is desirable for dealers to be equipped with a knowledge of the design and operation of Radiolas.

This manual has been compiled by the A.W.A. service section with a view to furthering this knowledge, and it is hoped that the ensuing pages will prove a practical help in servicing Radiolas.

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

(1) General information, containing data common to all types of 1936 Radiolas.

(2) General instructions for the alignment of Radiolas.

(3) Service data relative to each type of Radiola.

The latter is divided into fifteen sections as follows:—

GENERAL INFORMATION.

CHASSIS DESIGN.

Service consideration has been a controlling factor in the lay-out of the Radiola chassis parts and wiring. The assembly of these various elements is such that the number of conductors is minimised with all important connections readily accessible. Further, accessibility to all parts of the chassis is due to the open construction of the base and the removable chassis end plates.

CHASSIS INSPECTION.

When inspecting the chassis or replacing a component, take particular care not to disarrange the wiring. Each wire—especially those in the R.F. and I.F. circuits—has a definite relation to other wires, and if this arrangement is altered to any extent it is quite possible that the Radiola will become unstable.

RETURNING CHASSIS.

When returning a chassis to the Company, pack in a case with a solid base. Drill four holes corresponding to those in the bottom of the cabinet, and bolt the chassis rigidly to the bottom of the case with the "holding down" bolts provided with the instrument.

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.

CONTINUITY TESTS.

In the service data for each Radiola is given a Continuity 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 can be originated, which will be very helpful in localising faults.

Continuity tests should be made with an ohmmeter or with a D.C. voltmeter in series with a battery. See Fig. 1.

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.

SOCKET VOLTAGES.

The voltage values indicated in the socket voltage charts will serve to assist in locating causes for faulty operation when existent. Each value should hold within ± 20% when the receiver is operated at the rated power supply voltage. The voltages given in the socket voltage charts were measured by a meter with an internal resistance of 1,000 ohms per volt. Allowances must be made if a lower resistance voltmeter is used.

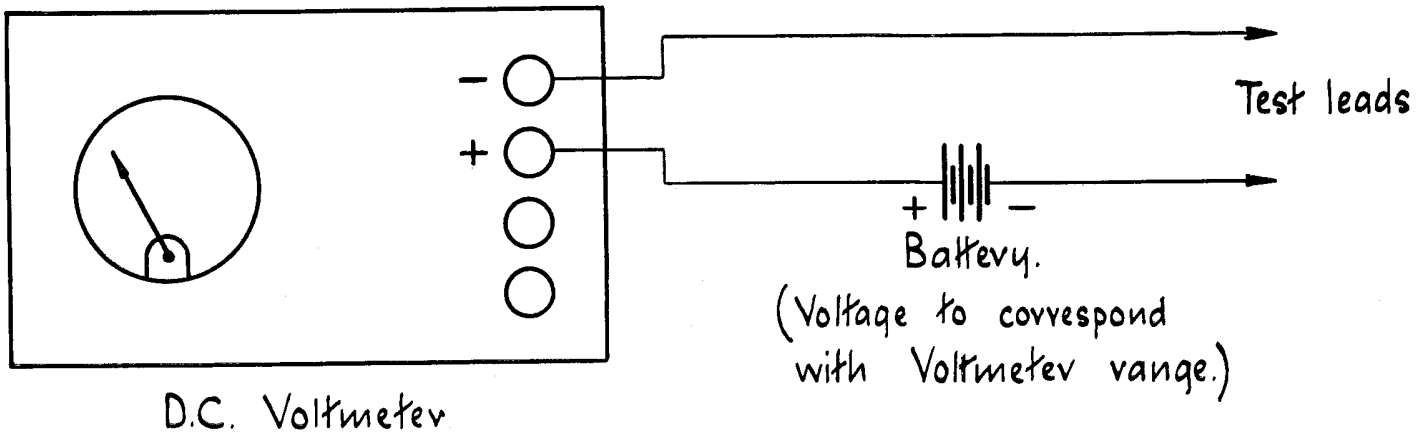

Fig. 1.—Continuity meter.

D.C. VOLTMETER.

Probably the most important instrument in the Radiola dealer's equipment is the D.C. voltmeter. It is recommended that the meter be of three ranges (0-10, 25, or 50), (0-250), and (0-600 or 750), with an internal resistance of 1,000 ohms per volt

This meter may be used:—

(1) For checking socket voltages.

(2) As a circuit tester—See Fig. 1.

(3) As an output meter—See Fig. 4.

Combination Voltmeters—ohmmeters or combination voltmeters—ohmmeters—output meters, etc., are available, but, of course, they are relatively expensive.

MICA CONDENSERS.

The capacity in micro microfarads is stamped on the condenser case.

TUBULAR (PAPER TYPE) CONDENSERS.

The capacity in microfarads is printed on the label.

SERVICING I.F. TRANSFORMER AND DUAL WAVE COIL UNITS.

A study of the layout diagrams will show that the I.F. transformer and dual wave coil units have three part numbers.

1. Complete unit part No., stamped on the shield.
2. Coil unit part No., stamped either on the coil mounting bridge or on the coil winding.
3. Coil base part No., stamped on the base.

It is advisable to locate the three numbers and quote them when communicating with the service department regarding these units. When returning either of the units to the service department for inspection, do not remove the coil unit from the base, but return the complete unit, including the shield.

To remove a unit, disconnect all leads from the points to which they are connected in the receiver (do not remove the connections within the shield) and remove the two mounting nuts from beneath the chassis. When replacing a unit, fit the shield to it before mounting on the chassis.

Radiolettes 31, 32 and 33 and Radiolas 248, 250, 253.

These receivers employ a small I.F. transformer, the can of which may be removed for inspection by unscrewing it in an anti-clockwise direction.

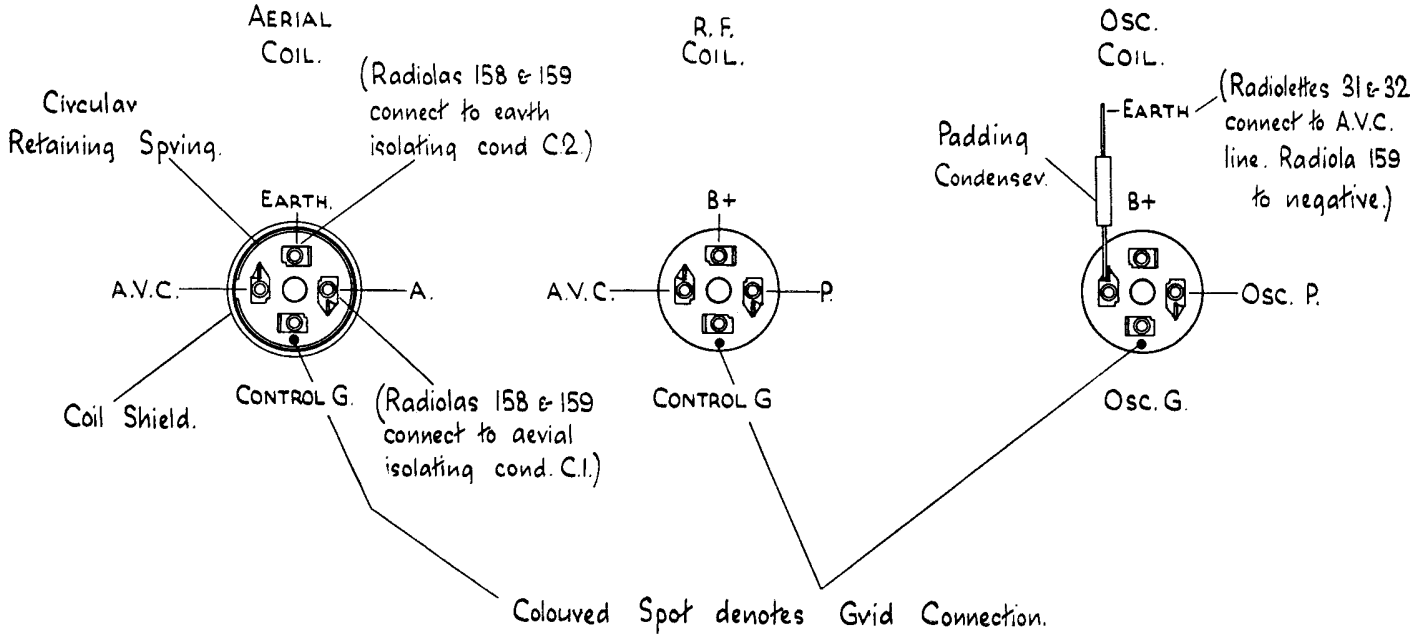

Fig. 2.—Wiring connections for Medium Wave Coils.

SERVICING TUNING COILS IN "MEDIUM WAVE" RADIOLAS.

Each tuning coil is secured in its shield by a circular retaining spring, which can be seen seated in a recess between the shield and the coil base. To remove a coil, disconnect the leads from the coil lugs, and insert a small screw-driver between the spring and the shield, then ease the spring from the recess.

A coloured spot on the coil base marks the grid connection, and note should be taken of its position in the shield, before removing the coil, to enable a coil to be replaced in the correct position.

The wiring connections for each coil are shown in Fig. 2.

When referring to a coil, the part number, which is stamped on the coil base, is all that is required for identification.

OSCILLATOR COIL.

If it is desired to remove the oscillator coil, it is desirable not to remove the padding condenser from the unit. This is so, because each oscillator coil is adjusted for use with the padding condenser fitted to it.

STRAIGHT LINE TUNING DIAL ASSEMBLY. REPLACEMENT OF DIAL SCALE.

1. Turn the station selector pointer to approximately 1,500 kilocycles on the dial scale.
2. Pull out, as far as possible, the four clips that hold the scale in position.
3. Remove the glass towards the left.

Before replacing, clean the glass lightly with a dry piece of chamois leather or dry tissue paper. Do not use pressure, as the calibration markings may be damaged. On replacing the scale, it may be necessary to recalibrate the receiver. To do this, tune in a known station, and reset the dial pointer.

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 gravity 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.

WIRING COLOUR CODE.

Each circuit in Radiola and Radiolette receivers is identified by a colour:—

CIRCUIT.	COLOUR.
B+	Red
Plate	Orange
Screen Grid	Blue
Cathode	White
Control Grid	Green
Earth, negative or A.V.C.	Black

RESISTOR COLOUR CODE.

BODY		END		DOT		
Brown	= 1	Black	= 0	Black	= No	Noughts
Red	= 2	Brown	= 1	Brown	= 1	Nought
Orange	= 3	Red	= 2	Red	= 2	Noughts
Yellow	= 4	Orange	= 3	Orange	= 3	"
Green	= 5	Yellow	= 4	Yellow	= 4	"
Blue	= 6	Green	= 5	Green	= 5	"
Violet	= 7	Blue	= 6	Blue	= 6	"
Grey	= 8	Violet	= 7	Violet	= 7	"
White	= 9	Grey	= 8	Grey	= 8	"
		White	= 9	White	= 9	"

EXAMPLES.

BODY	END	DOT		
Red	Green	Yellow	=	250,000 ohms
Brown	Brown	Orange	=	11,000 ohms
Orange	Black	Red	=	3,000 ohms

VALVE SOCKET CONNECTIONS
FOR
1936 RADIOLAS & RADIOLETTES.

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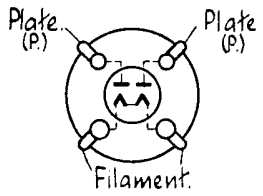

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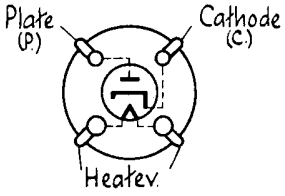

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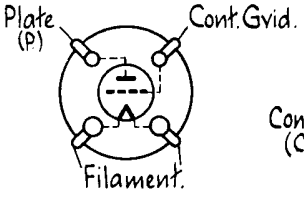

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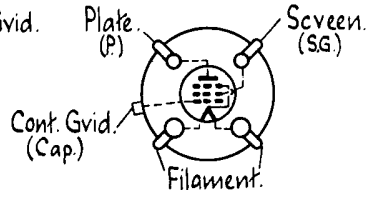

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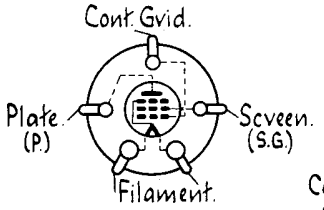

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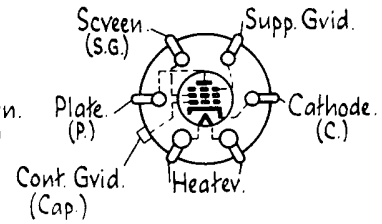

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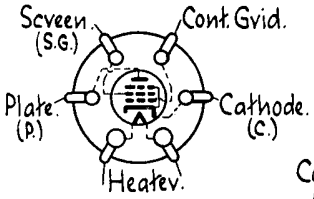

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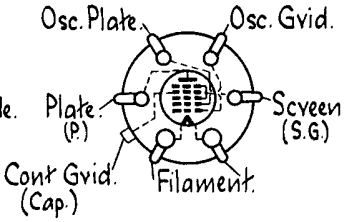

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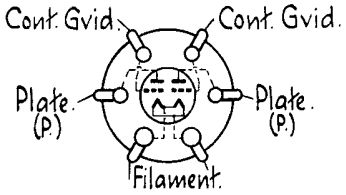

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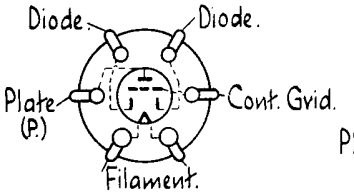

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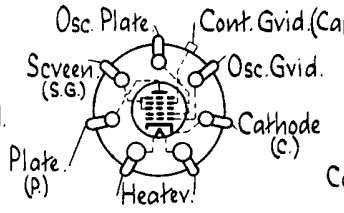

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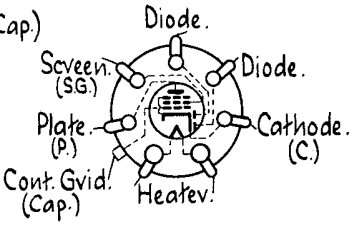

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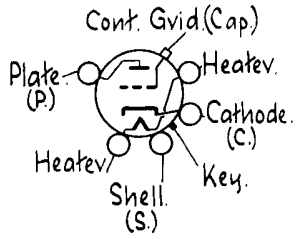

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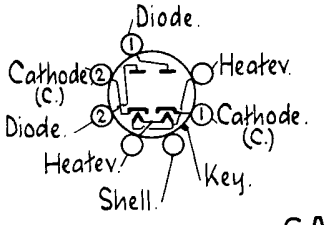

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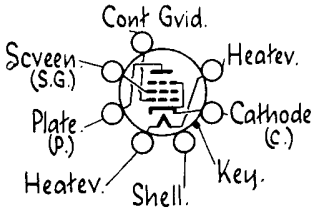

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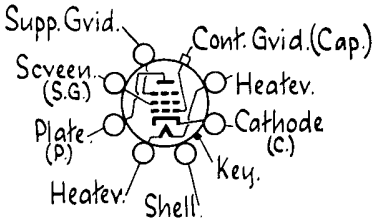

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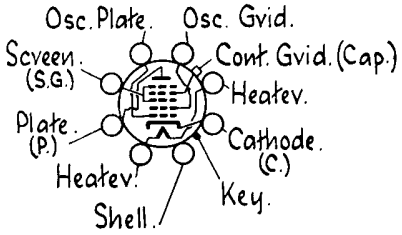


Fig. 3.

GENERAL INSTRUCTIONS FOR THE ALIGNMENT OF RADIOLAS AND RADIOLETTES

Radiola receivers are accurately aligned during manufacture by skilled operators, using elaborate and expensive equipment beyond the reach of the average service-man; it is therefore not desirable to make any alteration to the existing adjustments, unless it is felt certain that they are incorrect. In these cases, the complete alignment procedure (as described below) will need to be carried out. Also, after replacing any component part of any tuned circuit, complete realignment is necessary.

Accuracy in the line-up procedure cannot be over emphasised, because the ultimate performance given by each model is governed directly by the accuracy achieved in the adjustment of the intermediate frequency, and radio frequency stages.

EQUIPMENT.

In order to correctly align Radiola receivers, the following equipment should be used. An A.W.A. Modulated Oscillator Type C.1070, an output meter, and a non-metallic insulated screw-driver. While an output meter of conventional design is most convenient, an economical substitute which may be used is described below.

OUTPUT METER.

The output meter consists of a multi-range D.C. Voltmeter (as recommended on Page 3), a valve, either directly or indirectly heated, used as a diode rectifer to rectify the output voltage of the receiver, and a .5 mfd. paper condenser or larger if convenient. A circuit diagram is given below. When using this output meter, select a range on the meter which gives a convenient reading, depending on the output voltage obtained from the receiver.

(a) I.F. ALIGNMENT INSTRUCTIONS.

NOTE.—Individual instructions are included in the service data for each Radiola.

1. Place the Radiola and modulated oscillator in convenient positions for working.

2. With the existing clip removed, connect the valve clip of the modulated oscillator output cable to the control grid cap of the converter valve, and connect the earth tip of the cable to the earth terminal of the receiver.

3. Connect an output meter in the plate circuit of the output valve as shown in Fig. 4.

4. Switch the receiver on. In the event of the receiver under test using indirectly heated valves, a space of 30 seconds should be allowed before making adjustments, to enable the valves to assume their normal operating characteristics.

5. Set the station selector pointer of the receiver to 550 kilocycles or 550 meters, and turn the remaining controls to their maximum clockwise position.

6. Select the specified intermediate frequency on the modulated oscillator by means of the range switch and frequency control, and turn the modulated oscillator battery switch to the "MOD. ON" position.

7. Adjust the modulated oscillator attenuator so that a small deflection is observed on the output meter. During the I.F. alignment the modulated oscillator signal should be maintained at the lowest level that will give a good output indication.

8. Reference to the layout diagrams of the receiver under test will show the I.F. transformer adjustments numbered in the

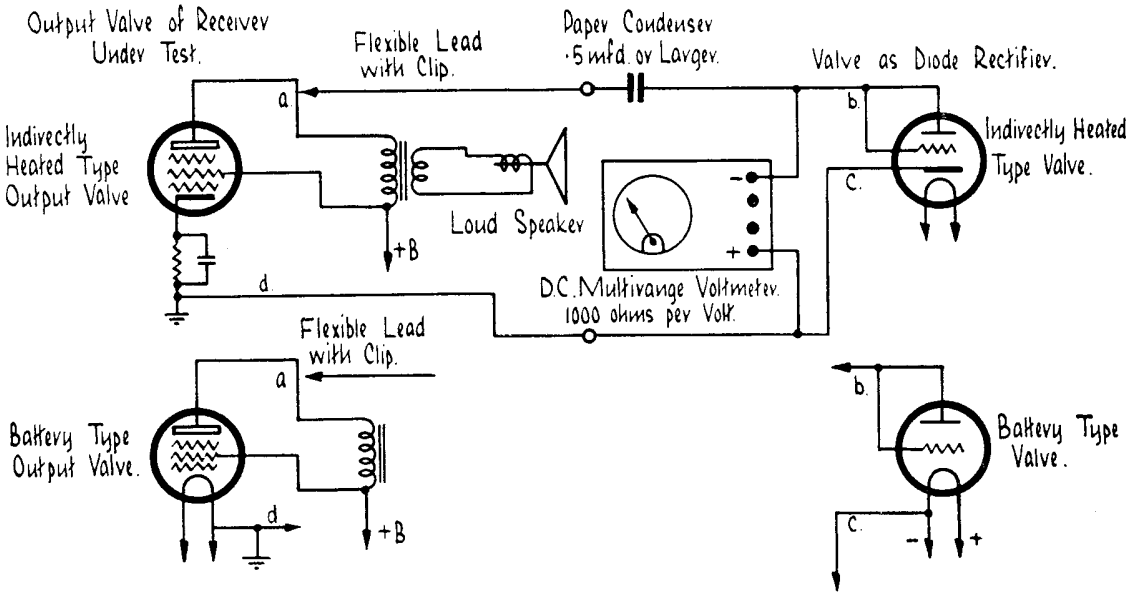


Fig. 4.—Output meter.

order in which they should be carried out. Beginning with adjustment No. 1, a non-metallic insulated screw-driver is used to adjust the trimmer screw to a point where the maximum output reading is obtained. When the output meter reading becomes excessive, it should be reduced by adjusting the modulated oscillator attenuator. The volume control must not be used, as inaccurate alignment will result if it is altered from the maximum clockwise position. Continue adjustments 2, 3, etc., in the same manner (refer tc layout diagrams). After completing this procedure, adjust all trimmers in the same order a second time for final alignment. The I.F. transformer alignment will then be complete.

WARNING.

By screwing the adjustment screws down hard it is sometimes possible to obtain another peak reading. This adjustment is incorrect and must be ignored.

(b) R.F. ALIGNMENT INSTRUCTIONS

on

"MEDIUM WAVE" RADIOLAS

NOTE.—R.F. adjustments are made after the I.F. transformer alignment has been completed. Individual instructions are included in the service data for each Radiola.

RADIOLAS 155, 156, 157, 158, 159.

1. After the I.F. alignment has been completed, remove the clip of the modulated oscillator output cable from the control grid of the converter valve, and insert the tip attached to this clip into the aerial terminal of the receiver. Replace the grid clip which was removed from the converter valve prior to the I.F. transformer alignment.

2. Set the station selector pointer of the receiver to 1,400 kilocycles.

3. Set the modulated oscillator frequency at 1,400 kilocycles, by means of the range switch and frequency control, and turn the modulated oscillator battery switch to the "MOD. ON" position.

4. Tune the receiver to the modulated oscillator signal, and adjust the modulated oscillator attenuator so that a small deflection is observed on the output meter. During the R.F. alignment the modulated oscillator signal should be maintained at the lowest level that will give a good output indication.

5. Reset the station selector pointer of the receiver at 1,400 kilocycles, and adjust the oscillator trimmer of the variable condenser with a non-metallic screw-driver to a point where the maximum reading is obtained on the output meter.

6. Adjust the R.F. and aerial trimmers, in their correct order (refer to layout diagrams), to give maximum output.

7. Tune the station selector of the receiver carefully to the highest reading on the output meter, and readjust the R.F. and aerial trimmers.

8. Switch the modulated oscillator off and disconnect it from the receiver. Connect the aerial and an earth wire to the receiver, then tune a broadcasting station of wave length between 450 and 550 meters. If the receiver is out of calibration, reset the pointer by loosening the set screws so that the calibration at the top end of the dial is correct. Next, repeat instructions Nos. 5, 6 and 7. This will bring the stations at the bottom end of the dial into correct calibration. The R.F. alignment will now be complete.

NOTE.—These receivers use a fixed padding condenser which is matched to the oscillator coil, thus eliminating a padding adjustment.

RADIOLETTES 31 AND 32.

Proceed with the above R.F. alignment instructions, setting the station selector pointer at 214 meters instead of 1,400 kilocycles.

RADIOLETTE 35.

As this receiver does not employ a radio frequency stage, instructions 6 and 7 apply to the aerial trimmer adjustment only. Otherwise the above procedure is followed.

(c) R.F. ALIGNMENT INSTRUCTIONS

on

"WORLD RANGE" RADIOLAS

MEDIUM WAVE BAND.

NOTE.—Individual instructions are included in the service data for each Radiola.

RADIOLAS 249, 302, 250, 251, 303, 252, 253, 254.

1. After the I.F. alignment has been completed, connect the valve clip of the modulated oscillator output cable to the aerial terminal of the receiver, and turn the range switch to the medium wave position. Replace the grid clip which was removed from the converter valve prior to the I.F. alignment.

2. Set the station selector pointer of the receiver at 1,400 kilocycles.

3. Set the modulated oscillator at 1,400 kilocycles, by means of the range switch and frequency control, and turn the modulated oscillator battery switch to the "MOD. ON" position.

4. Tune the receiver to the modulated oscillator signal, and adjust the modulated oscillator attenuator so that a small deflection is observed on the output meter. During the R.F. alignment the modulated oscillator signal should be maintained at the lowest level that will give a good output indication.

5. Reset the station selector pointer at 1,400 kilocycles, and adjust the medium wave oscillator coil trimmer (refer to layout diagram) with a non-metallic screw-driver to a point where the maximum reading is obtained on the output meter. When the output meter reading becomes excessive, it should be reduced by the oscillator attenuator.

6. Adjust the R.F. and aerial trimmers in their correct order (refer to layout diagram) to give the maximum output.

7. Tune the station selector carefully to the highest reading on the output meter, and readjust the R.F. and aerial trimmers.

8. Set the modulated oscillator frequency at 600 kilocycles by means of the frequency control.

9. Tune the receiver to the oscillator signal, and adjust the oscillator attenuator so that a small deflection is observed on the output meter.

10. Adjust the padding condenser adjustment screw (refer to layout diagram) with a non-metallic screw-driver while rocking the station selector back and forth through the modulated oscillator signal. The adjustment is correct when the highest reading is obtained on the output meter.

11. Switch the modulated oscillator off and disconnect it from the receiver. Connect an aerial and an earth wire to the receiver, then tune a broadcasting station of wave length between 450 and 550 meters. If the receiver is out of calibration, reset the pointer by loosening the set screws so that the calibration at the top end of the dial is correct. Next, repeat instructions Nos. 5, 6 and 7. This will bring the stations at the bottom end of the dial into correct calibration. The R.F. alignment will now be complete.

RADIOLETTE 33 AND RADIOLA 248.

For the alignment of the 33, proceed with the above medium wave band R.F. alignment instructions, setting the station selector pointer at 214 meters, instead of 1,400 kilocycles, as directed in instructions 2 and 5. As these receivers do not employ an R.F. stage, instructions 6 and 7 apply to the aerial trimmer adjustment only.

(d) R.F. ALIGNMENT INSTRUCTIONS

on

"WORLD RANGE" RADIOLAS

SHORT WAVE BAND.

NOTE.—Individual instructions are included in the service data for each Radiola.

1. After the Medium Wave R.F. alignment has been completed, connect the valve clip of the modulated oscillator output cable to the aerial terminal of the receiver, and turn the range switch to the short wave position.

2. Set the station selector pointer of the receiver to 20 meters.

3. Set the modulated oscillator frequency at 20 meters, by means of the range switch and frequency control, and turn the battery switch to the "MOD. ON" position.

4. Adjust the short wave oscillator coil trimmer, by turning the screw in an anti-clockwise direction, to the first position where the maximum output reading is obtained. Check for the image signal which should be received at about 21.4 meters on the dial. It will probably be necessary to increase the output from the modulated oscillator for this check. Retune the receiver to 20 meters, and decrease the output of the modulated oscillator to its previous value.

5. Tune the short wave R.F. coil trimmer by turning the screw in a clockwise direction to the first position where the maximum output reading is obtained, while rocking the station selector back and forth through the modulated oscillator signal.

NOTE.—It will be noticed on the short wave band that the oscillator and R.F. trimmers have two positions at which the signal will give maximum output. The position which uses the lower trimmer capacitance obtained by turning the screw in an anti-clockwise direction is the proper adjustment for the oscillator, while the position that uses the higher capacitance is proper for the R.F. trimmer.

6. Leave the station selector at the setting giving the maximum reading in instruction No. 5, and adjust the short wave aerial coil trimmer until the maximum output is obtained. The short wave band R.F. alignment will then be complete.

RADIOLETTE 33 AND RADIOLA 248.

As these receivers do not employ an R.F. stage, instruction No. 5 is omitted. Otherwise the above instructions should be followed.

SERVICE DATA.

Radiolettes 31 and 32

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190 - 260 Volts.
Frequency Rating	50 - 60 Cycles.
(Special instruments made for other voltage and frequency ratings)	
Power Consumption	50 WATTS.
Tuning Range	200 - 550 Metres.
Intermediate Frequency	175 Kilocycles.
Loudspeaker	Type D 33.
Loudspeaker Field Coil Resistance	1,600 Ohms.
Loudspeaker Audio Transformer	Type T.G.1.

VALVES AND CIRCUITS.

6D6 R.F. Amplifier.
6A7 Detector Oscillator.
6B7 I.F. Amplifier, Detector, A.V.C. and Audio Amplifier.
42 Output Pentode.
80 Rectifier.

GENERAL CIRCUIT DESCRIPTION.

The Radiolettes 31 and 32 are "Medium Wave" five valve A.C. operated superheterodyne receivers with a tuning range from 200-550 meters (1,500-550 kilocycles).

The signal from the aerial is applied to the control grid of the 6D6 R.F. amplifier, after magnification by the aerial coil (T-1), the secondary of which is tuned to the frequency of the signal by the front unit of the variable condenser (C-2). After amplification by the 6D6, the signal is applied by the secondary of the R.F. coil (T-2), which is tuned by the centre section of the variable condenser (C-4), to the control grid of the 6A7 converter. Combined with the R.F. signal in the 6A7 converter is the local oscillator signal, which is 175 kilocycles higher in frequency than the signal being received this difference in frequency remains at 175 K.C. throughout the tuning range of the instrument, owing to the design of the oscillator coil (T-3), the variable condenser (C-6) and the padding condenser (C-7).

The I.F. signal (175 K.C.), produced by the combining of the two signals within the 6A7, appears in the plate circuit of this valve where it is selected by the first I.F. transformer (T-4) and applied to the control grid of the 6B7 valve. The I.F. signal is amplified by this valve and is transferred by the second I.F. transformer (T-5) to the diode plates of the 6B7 for rectification across Resistors R-9 and R-10. The secondary

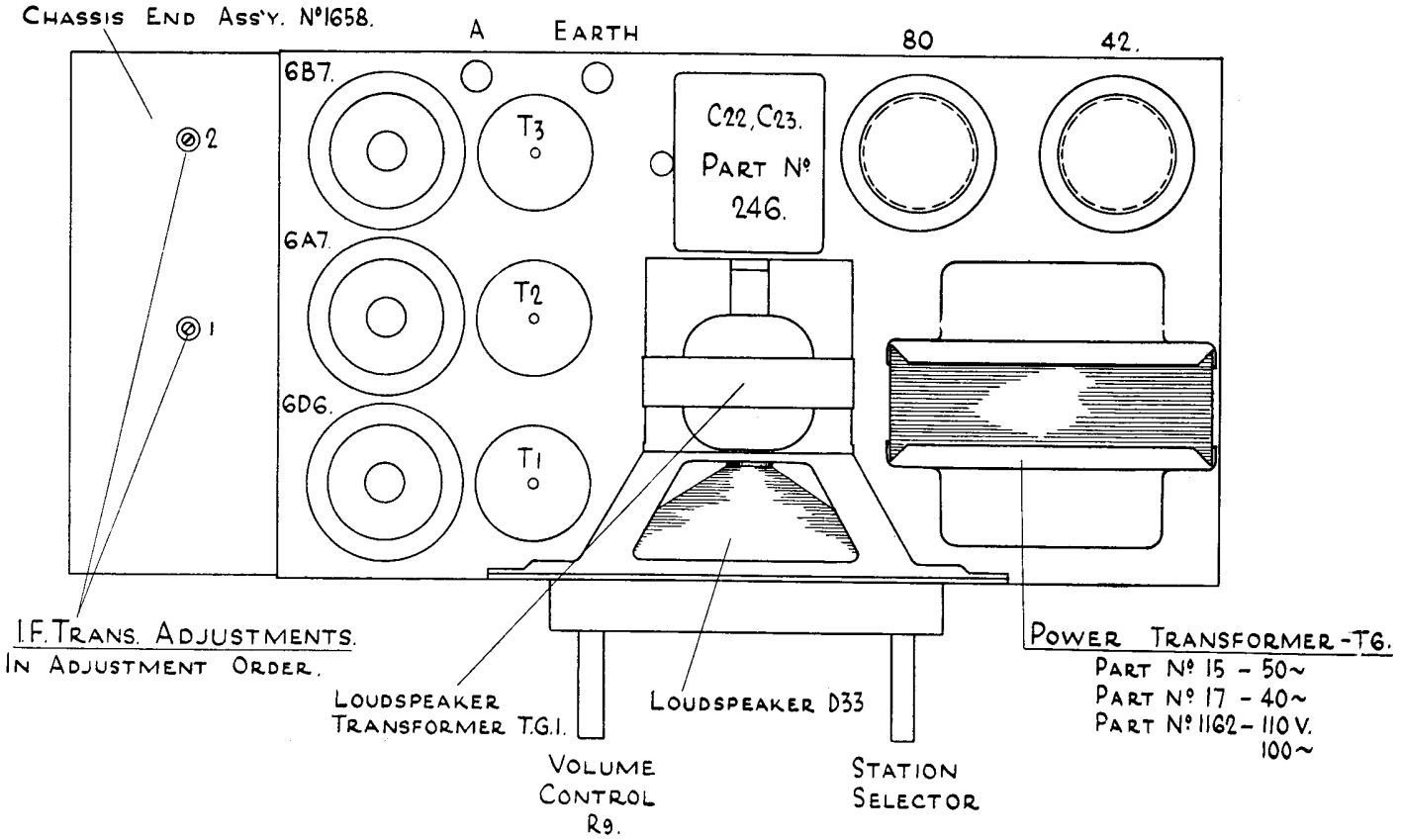


Fig. 5.—Layout diagram (top view), (31 and 32).

of the first I.F. transformer (T-4) and the primary of the second I.F. transformer (T-5) are tuned to 175 K.C. by trimmer condensers. The primary of T-4 is not tuned by a condenser, but is designed to resonate at 175 K.C.

The rectification of the I.F. signal, in the diode circuit of the 6B7, produces a D.C. voltage, which is applied (via filter R-11 and C24) as a grid bias to the control grid circuits of the 6A7 converter and 6D6 R.F. amplifier to give automatic volume control.

The volume control (R-9) selects the amount of audio signal, in the diode circuit of the 6B7, to be applied to the control grid of the same valve. The output of the 6B7 is resistance capacity coupled to the 42 output pentode to be amplified again for reproduction by the loudspeaker. Correct matching between the output valve and the loudspeaker is carried out by the transformer T.G.1. on the loudspeaker frame.

Socket voltages for all valves are supplied by a power unit employing a transformer (T-6) and an 80 valve rectifier, with the loud speaker field winding utilised as a filter reactor in conjunction with two high capacity condensers, C-22, C-23. Mounted at the rear of the chassis frame is a local distant switch, which connects an additional 3000ohms resistor (R-2) in series with the normal 1,200ohms cathode bias resistor (R-1) of the 6D6 and 6A7 valves.

I.F. ALIGNMENT.

This receiver uses one stage of I.F. amplification, which includes two I.F. transformers. These transformers are tuned to resonance (175 K.C.) by two trimmer condensers, which have adjustments (Nos. 1 and 2) situated in the chassis end assembly on the left side of the receiver. See fig. 5.

Full I.F. alignment instructions appear on page 6.

R.F. ALIGNMENT.

The R.F. adjustments (Nos. 3, 4 and 5) are situated on the variable condenser, which is mounted below the chassis. Reference to fig. 6 will show the R.F. adjustments, and detailed alignment instructions are given on page 7.

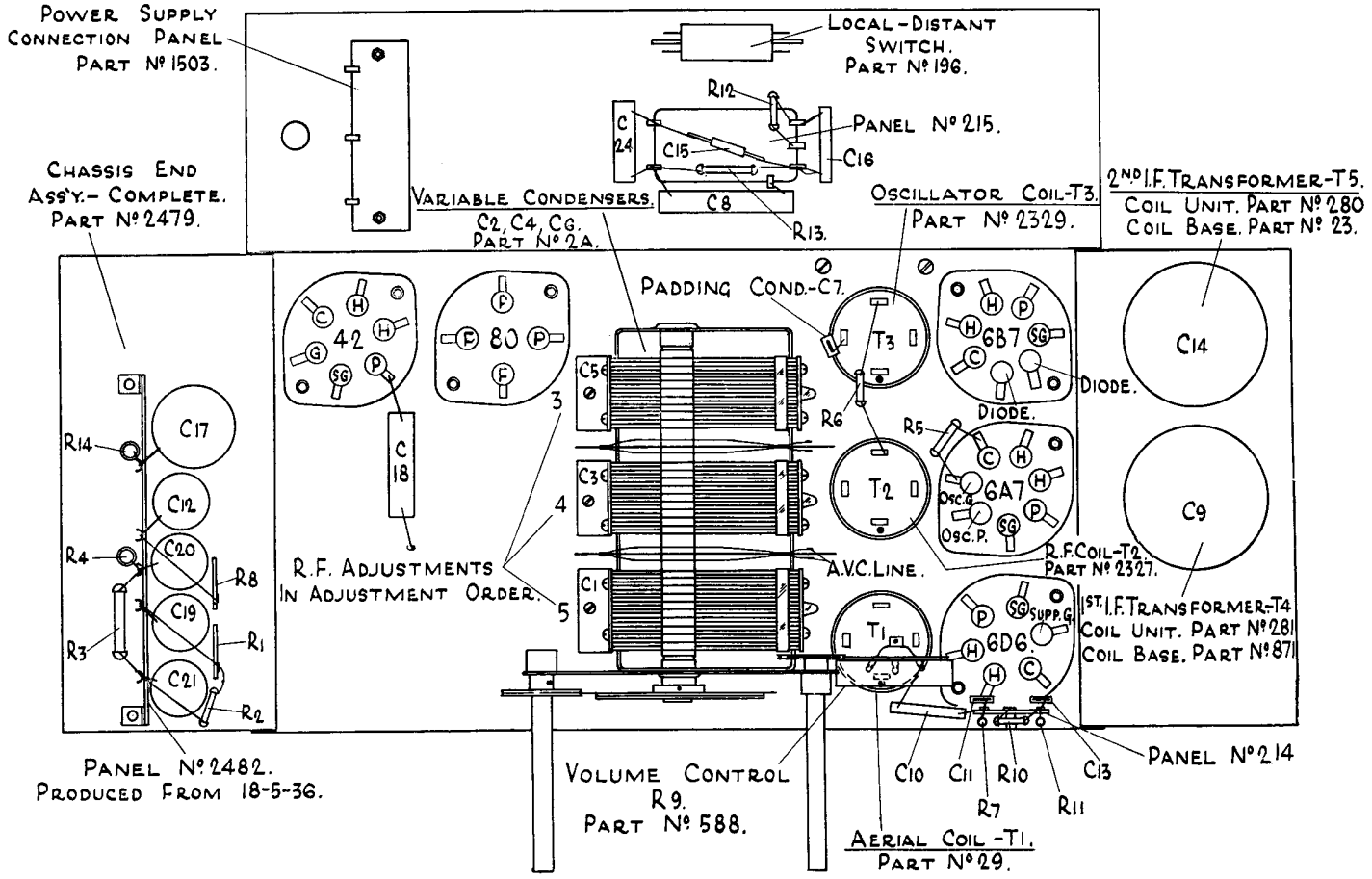


Fig. 6.—Layout diagram (underneath view), (31 and 32).

CONTINUITY TESTING SCHEDULE RADIOLETTES 31 AND 32.

N.B.—All readings to be made with valves withdrawn.

TEST BETWEEN	CORRECT READING	PROBABLE CAUSE OF IRREGULAR READING
Each plate 80 to chassis separately.	300 ohms.	T-6 secondary open circuit. Wiring open circuit.
Control grid 42 output pentode to chassis.	300,000 ohms.	R-13 short circuit or open circuit.
Screen grid 42 output pentode to chassis.	60,000 ohms.	R-3, R-4 short circuit or open circuit. C-20, C-21, C-22, C-23, C-8 or C-18 short circuit. Wiring short circuit to chassis.
Cathode 6B7 second detector to chassis.	2000 ohms.	R-8 short circuit or open circuit. C-12 short circuit.
Cathodes 6A7 converter and 6D6 R.F. amplifier to chassis.	1200 ohms — 4200 ohms relative to position of L.D. switch.	R-1, R-2 short circuit or open circuit, C-19 short circuit. L.D. switch fc ulty.
AVC line to chassis (See fig. 6).	No reading (over 2 megohms).	C-24 short circuit. Frame of variable condenser short circuiting to chassis.
Cathode 42 output pentode to chassis.	400 ohms.	R-14 short circuit or open circuit. C-17 short circuit.
Control grid clip 6B7 second detector to chassis.	No reading. (500,000 ohms.)	T-4 secondary open circuit. R-7 short circuit or open circuit. C-11 short circuit.
Diode plates 6B7 second detector to chassis.	300,000 ohms — 550,000 ohms with rotation of volume control.	T-5 secondary open circuit. Volume control R-9 faulty. R-10, R-8 short circuit or open circuit. C-13 short circuit.
Plate 6B7 second detector to chassis.	160,000 ohms.	C-15 short circuit. T-5 primary short circuit or open circuit.
Screen grid 6B7 second detector to chassis.	20,000 ohms.	R-4 short circuit or open circuit. C-20 short circuit.
Aerial terminal to chassis.	Continuity.	T-1 primary open circuit.
Screen grid 42 output pentode to plate 6D6 R.F. amplifier.	Continuity.	T-2 primary open circuit.
Screen grid 42 output pentode to plate 6A7 converter.	Continuity.	T-4 primary open circuit.
Screen grid 42 output pentode to plate 6B7 second detector.	100,000 ohms.	R-12 short circuit or open circuit.
Screen grid 42 output pentode to plate oscillator section 6A7 converter.	20,000 ohms.	T-3 primary open circuit. R-6 short circuit or open circuit.
Filament 80 to plate 42 output pentode.	2000 ohms.	Loudspeaker field open circuit or short circuit. Loudspeaker transformer T.G.1. primary open circuit or short circuit.
Screen grid 42 output pentode to screen grid of 6D6, 6A7, 6B7 valves.	40,000 ohms.	R-3 short circuit or open circuit.
Screen grid 42 output pentode to plate 42.	300 ohms.	Loudspeaker transformer T.G.1. primary open circuit.
Filament 80 to screen grid 42 output pentode.	1,600 ohms.	Loudspeaker field open circuit or short circuit
AVC line to control grid clip 6A7 converter.	Continuity.	T-2 secondary open circuit.
Diode plates 6B7 second detector to AVC line.	No reading ($1\frac{3}{4}$ megohm).	R-11 short circuit or open circuit. T-5 secondary open circuit.
Cathode 6A7 converter to grid oscillator section 6A7.	60,000 ohms.	R-5 short circuit or open circuit.
AVC line to control grid clip 6D6 R.F. amplifier.	Continuity.	T-1 secondary open circuit.
Across power cable.	Continuity.	T-6 primary open circuit. Power cable open circuit.
Across heaters 42 output pentode.	Continuity.	T-6 heater winding open circuit. Wiring open circuit.
Across filament 80.	Continuity.	T-6 filament winding open circuit. Wiring open circuit.
Plate 6B7 second detector to control grid 42 output pentode.	No reading ($\frac{1}{2}$ megohm).	C-16 short circuit.
Fixed plates C-6 to coil end of padding condenser C-7.	Continuity.	T-3 secondary open circuit.

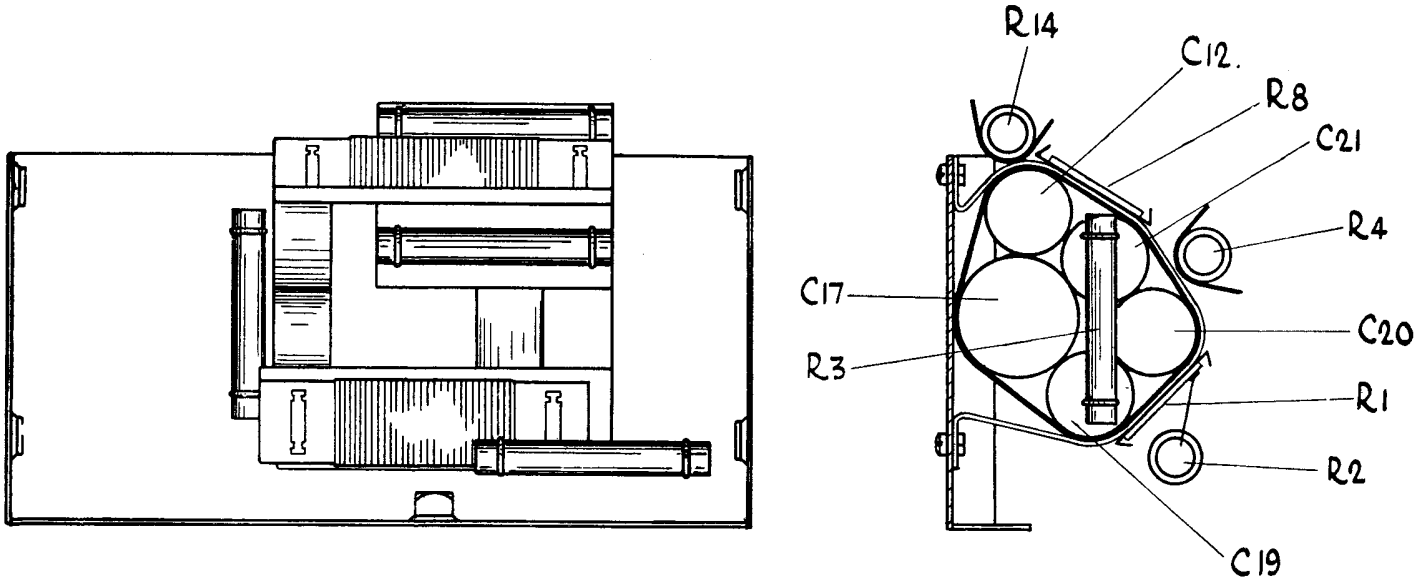


Fig. 7.—"L" type chassis end assembly.
(Produced prior to 18-5-36)

SERVICE NOTES.

All parts on the chassis may be made conveniently accessable by making use of the hinging feature of the chassis ends. To hinge, remove two screws nearest the foot and loosen the other two screws. Unsolder the two or three necessary leads and hinge the chassis end back. Self-tapping screws are used to eliminate the use of nuts.

VARIABLE CONDENSER AND VOLUME CONTROL UNIT.

The variable condenser and volume control unit is removed as follows:—

1. Remove the chassis and speaker stays from the front of the chassis.

2. Remove the loudspeaker.

3. Disconnect all leads from the variable condenser and volume control.

4. Remove three nuts and washers on the top of the chassis holding the unit to the chassis.

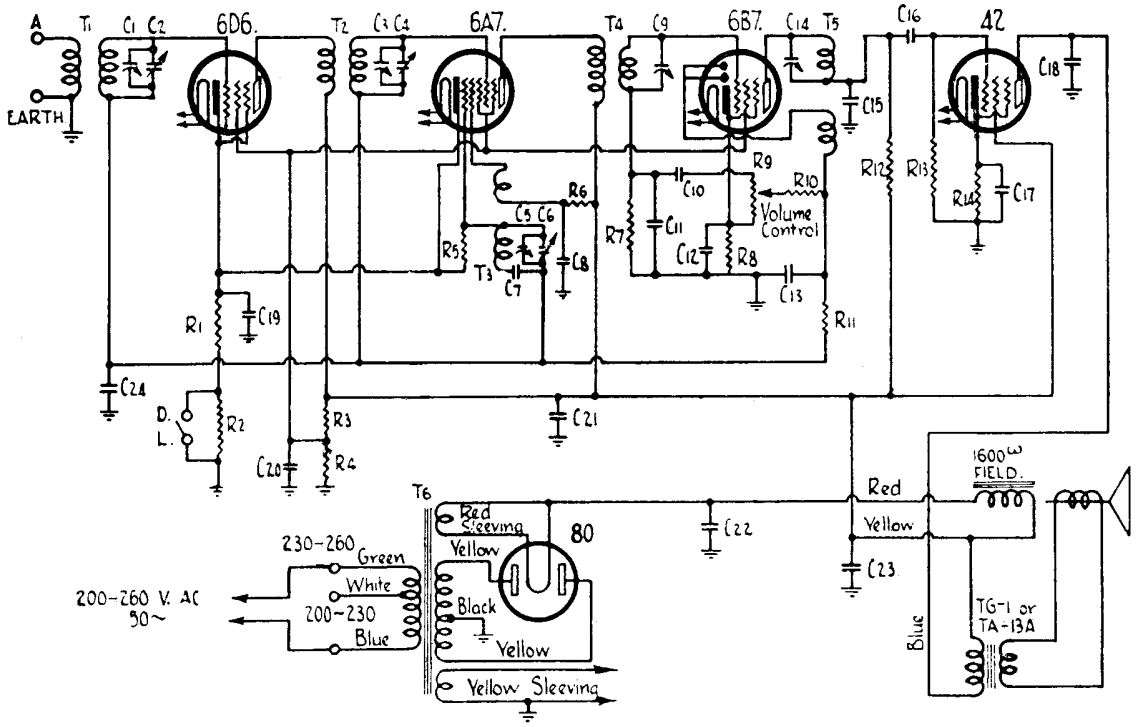
NOTE.

It is important that the variable condenser be mounted by means of the rubber bushes and kept insulated from the chassis since the frame of the variable condenser is connected to the A.V.C. circuit.

SOCKET VOLTAGES.

Valve.	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Heater Volts
6D6 R.F. Amplifier	6.0	55 -	245	1.0	6.3
6A7 converter	6.0	55	245	0.5	6.3
" Oscillator	—	—	170	3.0	—
6B7 Reflex Amplifier	2.5	55	100*	1.2	6.3
42 Pentode	14.0	245	230	30.0	6.3
80 Rectifier	600/300 volts, 45 m.a. total current.				5.0

* Cannot be measured accurately with ordinary voltmeter. Measured with 240 volts A.C. supply. No signal input. Controls in maximum clockwise postion. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	29	Aerial Coil
T2	2327	R.F. Coil
T3	2329	Oscillator Coil
T4	871	First I.F. Transformer
T5	23	Second I.F. Transformer
T6	15	Power Transformer, 50~
T6	17	Power Transformer, 40~
T6	1162	Power Transformer, 100~

Code	Part No.	RESISTORS.
R1		1,200 ohms, Wire Wound
R2		3,000 ohms, $\frac{1}{8}$ watt
R3		40,000 ohms, 1 watt
R4		20,000 ohms, 1 watt
R5		60,000 ohms, $\frac{1}{8}$ watt
R6		20,000 ohms, $\frac{1}{8}$ watt
R7		500,000 ohms, $\frac{1}{8}$ watt
R8		2,000 ohms, Wire Wound
R9	588	250,000 ohms, Volume Control
R10		300,000 ohms, $\frac{1}{8}$ watt
R11		$1\frac{3}{4}$ megohms, $\frac{1}{8}$ watt
R12		100,000 ohms, $\frac{1}{8}$ watt
R13		300,000 ohms, $\frac{1}{8}$ watt
R14		400 ohms, 1 watt

Code	Part No.	CONDENSERS.
C1		10-50 mmfd. Mica Trimmer
C2	2A	Variable Condenser
C3		10-50 mmfd. Mica Trimmer
C4	2A	Variable Condenser
C5		10-50 mmfd. Mica Trimmer
C6	2A	Variable Condenser
C7	80	900 mmfd. Mica Padding Con.
C8	43	.05 mfd. Paper Tubular Cond.
C9		100-200 mmfd. Mica Trimmer
C10	39	.01 mfd. Paper Tubular Cond.
C11	73	200 mmfd. Mica Condenser
C12		5 mfd. 25 V. Electrolytic Cond.
C13	73	200 mmfd. Mica Condenser
C14		10-50 mmfd. Mica Trimmer
C15	78	700 mmfd. Mica Condenser
C16	39	.01 mfd. Paper Tubular Cond.
C17		25 mfd. 25 V. Electrolytic Cond.
C18	40-41	.02-03 mfd. Paper Tubular Cond
C19	45	.25 mfd. Paper Tubular Cond.
C20	45	.25 mfd. Paper Tubular Cond.
C21	45	.25 mfd. Paper Tubular Cond.
C22	246	8 mfd. 500 V. Electrolytic Cond.
C23	246	4 mfd. 350 V. Electrolytic Cond.
C24	43	.05 mfd. Paper Tubular Cond.

Fig. 8.—Circuit data (31 and 32).

Radiolette 33

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190-260 Volts.
Frequency Rating	50-60 Cycles.
(Special instruments made for other voltage and frequency ratings)	
Power Consumption	50 Watts.
Tuning Ranges	(a) 200-550 Metres.
	(b) 19-50 Metres.
Intermediate Frequency	460 K.C.
Loudspeaker	Type D52
Loudspeaker Field Coil Resistance	1600 ohms
Loudspeaker Audio Transformer	Type T.G.1

VALVES AND CIRCUITS.

6A7 Detector-oscillator.
6D6 I.F. Amplifier.
6B7 I.F. Amplifier, Detector, A.V.C. and Audio Amplifier.
42 Output Pentode.
80 Rectifier

GENERAL CIRCUIT DESCRIPTION.

The Radiolette 33 is a "World Range" five valve A.C. operated superheterodyne receiver, which has two tuning ranges.

(1) 200-550 metres (1500-550 kilocycles), which covers the standard medium wave broadcasting band.

(2) 19-50 metres, which includes four short wave broadcasting bands.

Two separate groups of tuning coils are used. A dual position range switch is used to select the coils covering the range it is desired to tune.

The incoming signal, after magnification by the aerial coil (T-1 or T-2), is applied to the control grid of the 6A7 converter. The secondary of the aerial coil is tuned by the front section of the variable condenser (C-4). A local oscillator signal, which is derived within the elements of the converter valve, is combined (heterodyned) with the R.F. signal to produce the I.F. or beat frequency. The difference of 460 K.C., between the incoming R.F. frequency and the local oscillator frequency, remains constant throughout both tuning ranges of the receiver. The inherent design of the oscillator coils (T-3 and T-4) in conjunction with the variable condenser (C-18) and padding condensers (C-13-C-14 and C-16) make this possible.

The I.F. signal in the plate circuit of the 6A7 is admitted through the first I.F. transformer (T-5) to the 6D6 I.F. amplifier. Here it is boosted by the gain of the valve and is applied through the second I.F. transformer (T-6) to the control grid of the 6B7 valve. After amplification by the 6B7, the I.F. signal is transferred by the third I.F. transformer (T-7) to the diode plates of the same valve for rectification across resistors R-15 and R-16. The plate circuit of the converter, the grid circuit of the I.F. amplifier, the plate circuit of the I.F. amplifier, the grid circuit of the 6B7, and the plate circuit of the 6B7 are all tuned by compression type trimmer condensers to 460 K.C. The I.F. signal is by-passed by C-25 in the grid circuit, and by C-31 in the plate circuit of the 6B7. After rectification, the I.F. carrier is filtered by resistor R-16 and condensers C-28 and C-25 (via C-26).

The rectification of the I.F. signal in the diode circuit of the 6B7 produces a D.C. voltage across resistors R-15 and R-16 proportional to the signal being received, and this voltage is applied (via filter R14 and C35) as a grid bias to the control grid circuits of the 6A7 and 6D6 valves to give automatic volume control.

The audio signal developed across R-15 (volume control) is applied to the control grid of the 6B7 (via coupling condenser C-26). The volume control (R-15) is a variable resistance control, which allows the magnitude of the audio signal impressed on the control grid of the 6B7 to be adjusted as desired.

The series and parallel impedances of T-6 and C-25, respectively, are negligible to audio frequencies. Amplified by the 6B7 the audio signal is then coupled through a resistance-capacity circuit to the 42 output pentode. I.F. transformer T-7 and condenser C-31 have negligible impedances to audio frequencies.

The loudspeaker is matched to the output of the 42 by the transformer T.G.1.

The power unit consists of a transformer T-8, an 80 valve rectifier, and the 1600 ohms field winding of the loudspeaker serves as a filter reactor in conjunction with two high capacity electrolytic condensers, C-38 and C-39.

The sensitivity control is a three-point switch, which reduces or increases the sensitivity of the receiver by varying the bias voltage on the cathodes of the 6A7 and 6D6 valves.

I.F. ALIGNMENT.

This receiver employs two I.F. stages which include three I.F. transformers (T-5, T-6, T-7). Five trimmer condensers align these transformers to resonance (460 K.C.). Align first the third I.F. transformer adjustment (No. 1) situated on the top of the chassis (see Fig. 9), and continue with adjustments 2, 3, 4 and 5 located below the chassis. See Fig. 10.
I.F. alignment instructions in detail appear on page 6.

R.F. ALIGNMENT.
MEDIUM WAVE.

Reference to Fig. 10 will show the location of the medium wave coil adjustments (Nos. 6, 7, and 600 K.C. padding condenser). Beginning with No. 6 (oscillator trimmer), refer to page 7 for full alignment instructions.

SHORT WAVE.

Refer to Fig. 10 for the location of the Short Wave coil adjustments (Nos. 8 and 9). Beginning with No. 8 (oscillator trimmer), refer to page 8 for full alignment instructions.

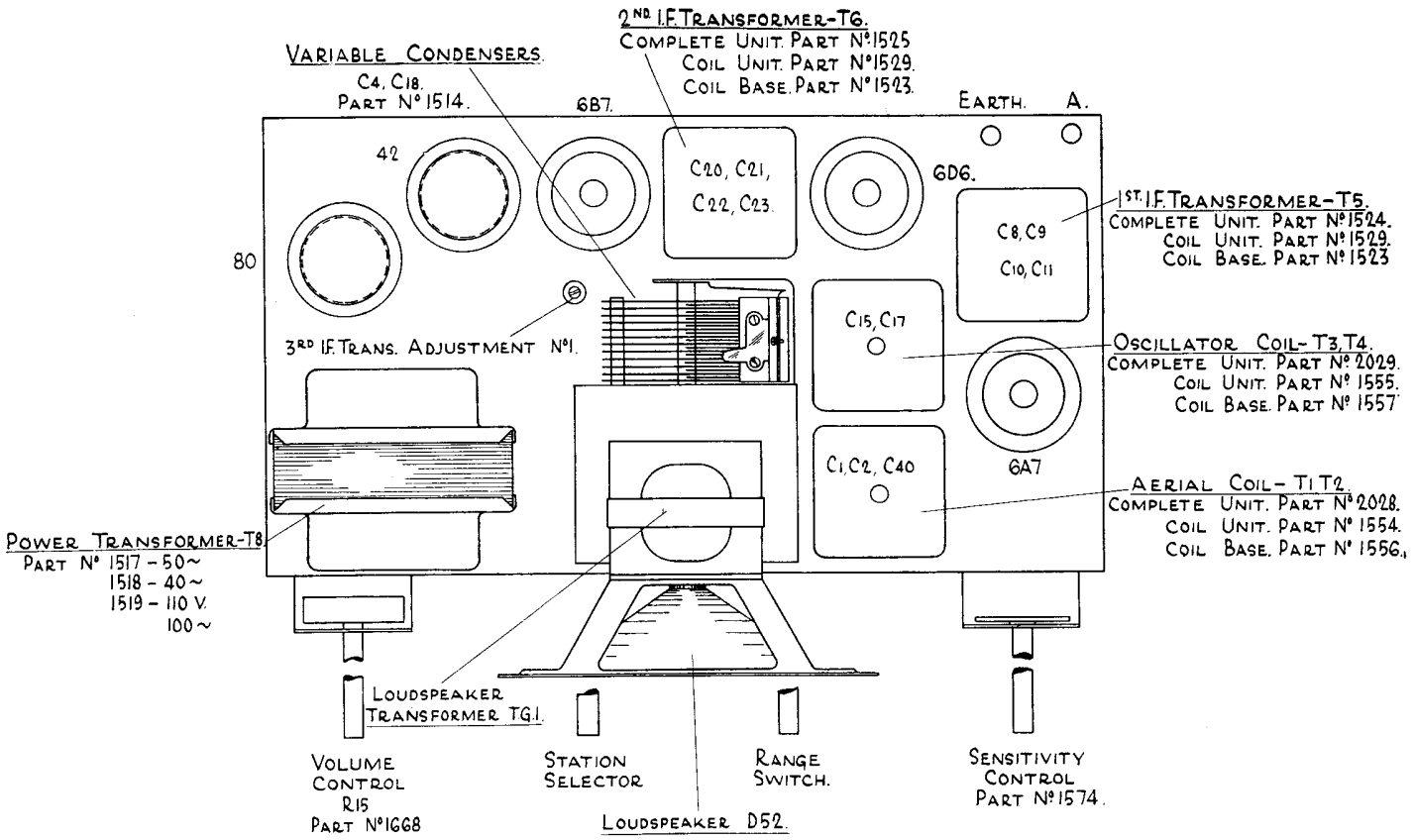


Fig. 9.—Layout diagram (top view), (33).

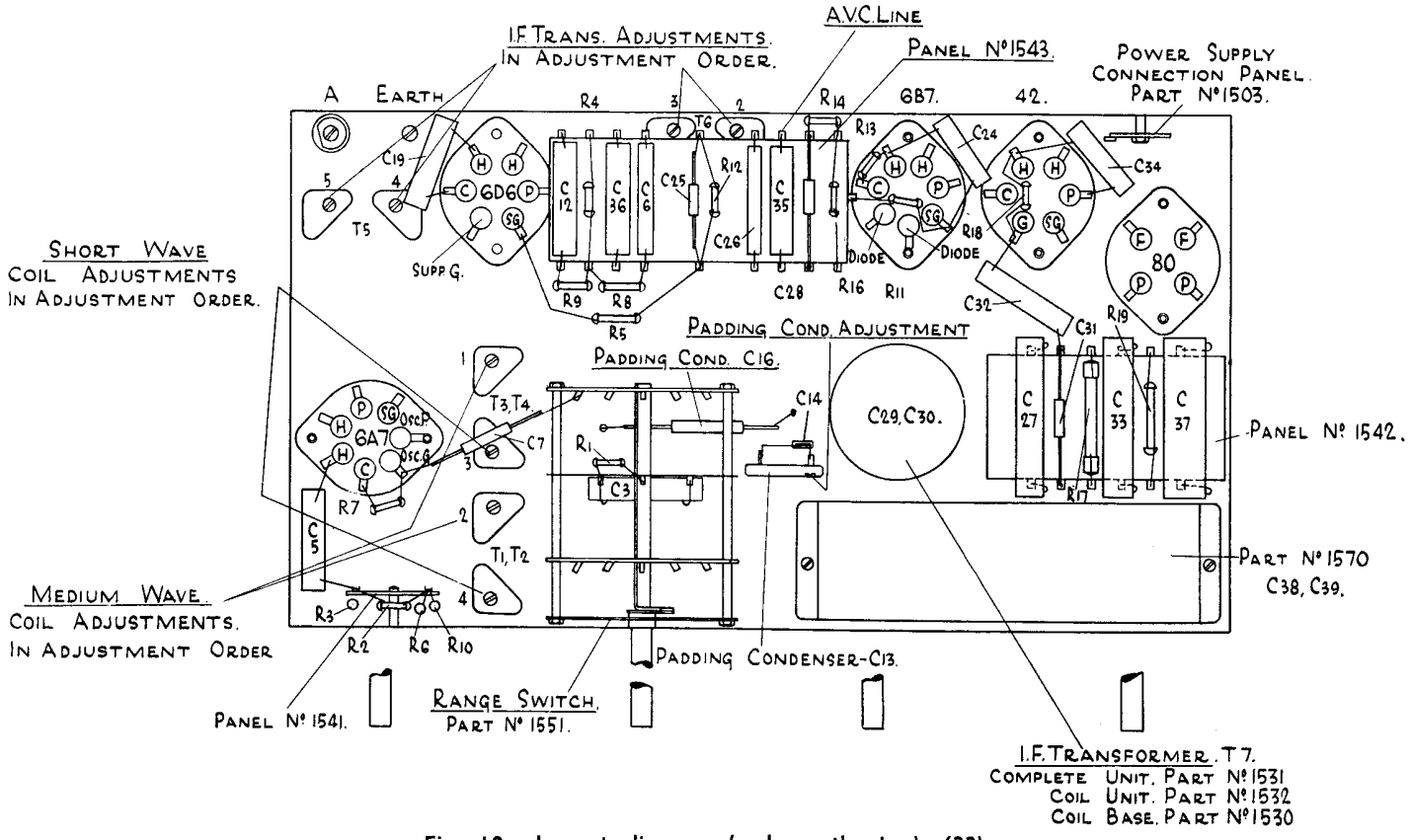


Fig. 10.—Layout diagram (underneath view), (33).

CONTINUITY TESTING SCHEDULES RADIOLETTE 33.

N.B.—All readings to be made with valves withdrawn.

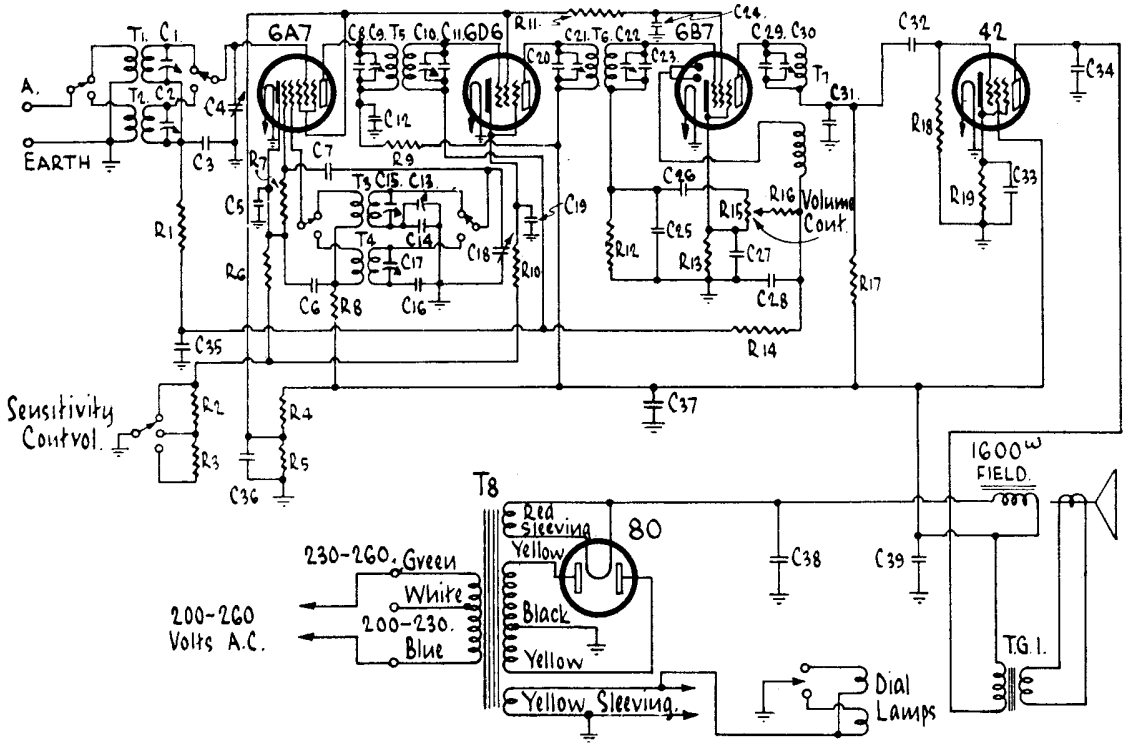
TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to each plate 80 separately.	300 ohms.	T-8 secondary open circuit. Wiring open circuit.
Chassis to filament 80.	71,600 ohms.	Loudspeaker field open circuit. R-4, R-5, short circuit or open circuit. C-34, C-36, C-37, C-38, C-39, C-12 or C-6, short circuit. Wiring short circuit to chassis.
Chassis to cathode 42 output pentode.	400 ohms.	R-19 short circuit or open circuit. C-33 short circuit.
Chassis to control grid 42 output pentode.	300,000 ohms.	R-18 short circuit or open circuit.
Chassis to plate 6B7 second detector.	170,000 ohms.	C-31 short circuit. T-7 primary short circuit or open circuit.
Chassis to screen grid 6B7 second detector.	130,000 ohms.	C-24 short circuit.
Chassis to control grid clip 6B7 second detector.	No reading. ($\frac{1}{2}$ megohm.)	T-6 secondary open circuit. R-12 short circuit or open circuit. C-25 short circuit.
Chassis to cathode 6B7 second detector.	2,000 ohms.	R-13 short circuit or open circuit. C-27 short circuit.
Chassis to diode plates 6B7 second detector.	300,000 - 600,000 ohms with rotation of volume control.	T-7 secondary open circuit. R-13, R-16, short circuit or open circuit. Volume control faulty. C-28 short circuit.
Chassis to aerial terminal. In both positions of range switch.	Continuity.	T-1 or T-2 primary open circuit. Range switch faulty.
Chassis to AVC line. (See Fig. 10).	No reading (over 2 megohms).	C-3, C-35, short circuit.
Chassis to frame of variable condenser.	Continuity.	Earth connections to C-4, C-18 open circuit.
Chassis to cathode 6A7 converter or 6D6 I.F. amplifier.	3,500 ohms, 2,600 ohms, 600 ohms, relative to position of sensitivity control.	R-10, R-3, R-6, R-2, short circuit or open circuit. Sensitivity control faulty. C-5, C-19, short circuit.
Screen grid 42 output pentode to plate 42.	350 ohms.	Loudspeaker transformer T.G.1. primary open circuit.
Screen grid 42 output pentode to plate detector section 6A7 converter.	300 ohms.	T-5 primary open circuit. R-9 short circuit or open circuit.
Screen grid 42 output pentode to plate 6D6 I.F. amplifier.	Continuity.	T-6 primary open circuit.
Screen grid 42 output pentode to plate oscillator section 6A7 converter. In both positions of range switch.	20,000 ohms.	T-3 or T-4 primary open circuit. R-8 short circuit or open circuit. Range switch faulty.
Screen grid 42 output pentode to plate 6B7 second detector.	100,000 ohms.	T-7 primary open circuit. R-17 short circuit or open circuit.
Screen grid 42 output pentode to screen grid 6A7 converter.	40,000 ohms.	R-4 short circuit or open circuit.
Screen grid 42 output pentode to screen grid 6B7 second detector.	140,000 ohms.	R-4, R-11, short circuit or open circuit.
Plate 6B7 second detector to control grid 42 output pentode.	No reading ($\frac{1}{2}$ megohm).	C-32 short circuit.
Control grid clip 6A7 converter to AVC line. In both positions of range switch.	100,000 ohms.	T-1 or T-2 secondary open circuit. R-1 short circuit or open circuit. Range switch faulty.
Diode plates 6B7 second detector to AVC line.	No reading ($1\frac{3}{4}$ megohms).	T-7 secondary open circuit. R-14 short circuit or open circuit.
Control grid clip 6D6 I.F. amplifier to AVC line.	Continuity.	T-5 secondary open circuit.
Cathode to grid oscillator section 6A7 converter.	60,000 ohms.	R-7 short circuit or open circuit.
Fixed plates C-18 to coil end of padding condensers C-13-C-14 and C-16, in both positions of range switch.	Continuity.	T-3 or T-4 secondary open circuit. Range switch faulty.
Across heaters 6A7 converter.	Continuity.	T-8 heater winding open circuit. Wiring open circuit.
Across power cable.	Continuity.	T-8 primary open circuit. Power cable open circuit.
Across filament 80.	Continuity.	T-8 filament winding open circuit. Wiring open circuit.

SOCKET VOLTAGES.

Valve	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Heater Volts
6A7 Converter	3.0	55	240	1.5	6.3
,, Oscillator	—	—	170	3.0	—
6D6 I.F. Amplifier	3.0	55	240	3.0	6.3

Valve.	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Heater Volts
6B7 Reflex Amplifier	1.5	30*	60*	1.0	6.3
42 Pentode	14.5	240	220	30.0	6.3
80 Rectifier	600/300 volts 50 M.A. total current				5.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volts A.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	2028	Aerial Coil, 200-550 Metres
T2	2028	Aerial Coil, 19-50 Metres
T3	2029	Osc. Coil, 200-550 Metres
T4	2029	Osc. Coil, 19-50 Metres
T5	1524	First I.F. Transformer
T6	1525	Second I.F. Transformer
T7	1531	Third I.F. Transformer
T8	1517	Power Transformer, 50~
	1518	Power Transformer, 40~
	1519	Power Transformer, 110 Volts
		RESISTORS.
R1		100,000 ohms, ⅛ watt
R2		2,000 ohms, ⅛ watt
R3		900 ohms, ⅛ watt
R4		40,000 ohms, 1 watt
R5		30,000 ohms, 1 watt
R6		600 ohms, ⅛ watt
R7		60,000 ohms, ⅛ watt
R8		20,000 ohms, ⅛ watt
R9		300 ohms, ⅛ watt
R10		600 ohms, ⅛ watt
R11		100,000 ohms, ⅛ watt
R12		500,000 ohms, ⅛ watt
R13		2,000 ohms, ⅛ watt
R14		1¾ Megohms, ⅛ watt
R15	1668	300,000 ohms, Volume Cont.
R16		300,000 ohms, ⅛ watt
R17		100,000 ohms, 1 watt
R18		300,000 ohms, ⅛ watt
R19		400 ohms, 1 watt

Code	Part No.	CONDENSERS.
C1		5-20 mmf. Mica Trimmer
C2		5-20 mmf. Mica Trimmer
C3		.05 mf. Paper Cond.
C4	1514	Variable Condenser
C5		.1 mf. Paper Cond.
C6		.05 mf. Paper Cond.
C7		50 mmf. Mica Cond.
C8		130 mmf. Mica Cond.
C9		10-50 mmf. Mica Trimmer
C10		10-50 mmf. Mica Trimmer
C11		130 mmf. Mica Cond.
C12		.05 mf. Paper Cond.
C13	1592	10-50 mmf. Mica Trimmer
C14	1592	390 mmf. Mica Padding Cond.
C15		5-20 mmf. Mica Trimmer
C16		2,800 mmf. Mica Padding Cond
C17		5-20 mmf. Mica Trimmer
C18	1514	Variable Condenser
C19		.1 mf. Paper Cond.
C20		130 mmf. Mica Cond.
C21		10-50 mmf. Mica Trimmer
C22		10-50 mmf. Mica Trimmer
C23		130 mmf. Mica Cond.
C24		.1 mf. Paper Cond.
C25		200 mmf. Mica Cond.
C26		.01 mf. Paper Cond.
C27		5 mf. 25 V. Elect. Cond.
C28		200 mmf. Mica Cond.
C29		130 mmf. Mica Cond.
C30		10-50 Mica Trimmer
C31		700 mmf. Mica Cond.

Code	Part No.	CONDENSERS.
C32		.01 mf. Paper Cond.
C33		5 mf. 25 V. Elect. Cond.
C34		.03 mf. Paper Cond.
C35		.05 mf. Paper Cond.
C36		.1 mf. Paper Cond.
C37		.5 mf. Paper Cond.
C38	1570	8 mf. 500 V. Elect. Cond.
C39	1570	8 mf. 500 V. Elect. Cond.
C40		10 mmf. Mica Cond. in parallel with C2

Fig. 11.—Circuit data (33).

Radiolette 35

ELECTRICAL SPECIFICATIONS.

"A" Battery	2 Volts (0.60 amps.)
(Dial lamp off 0.54 amps.)	
"B" Battery	120 Volts 10-12 M A
"C" Battery	4½ Volts Bias
Tuning range	200-550 Metres
Intermediate frequency	460KC.
Loudspeaker .... (Permanent Magnet)	Type D50.
Loudspeaker Audio Transformer	Type T.G.3A.

VALVES AND CIRCUITS.

1C6 Detector Osciliator.
1C4 I.F. Amplifier.
1B5 Detector A.V.C. and Audio Amplifier.
1D4 Output Pentode.

GENERAL CIRCUIT DESCRIPTION.

The Radiolette 35 is a "Medium Wave" four valve battery operated receiver.

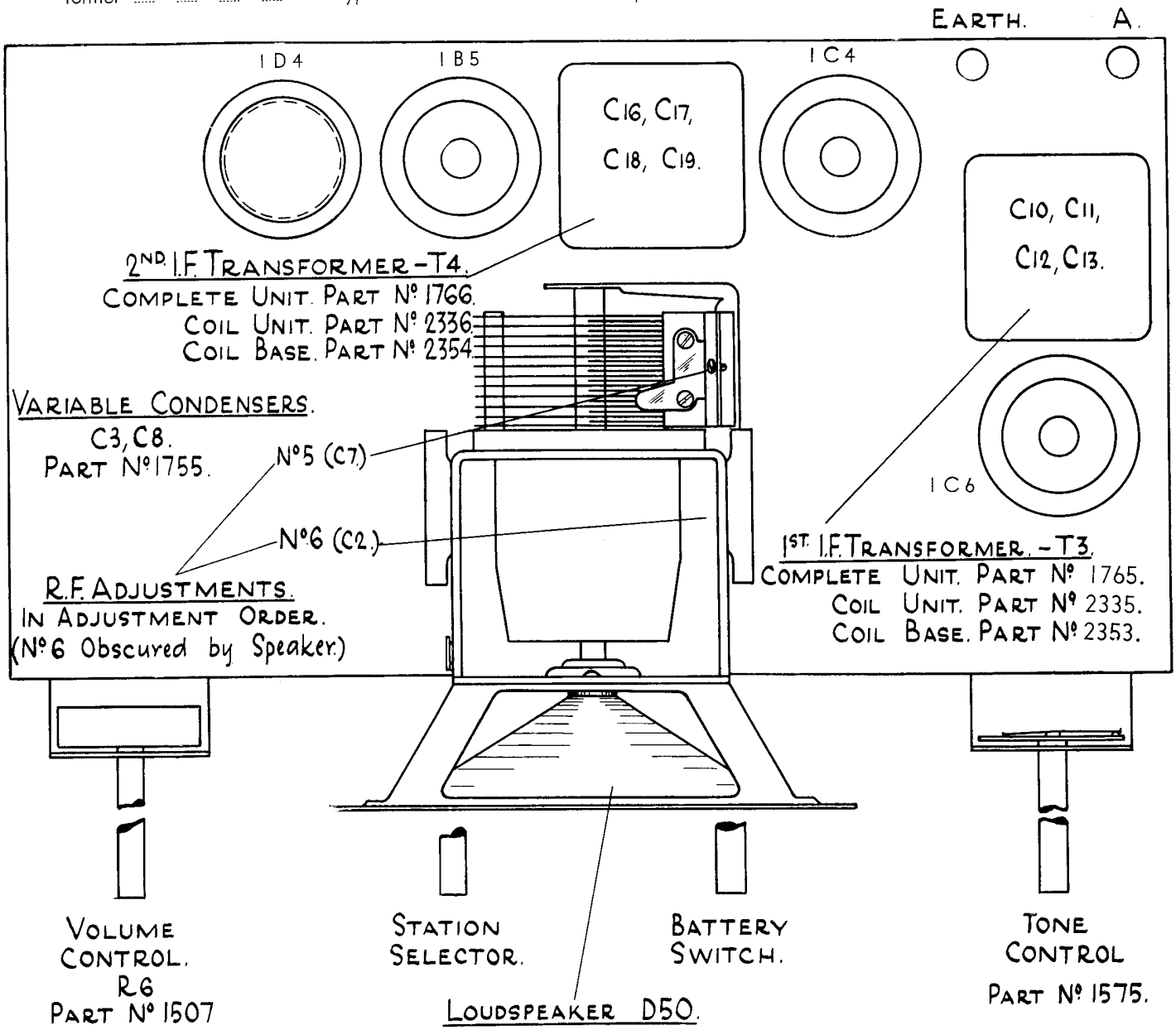


Fig. 12.—Layout diagram (top view), (35).

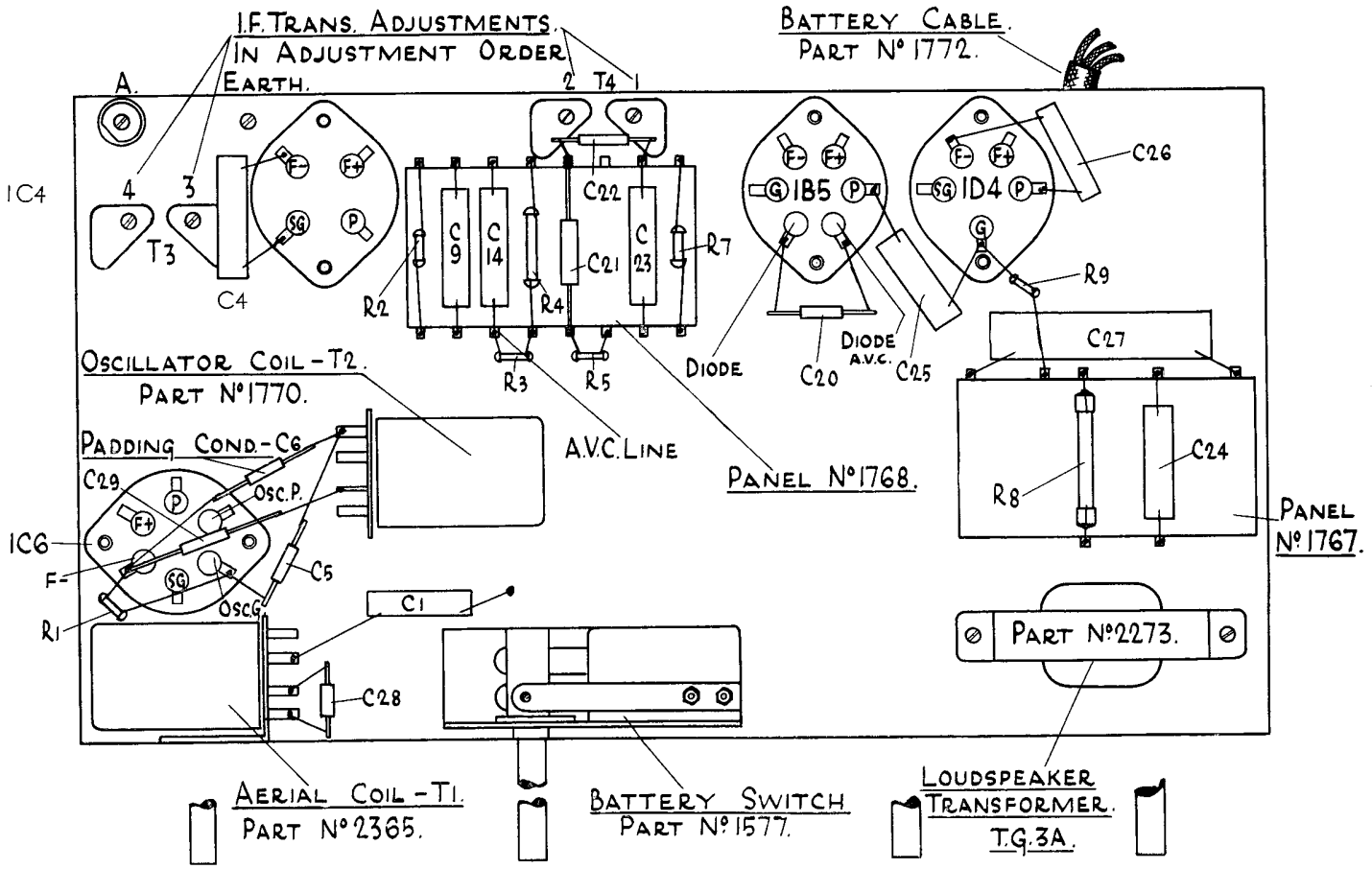


Fig. 13.—Layout diagram (underneath view), (35).

The tuning range of the instrument is from 200-550 meters (1500-550 kilocycles).

The incoming signal, on entering the receiver from the aerial, is coupled to the control grid of the 1C6 converter by the aerial coil (T-1), the secondary of which is tuned by the rear unit of the variable condenser (C-3). In the 1C6, the R.F. signal is combined with the local oscillator signal, which is 460 kilocycles higher in frequency than the incoming signal; the oscillator coil (T-2) in conjunction with a unit of the variable condenser (C-8) and padding condenser (C-6) keep this difference in frequency constant throughout the tuning range of the receiver. The intermediate frequency of 460 kilocycles, to which both the primaries and secondaries of the I.F. transformers (T-3) and (T-4) are tuned, is produced by the combination of the two signals within the 1C6 converter.

The I.F. signal, in the plate circuit of the 1C6, is applied to the control grid of the 1C4 I.F. amplifier by the secondary of the first I.F. transformer (T-3). The I.F. signal is amplified in the 1C4 and is applied by the secondary of the second I.F. transformer (T-4) to one diode of the 1B5 second detector for rectification across Resistors R-5 and R-6. A signal is transferred (via C-20) to the other diode of the 1B5, and a D.C. voltage is produced in this circuit (across R-4), proportional to the signal being received. This voltage is applied as a bias voltage to the control grids of the 1C6 converter and 1C4 I.F. amplifier valves for automatic volume control.

An audio signal is developed across R-6 (volume control), and as R-6 is a control of variable resistance, the amount of audio signal applied to the control grid of the 1B5 (via C-23) may be controlled as desired. The audio signal is amplified in the 1B5 and thence is transferred through a resistance-capacitance coupling circuit to the control grid of the 1D4 output pentode, where it is again amplified to a suitable magnitude for reproduction.

The output of the 1D4 is matched to the loudspeaker by the step-down transformer T.G. 3A mounted beneath the chassis.

The tone control is a two point switch, which connects a .01 mfd condenser (C-24) between the plate of the 1B5 and earth.

I.F. ALIGNMENT.

This receiver has a single I.F. stage including two I.F. transformers which are tuned to resonance 460 K.C. by four trimmer condensers. Reference to fig. 13 will show the adjustments in their adjustment order (1, 2, 3, 4). I.F. alignment instructions in detail appear on page 6.

R.F. ALIGNMENT.

The R.F. adjustments (Nos. 5 and 6) are situated on the variable condenser. Refer to fig. 12 for their location and adjustment order. Detailed R.F. alignment instructions appear on page 7.

CONTINUITY TESTING SCHEDULE RADIOLETTE 35.

N.B. All readings to be made with the batteries disconnected, valves withdrawn, and battery switch **on**, unless stated to the contrary.

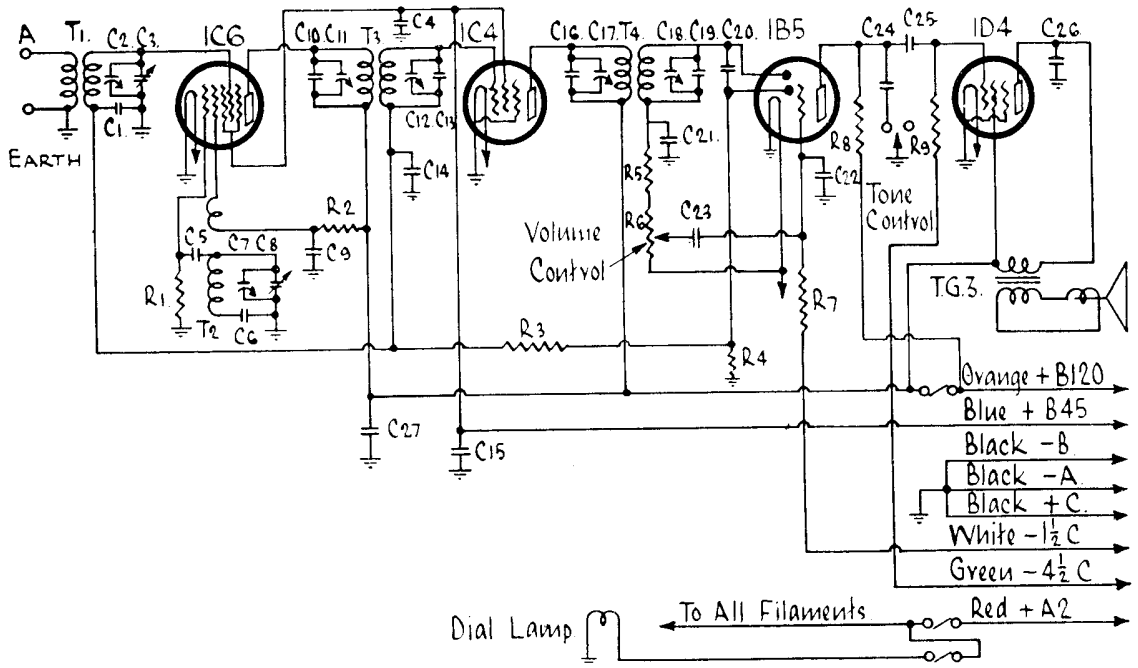
TEST BETWEEN	CORRECT READING	PROBABLE CAUSE OF IRREGULAR READING.
Aerial terminal to chassis.	Continuity.	T-1 primary open circuit.
Plate 1D4 output pentode to chassis.	No reading.	C-26 short circuit.
Frame of variable condenser to chassis.	Continuity.	Earth connection to C-3, C-8 open circuit.
A.V.C. diode plate 1B5 second detector (see fig. 13) to chassis.	No reading ($1\frac{3}{4}$ megohms)	R-4 short circuit or open circuit.
C+ (black) battery cable to chassis.	Continuity.	Wiring open circuit.
B— (black) battery cable to chassis.	Continuity.	Wiring open circuit.
B+ 120V (orange) battery cable to chassis.	No reading.	C-9, C-26, C-27 short circuit.
B+ 45V (blue) battery cable to chassis.	No reading.	C-4, C-15 short circuit.
A— (black) battery cable to chassis.	Continuity.	Wiring open circuit.
Oscillator grid 1C6 converter to chassis.	60,000 ohms	R-1 short circuit or open circuit.
Control grid clip 1C4 I.F. amplifier or control grid clip 1C6 converter to chassis.	No reading.	C-1 or C-14 short circuit.
A+ (red) battery cable to F+ all valves.	Continuity.	Wiring open circuit.
A+ (red) battery cable to centre contact on dial holder with dial lamp section of switch **on.**	Continuity.	Faulty dial lamp section of switch.
B+ 120V (orange) battery cable to plate detector section 1C6 converter.	Continuity.	Battery switch faulty. B+120V cable open circuit. T-3 primary open circuit.
B+ 120V (orange) battery cable to plate oscillator section 1C6 converter.	50,000 ohms.	T-2 primary open circuit. R-2 short circuit or open circuit.
B+ 120V (orange) battery cable to plate 1C4 I.F. amplifier valve.	Continuity.	T-4 primary open circuit.
B+ 120V (orange) battery cable to screen grid 1D4 output pentode.	Continuity.	Wiring open circuit.
B+ 120V (orange) battery cable to plate 1B5 2nd detector with switch off.	250,000 ohms.	R-8 short circuit or open circuit.
B+ 120V (orange) battery cable to plate 1D4 output pentode.	300 ohms (approx.)	Loudspeaker transformer T.G.3A primary open circuit.
B+ 45V (blue) battery cable to screen grid 1C6 converter.	Continuity.	Wiring open circuit.
B+ 45V (blue) battery cable to screen grid 1C4 I.F. amplifier.	Continuity.	Wiring open circuit.
C— $1\frac{1}{2}$V (white) battery cable to control grid 1B5 2nd detector.	No reading ($1\frac{3}{4}$ megohms).	R-7 short circuit or open circuit.
C— $4\frac{1}{2}$V (green) battery cable to control grid 1D4 output pentode.	No reading (500,000 ohms).	R-9 short circuit or open circuit.
Diode rectifier plate 1B5 2nd detector to F+ 1B5.	No reading (600,000 ohms).	T-4 secondary open circuit. Faulty volume control R-6, R-5 short circuit or open circuit.
A.V.C. line (see fig. 13) to grid clips 1C6 converter and 1C4 I.F. amplifier.	Continuity.	T-1 or T-3 secondary open circuit.
Plate 1B5 2nd detector to control grid 1D4 output pentode.	No reading.	C-25 short circuit.
Fixed plates of variable condenser C-8 to coil side of padding condenser C-6.	Continuity.	T-2 secondary open circuit.
A.V.C. diode plate 1B5 to control grid clips 1C6 converter and 1C4 I.F. amplifier.	No reading ($1\frac{3}{4}$ megohms).	R-3 short circuit or open circuit. T-1 secondary open circuit. T-3 secondary open circuit.

SOCKET VOLTAGES.

Valve	Chassis to Control Grid Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P)	Plate Current M.A.	Filament Volts
1C6 Converter	0	45	120	1.0	2.0
,, Oscillator	—	—	55	1.5	—
1C4 I.F. Amplifier	0	45	120	1.5	2.0
1B5 Detector	—1.5*	—	60*	0.25	2.0
1D4 Pentode	—4.5*	120	110	6.0	2.0

* Cannot be measured accurately with ordinary voltmeter.

Measured with controls in maximum clockwise position. No signal input. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	2365	Aerial Coil
T2	1770	Oscillator Coil
T3	2353	First I.F. Transformer
T4	2354	Second I.F. Transformer

Code	Part No.	RESISTORS.
R1		60,000 ohms, ⅓ watt
R2		50,000 ohms, ⅓ watt
R3		1¾ Megohms, ⅓ watt
R4		1¾ Megohms, ⅓ watt
R5		100,000 ohms, ⅓ watt
R6	1507	500,000 ohms, Volume Cont.
R7		1¾ Megohms, ⅓ watt
R8		250,000 ohms, 1 watt
R9		500,000 ohms, ⅓ watt

Code	Part No.	CONDENSERS.
C1		.05 mf. Paper Cond.
C2		10-50 mmf. Mica Trimmer
C3	1755	Variable Condenser
C4		.1 mf. Paper Cond.
C5		50 mmf. Mica Cond.
C6		410 mmf. Mica Padding Cond.
C7		10-50 mmf. Mica Cond.
C8	1755	Variable Condenser
C9		.05 mf. Paper Cond.
C10		50 mmf. Mica Cond.
C11		10-50 mmf. Mica Trimmer
C12		10-50 mmf. Mica Trimmer
C13		50 mmf. Mica Cond.
C14		.05 mf. Paper Cond.
C15		Not used
C16		30 mmf. Mica Cond.
C17		10-50 mmf. Mica Trimmer
C18		10-50 mmf. Mica Trimmer
C19		30 mmf. Mica Cond.
C20		700 mmf. Mica Cond.
C21		200 mmf. Mica Cond.
C22		200 mmf. Mica Cond.
C23		.05 mf. Paper Cond.
C24		.01 mf. Paper Cond.
C25		.05 mf. Paper Cond.
C26		.005 mf. Paper Cond.
C27		.5 mf. Paper Cond.
C28		15 mmf. Coupling Condenser on Aerial Coil
C29		10 mmfd. Condenser across C7

Fig. 14.—Circuit data (35).

Radiola 155

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190 - 260 Volts.
Frequency Rating	50 - 60 Cycles.
(Special instruments made for other voltage and frequency ratings)	
Power Consumption	50 Watts.
Tuning Range	1500-550 Kilocycles.
Intermediate Frequency	175 K.C.
Loudspeaker	Type D40
Loudspeaker Field Coil Resistance	2000 ohms
Loudspeaker Audio Transformer	Type T.A.13Y.

VALVES AND CIRCUITS.

6D6	R.F. Amplifier.
6A7	Detector Oscillator.
6B7	I.F. Amplifier, Detector, A.V.C. and Audio Amplifier.
42	Output Pentode.
80	Rectifier.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 155 is a "Medium Wave" five valve A.C. operated superheterodyne receiver.

This instrument has a tuning range from 1500-550 kilocycles (200-550 metres).

The incoming signal is applied to the control grid of the 6D6 R.F. amplifier, after step up by the aerial coil (T-1), the secondary of which is tuned by the rear section of the variable condenser (C-2). Amplified by the 6D6, the signal is impressed on the grid of the 6A7 converter by the secondary of the R.F. coil (T-2), which is tuned by the centre section of the variable condenser (C-7).

In the 6A7, the R.F. signal is combined (heterodyned) with the oscillator signal, which is 175 kilocycles higher in frequency than the signal being received; this difference in frequency is maintained throughout the tuning range of the receiver by the front section of the variable condenser (C-15) in conjunction with the oscillator coil (T-3) and padding condenser (C-16). The combination of the two signals produces the intermediate frequency of 175 kilocycles to which both the primaries and secondaries of the I.F. transformers (T-4 and T-5) are tuned.

The heterodyne (or beat note) signal, in the plate circuit of the 6A7 is selected by the first I.F. transformer (T-4) to be applied to the control grid of the 6B7 valve. The I.F. signal is amplified in the 6B7 and is applied (via the second I.F. transformer (T-5)) to the diodes of the same valve for rectification across resistors R-12 and R-13. The I.F. signal is by-passed by C-18 in the grid circuit, and by C-24 in the plate circuit of the 6B7. After rectification, the I.F. carrier is filtered by resistor R-13 and condensers C-21 and C-18 (via C-19).

The rectified signal in the diode circuit of the 6B7 produces a D.C. voltage across R-12 and R-13 proportional to the signal being received, and this voltage is applied (via filter R-6 and C-8) as a bias voltage to the control grid circuits of the 6D6 and 6A7 valves to give automatic volume control.

The audio signal across R-12 (volume control) is applied to the control grid of the 6B7 (via coupling condenser C-19), and since R-12 is a variable resistance control, the magnitude of the audio signal applied to the 6B7 may be adjusted as desired. The series and parallel impedances of T-4 and C-18, respectively, are negligible to audio frequencies.

After amplification by the 6B7, the audio signal is transmitted by a resistance-capacity coupling network to the 42 output pentode. I.F. transformer T-5 and condenser C-24 have negligible impedances to audio frequencies.

The output of the 42, which is matched to the loudspeaker by the transformer TA-13Y, is delivered to the loudspeaker through a four lead cable.

The power unit consists of a transformer (T-6), an 80 valve rectifier, and a smoothing circuit consisting of two high capacity condensers (C-30) and (C-31), with the 2000 ohms field of the loudspeaker functioning as a smoothing choke.

The sensitivity control is a two point switch, which connects an additional 3000 ohms resistor (R-3) in series with the normal 900 ohms cathode bias resistor (R-2), on the 6D6 and 6A7 valves.

The tone control circuit consists of a variable control (R-18) connected in a series with a .01 mfd. paper condenser (C-25), between the plate of the 6B7 and earth.

I.F. ALIGNMENT.

This receiver has a single I.F. stage including two I.F. transformers. Trimmer condensers are used across both the primary and secondary windings, making a total of four adjustments at 175 kilocycles. Reference to fig. 16 will show the location of these adjustments, also the order in which they should be aligned (1, 2, 3, 4). I.F. alignment instructions in detail appear on page 6.

R.F. ALIGNMENT.

The R.F. adjustments (Nos. 5, 6, 7) are situated on the variable condenser and reference to fig. 15 will show them in their adjustment order. R.F. alignment instructions in detail appear on page 7.

CONTINUITY TESTING SCHEDULE RADIOLA 155.

N.B.—All reading to be made with valves and loudspeaker withdrawn.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to No. 3 loudspeaker socket.	Continuity.	Wiring open circuit.
Chassis to filament 80.	60,000 ohms.	C-31, C-32, C-5, C-17 or C-27, short circuit. Resistors R-4 and R-5 short circuit or open circuit. Wiring short circuit to chassis.
Chassis to cathode 42 output pentode.	400 ohms.	R-17 short circuit or open circuit. C-28 short circuit.
Chassis to cathode 6B7 second detector.	2000 ohms.	R-11 short circuit or open circuit. C-20 short circuit.
Chassis to control grid 42 output pentode.	300,000 ohms.	R-16 short circuit or open circuit.
Chassis to control grid 6B7 second detector.	No reading ($\frac{1}{2}$ megohm).	T-4 secondary open circuit. C-18 short circuit. R-10 short circuit or open circuit.
Chassis to diode plates 6B7 second detector.	300,000-600,000 ohms with rotation of volume control.	T-5 secondary open circuit. Volume control R-12 faulty. R-13 short circuit or open circuit. C-21 short circuit.
Chassis to oscillator grid 6A7 converter.	60,900 ohms and 63,900 ohms relative to position of sensitivity control.	Padding condenser C-16 short circuit. R-7 short circuit or open circuit.
Chassis to cathodes 6A7 converter and 6D6 R.F. amplifier.	900-3900 ohms relative to position of sensitivity control.	R-2, R-3 short circuit or open circuit. Sensitivity control faulty. C-4 short circuit.
Chassis to AVC line. (See fig. 16.)	No reading (over 2 megohms).	C-3, C-8 short circuit.
Chassis to plate 42 output pentode.	No reading.	C-29 short circuit.
Chassis to frame of variable condenser.	Continuity.	Earth connection to variable condensers C-2, C-7, C-15 open circuit.
Chassis to aerial terminal.	Continuity.	T-1 primary open circuit.
Chassis to front orange lead on panel No. 1545.	Continuity — 250,000 ohms with rotation of tone control.	Tone control R-18 faulty.
Filament 80 to No. 1 loudspeaker socket. (See fig. 16.)	Continuity.	Wiring open circuit.
Filament 80 to plate 6A7 converter.	Continuity.	T-4 primary open circuit.
Filament 80 to screen grid 42 output pentode.	Continuity.	Wiring open circuit.
Filament 80 to plate 6D6 R.F. amplifier.	Continuity.	T-2 primary open circuit.
Filament 80 to oscillator plate 6A7 converter.	20,000 ohms.	T-3 primary open circuit. R-9 short circuit or open circuit.
Filament 80 to plate 6B7 second detector.	125,000 ohms.	T-5 primary open circuit. R-14, R-15, short circuit or open circuit.
Filament 80 to screen grid 6B7 second detector.	90,000 ohms.	R-4, R-8 short circuit or open circuit.
Filament 80 to screen grid 6D6 R.F. amplifier and 6A7 converter.	40,000 ohms.	R-4 short circuit or open circuit.
Plate 42 output pentode to No. 2 loudspeaker socket. See fig. 16.	Continuity.	Wiring open circuit.
Diode plates 6B7 second detector to AVC line.	No reading. ($1\frac{3}{4}$ megohms.)	T-5 secondary open circuit. R-6, R-13 short circuit or open circuit.
AVC line to grid clip 6A7 converter.	Continuity.	T-2 secondary open circuit.
AVC line to control grid clip 6D6 R.F. amplifier.	100,000 ohms.	T-1 secondary open circuit. R-1 short circuit or open circuit.
Plate 6B7 second detector to control grid 42 output pentode.	No reading. ($\frac{1}{2}$ megohm.)	C-26 short circuit.
No. 4 loudspeaker socket (see fig. 16) to each plate 80 separately.	300 ohms.	T-6 secondary open circuit. Wiring open circuit.
Across heaters 6A7 converter.	Continuity.	T-6 heater winding open circuit. Wiring open circuit.
Across power cable.	Continuity.	T-6 primary open circuit. Power cable open circuit.
Across filament 80.	Continuity.	Power transformer T-6 filament winding open circuit. Wiring open circuit.
Across thick pins of loudspeaker plug.	2000 ohms.	Loudspeaker field open circuit or short circuit.
Across thin pins of loudspeaker plug.	570 ohms (approx.).	T.A.13Y. primary open circuit or short circuit. (Loudspeaker transformer.)
Fixed plates of variable condenser C-15 to coil end of padding condenser C-16.	Continuity.	T-3 secondary open circuit.

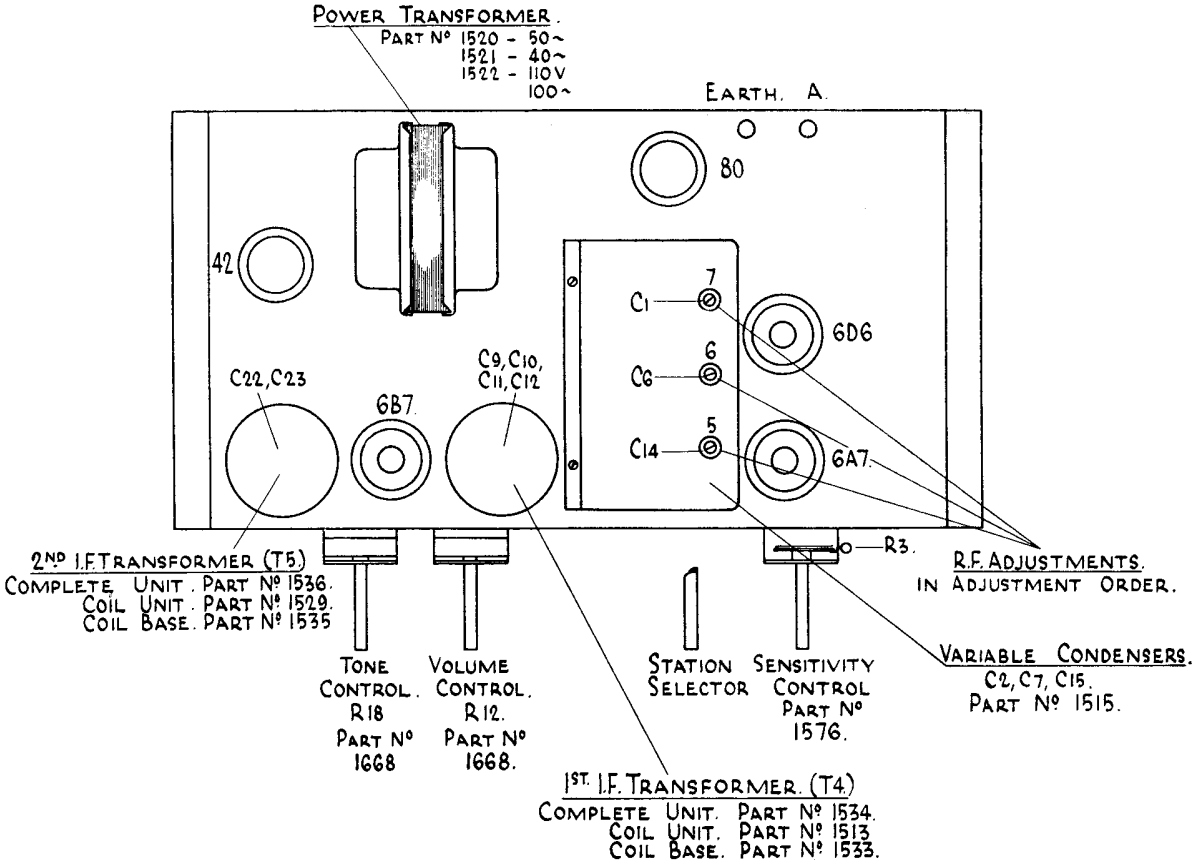


Fig. 15.—Layout diagram (top view), (155).

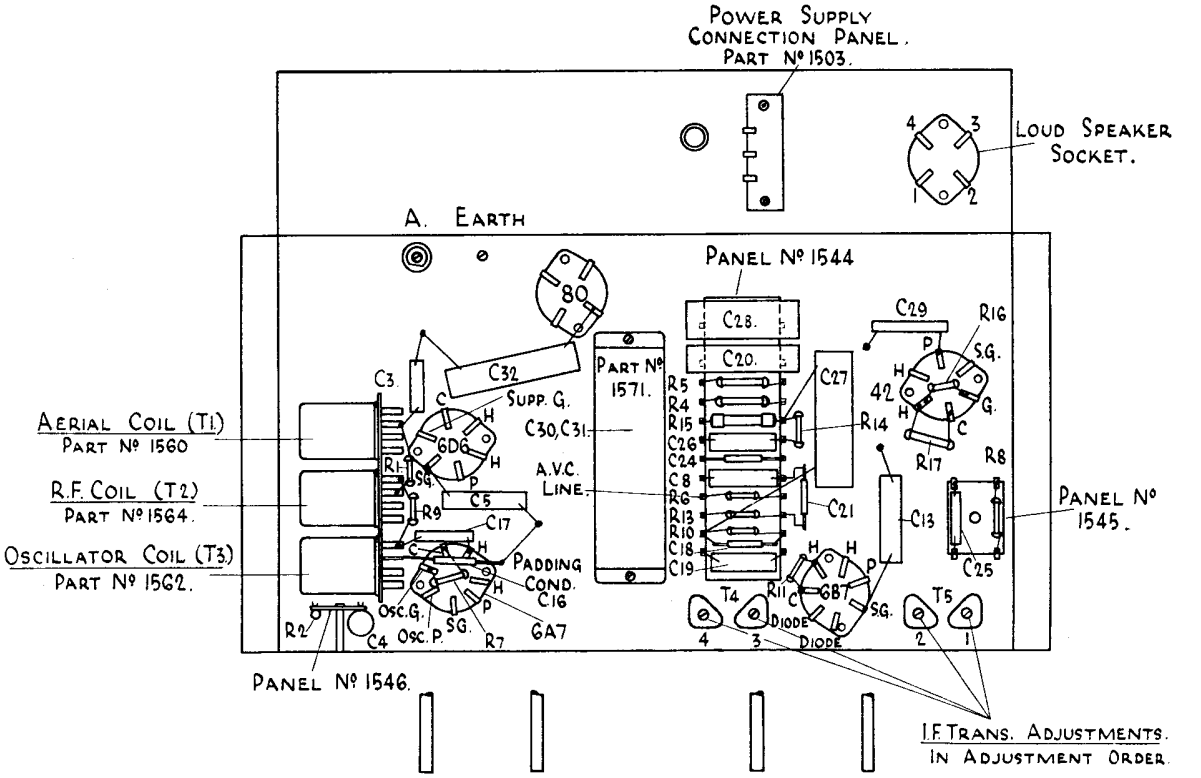
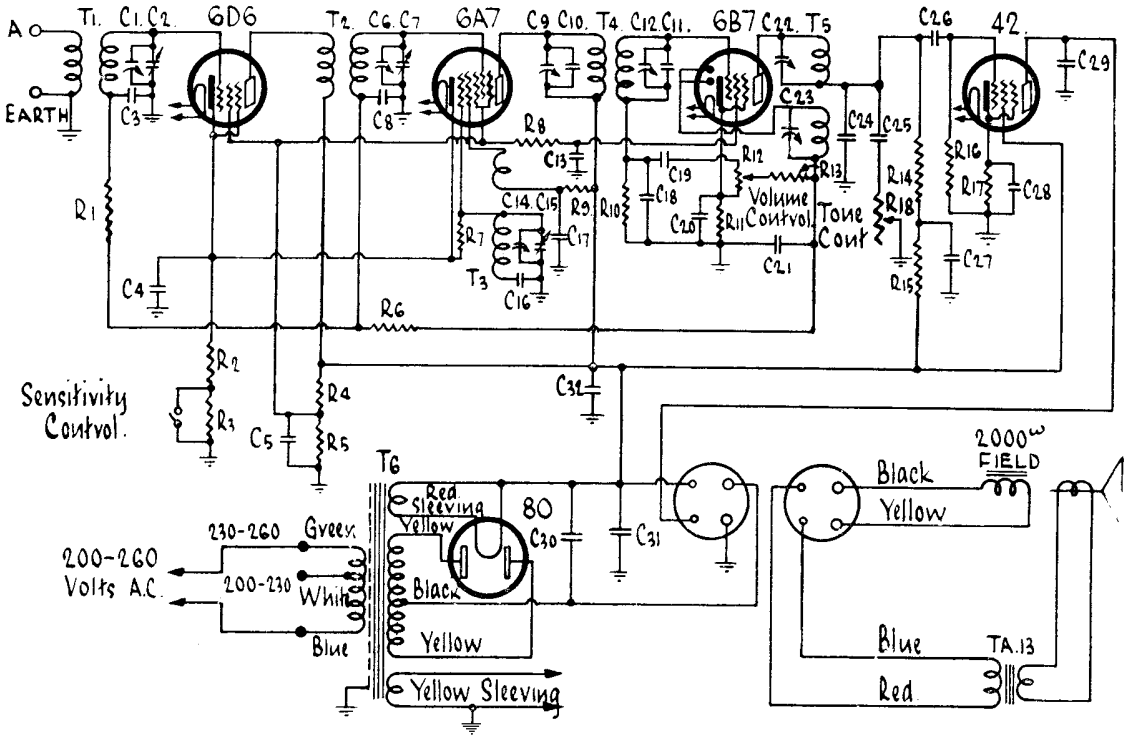


Fig. 16.—Layout diagram (underneath view), (155).

SOCKET VOLTAGES.

Valve	Cathode (C) to Chassis Volts	Screen Grid (SG) to Chassis Volts	Plate (P) to Chassis Volts	Plate Current M.A.	Heater Volts A.C.
6D6 R.F. Amplifier	6.0	55	240	1.0	6.3
6A7 Converter	6.0	55	240	0.5	6.3
,, Oscillator	—	—	170	3.0	—
6B7 Reflex Amplifier	2.0	40	100*	1.0	6.3
42 Pentode	14.5	240	225	30.0	6.3
80 Rectifier	630/315 Volts, 45 M.A. Total Current.				5.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volts A.C. supply. No signal input. Controls in maximum clockwise position. D.C. Voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	1560	Aerial Coil
T2	1564	R.F. Coil
T3	1562	Oscillator Coil
T4	1534	First I.F. Transformer
T5	1536	Second I.F. Transformer
T6	1520	Power Transformer, 50~
	1521	Power Transformer, 40~
	1522	Power Transformer 110 Volts
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		900 ohms, ⅓ watt
R3		3,000 ohms, ⅓ watt
R4		40,000 ohms, 1 watt
R5		20,000 ohms, 1 watt
R6		1¾ Megohms, ⅓ watt
R7		60,000 ohms, ⅓ watt
R8		50,000 ohms, ⅓ watt
R9		20,000 ohms, ⅓ watt
R10		500,000 ohms, ⅓ watt
R11		2,000 ohms, ⅓ watt
R12	1668	300,000 ohms, Volume Control
R13		300,000 ohms, ⅓ watt
R14		100,000 ohms, ⅓ watt
R15		25,000 ohms, 1 watt
R16		300,000 ohms, ⅓ watt
R17		400 ohms, 1 watt
R18		300,000 ohms, Tone Control

Code	Part No.	CONDENSERS.
C1		10-50 mmf. Mica Trimmer
C2	1515	Variable Condenser
C3		.05 mf. Paper Cond.
C4		.1 mf. Paper Cond
C5		.1 mf. Paper Cond.
C6		10-50 mmf. Mica Trimmer
C7	1515	Variable Condenser
C8		.05 mf. Paper Cond.
C9		10-50 mmf. Mica Trimmer
C10		95 mmf. Mica Condenser
C11		85 mmf. Mica Condenser
C12		10-50 mmf. Mica Trimmer
C13		.1 mf. Paper Cond.
C14		10-50 mmf. Mica Trimmer
C15	1515	Variable Condenser
C16		1050 mmf. Mica Padding Cond.
C17		.05 mf. Paper Cond.
C18		200 mmf. Mica Cond.
C19		.05 Paper Cond.
C20		5 mf. 25 V. Elect. Cond.
C21		200 mmf. Mica Cond.
C22		30-70 mmf. Mica Cond. and Trimmer
C23		10-50 mmf. Mica Trimmer
C24		700 mmf. Mica Cond.
C25		.01 mf. Paper Cond.
C26		.05 mf. Paper Cond.
C27		.5 mf. Paper Cond.
C28		25 mf. 25 V. Elect. Cond.
C29		.005 mf. Paper Cond.

Code	Part No.	CONDENSERS.
C30	1571	8 mf. 500 V. Elect. Cond.
C31	1571	8 mf. 500 V. Elect. Cond.
C32		.5 mf. Paper Cond.

Fig. 17.—Circuit data (155).

Radiola 156

ELECTRICAL SPECIFICATIONS.

"A" Battery	6 Volts (0.79 Amps.)
(Dial Lamp off, 0.54 Amps.)	
"B" Battery	135 Volts, 10-12 M.A.
Tuning Range	1500-550 Kilocycles.
Intermediate Frequency	175 K.C.
Loudspeaker .... (Permanent Magnet)	Type D51.
Loudspeaker Audio Transformer	Type TA31Y.

VALVES AND CIRCUITS.

1C4 R.F. Amplifier.
1C6 Detector Oscillator.
6B7 I.F. Amplifier Detector A.V.C. and Audio Amplifier.
1D4 Output Pentode.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 156 is a four valve "Medium Wave" six-volt battery operated receiver.

The signal from the aerial enters the receiver through the aerial coil (T-1) and is applied to the control grid of the 1C4 R.F. amplifier. The secondary of the aerial coil is tuned by the rear unit of the variable condenser (C-2). The output of the R.F. amplifier is coupled to the control grid of the 1C6 converter by the R.F. coil (T-2), the secondary of which is tuned by the centre unit of the variable condenser (C-6). A local signal, which is 175 kilocycles higher in frequency than the incoming signal, is generated within the 1C6 converter; the oscillator coil (T-3), in conjunction with the variable condenser (C-10) and padding condenser (C-11), has been designed to maintain this frequency separation throughout the tuning range of the receiver.

The combination of the local oscillator signal with the R.F. signal produces the intermediate frequency of 175 K.C., to which both the primaries and the secondaries of the I.F. transformers (T-4 and T-5) are tuned. The I.F. signal, in the plate circuit of the 1C6 converter, is selected by the first I.F. transformer (T-4) to be applied to the control grid of the 6B7 valve. After amplification by the 6B7, the I.F. signal is applied (via the second I.F. transformer T-5) to one diode of the same valve for rectification across resistors R-9 and R-10. The I.F. signal is by-passed in the grid circuit of the 6B7 by C-18, and in the plate circuit by C-26. After rectification, the I.F. carrier is filtered by resistor R-10, and condensers C-21 and C-18 (via C-17).

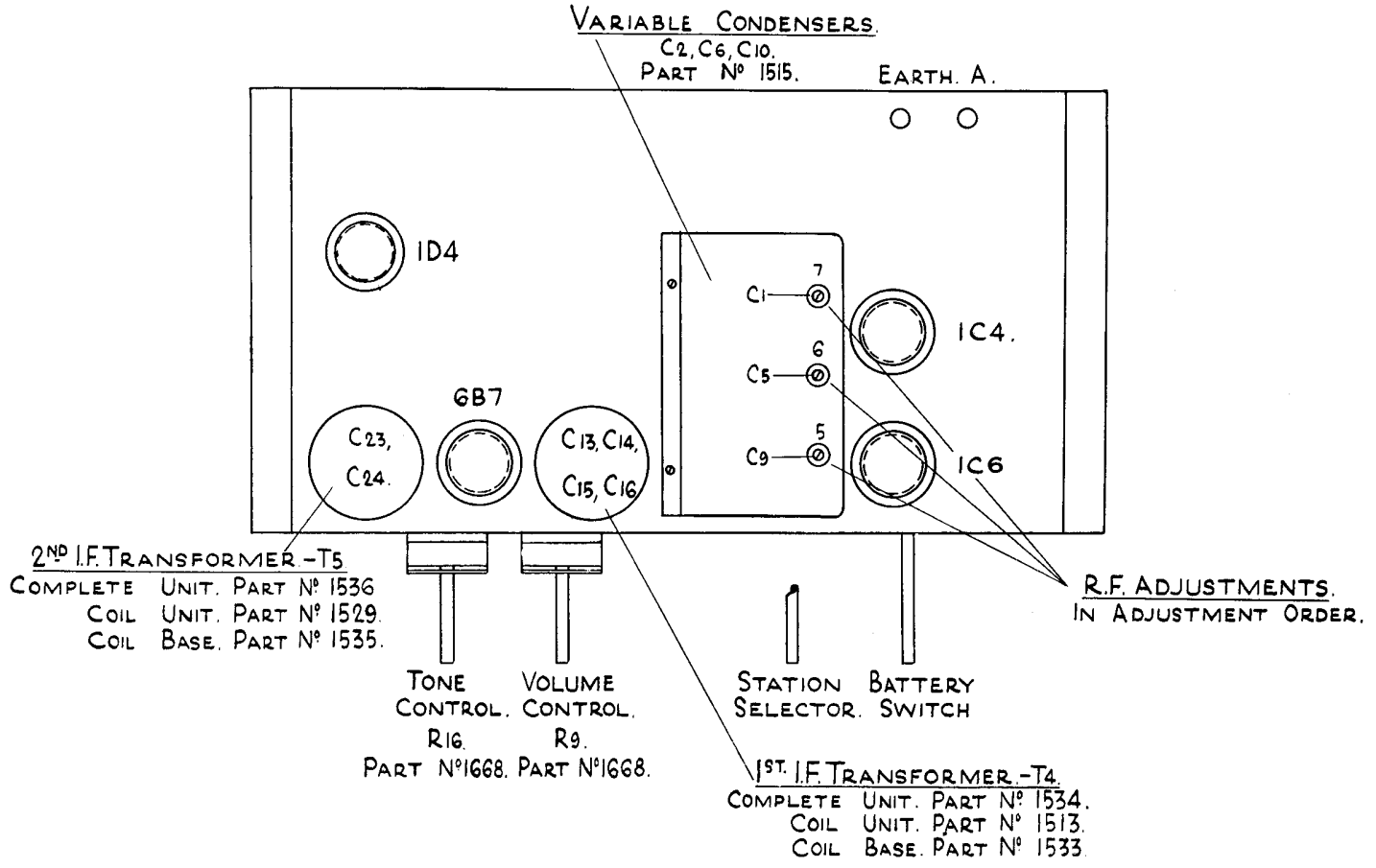


Fig. 18.—Layout diagram (top view), (156).

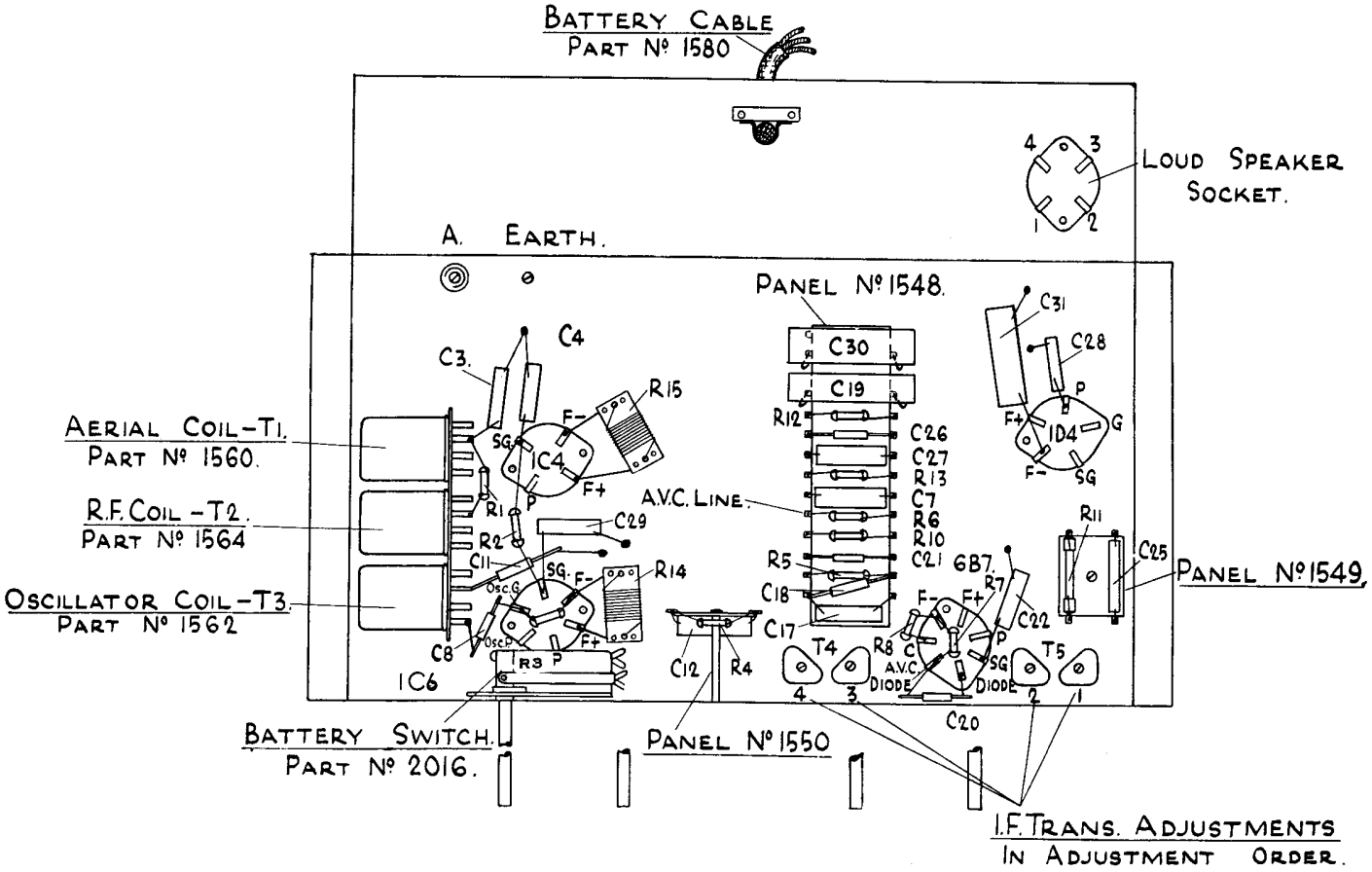


Fig. 19.—Layout diagram (underneath view), (156).

A signal is transferred to the other diode of the 6B7 (through C-20), and a D.C. voltage is produced in this circuit (across R-7) proportional to the signal being received. This voltage is applied (via filter R-6 and C-7) to the control grid circuits of the 1C4 and 1C6 valves for automatic volume control.

The audio signal across R-9 (volume control) is applied to the control grid of the 6B7 (via coupling condenser C-17), and since R-9 is a variable resistance control, the magnitude of the audio signal applied to the 6B7 may be adjusted as desired. The series and parallel impedances of T-4 and C-18, respectively, are negligible to audio frequencies. The audio signal applied to the 6B7 is amplified by the valve, and is transmitted by a resistance capacity network to the 1D4 output pentode to be amplified again for reproduction by the permanent magnet loudspeaker. The output of the 1D4, which is matched to the loudspeaker by the transformer TA31Y, is delivered to the loudspeaker through a two lead cable.

The tone control circuit consists of a variable control (R-16) in series with a .01 mfd. paper condenser, connected between the plate of the 6B7 and earth.

A study of the circuit diagram (fig. 20) will show that the filaments of the 1C4, 1C6, and 1D4 are connected in series. To equalise the filament current drain of the 1C4 and 1C6 valves with that of the 1D4, resistors R-14 and R-15 are connected across the filaments of the 1C4 and 1C6.

I.F. ALIGNMENT.

This receiver has one I.F. stage, which includes two I.F. transformers (T-4 and T-5). The primaries and secondaries of these transformers are tuned to resonance (175 K.C.) by compression type trimmer condensers, making a total of four adjustments.

Fig. 19 shows the location of these adjustments and their adjustment order—1, 2, 3, 4.

Detailed I.F. alignment instructions appear on page 6.

R.F. ALIGNMENT.

The R.F. adjustments are situated on the variable condenser, and fig. 18 shows them in their adjustment order—5, 6, 7. R.F. alignment instructions appear on page 7.

SOCKET VOLTAGES.

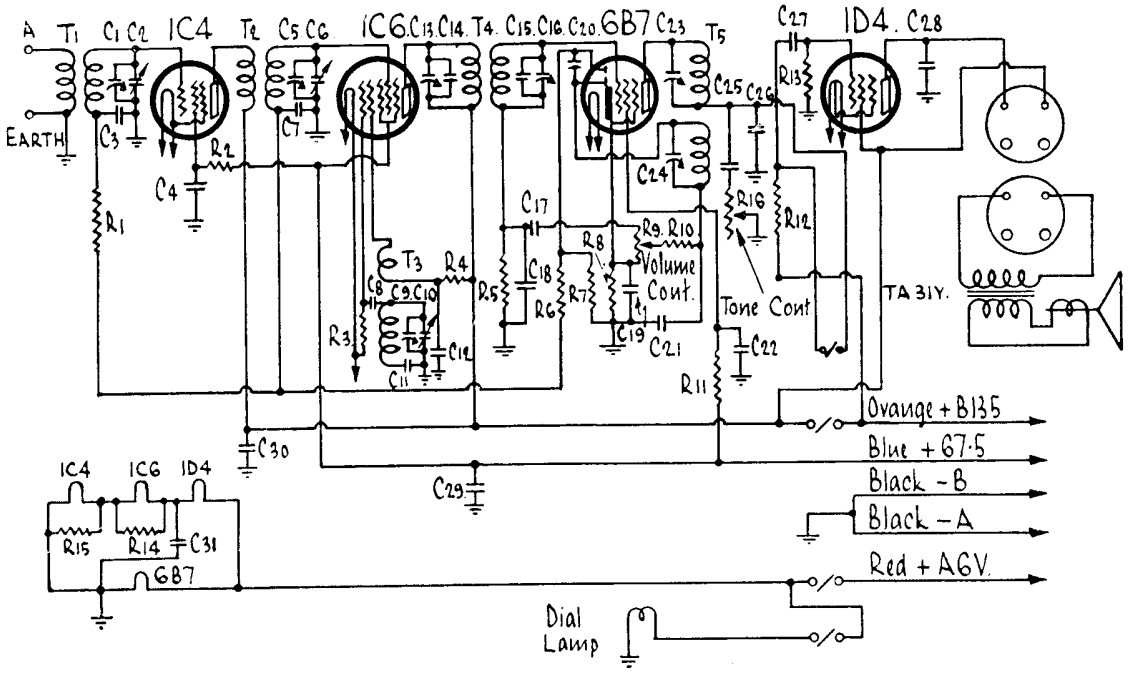
Valve.	Chassis to Negative Filament or Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Filament or Heater Volts
1C4 R.F. Amplifier ...	0	30*	135	1.0	2.0
1C6 Converter	2	67.5	135	2.0	2.0
,, Oscillator	—	—	70	1.5	—
6B7 Reflex Amplifier	1	30*	60*	0.5	6.0
1D4 Pentode	4	135	125	6.0	2.0

* Cannot be measured accurately with ordinary voltmeter. Measured with controls in maximum clockwise position. No signal input. D.C. voltmeter used as suggested on page 3.

CONTINUITY TESTING SCHEDULE RADIOLA 156.

N.B.—All readings to be made with batteries disconnected, valves and loudspeaker withdrawn, and battery switch **on**, unless stated to the contrary.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to A— (black) battery cable.	Continuity.	Wiring open circuit.
Chassis to B+ 135 V. (orange) battery cable.	No reading.	C-12, C-26, C-30 short circuit. Wiring short circuit to chassis.
Chassis to B+ 67½ V. (blue) battery cable.	No reading.	C-4, C-22, C-29 short circuit. Wiring short circuit to chassis.
Chassis to B— (black) battery cable.	Continuity.	Wiring open circuit.
Chassis to control grid 6B7.	No reading. (½ megohm).	T-4 secondary open circuit. R-5 short circuit or open circuit. C-18 short circuit.
Chassis to frame of variable condensers.	Continuity.	Earth connections to C-2, C-6, C-10 open circuit.
Chassis to plate 1D4 output pentode.	No reading.	C-28 short circuit.
Chassis to A.V.C. line (see fig. 19).	No reading. (over 3 megohms).	C-3, C-7 short circuit.
Chassis to orange lead on front of panel No. 1549.	Continuity — 250,000 ohms with rotation of tone control.	Tone control (R-16) faulty.
Chassis to aerial terminal.	Continuity.	T-1 primary open circuit.
Chassis to cathode 6B7.	2,000 ohms.	R-8 short circuit or open circuit. C-19 short circuit.
Chassis to diode rectifier plate 6B7.	300,000-600,000 ohms with rotation of volume control.	T-5 secondary open circuit. R-10 short circuit or open circuit. Volume control (R-9) faulty. C-19, C-21 short circuit.
Chassis to control grid 1D4 output pentode.	No reading. (½ megohm).	R-13 short circuit or open circuit.
B+ 135 V. (orange) battery cable to plate 1C4 R.F. amplifier.	Continuity.	T-2 primary open circuit. B+ 135V battery cable open circuit. Battery switch faulty.
B+ 135 V. (orange) battery cable to oscillator plate 1C6 converter.	50,000 ohms.	T-3 primary open circuit. R-4 short circuit or open circuit.
B+ 135 V. (orange) battery cable to plate 1C6 converter.	Continuity.	T-4 primary open circuit.
B+ 135 V. (orange) battery cable to plate 6B7.	100,000 ohms.	T-5 primary open circuit. R-12 short circuit or open circuit. Battery switch faulty.
B+ 135 V. (orange) battery cable to screen grid 1D4 output pentode.	Continuity.	Wiring open circuit.
B+ 135 V. (orange) battery cable to No. 2 loudspeaker socket. (See fig. 19.)	Continuity.	Wiring open circuit.
B+ 67½ V. (blue) battery cable to screen grid 1C4 R.F. amplifier.	100,000 ohms.	R-2 short circuit or open circuit. Wiring open circuit.
B+ 67½ V. (blue) battery cable to screen grid 1C6 converter.	Continuity.	Wiring open circuit.
B+ 67½ V.(blue) battery cable to screen grid 6B7.	250,000 ohms.	R-11 short circuit or open circuit.
A+ red battery cable to F+ 6B7.	Continuity.	Filament wiring open circuit. A+ (red) battery cable open circuit. Battery switch faulty.
Across filament prongs 1C4 socket.	16 ohms.	R-15 short circuit or open circuit.
Across filament prongs 1C6 socket.	16 ohms.	R-14 short circuit or open circuit.
Connection between 1C6 and 1C4 filaments to chassis.	32 ohms.	C-31 short circuit.
A+ (red) battery cable to centre contact of dial lamp holder (with dial lamp section of battery switch on).	Continuity.	Dial lamp section of battery switch faulty.
A.V.C. line to control grid clip 1C6 converter.	Continuity.	T-2 secondary open circuit.
A.V.C. line to control grid clip 1C4 R.F. amplifier.	100,000 ohms.	R-1 short circuit or open circuit.
A.V.C. line to A.V.C. diode 6B7. (See fig. 19.)	No reading. (1¾ megohm).	R-6 short circuit or open circuit.
Fixed plates of variable condenser C-10 to coil end of padding condenser (C-11).	Continuity.	T-3 secondary open circuit.
Plate 6B7 to control grid 1D4 output pentode.	No reading.	C-27 short circuit.
Connection between 1C6 and 1C4 filaments to oscillator grid 1C6 converter.	60,000 ohms.	R-3 short circuit or open circuit.
Across thin pins loudspeaker plug.	700 ohms. (approx).	T.A. 31Y primary open circuit (loudspeaker transformer).



Code	Part No.	COILS.
T1	1560	Aerial Coil
T2	1564	R.F. Coil
T3	1562	Oscillator Coil
T4	1534	First I.F. Transformer
T5	1536	Second I.F. Transformer
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		100,000 ohms, ⅓ watt
R3		60,000 ohms, ⅓ watt
R4		50,000 ohms, ⅓ watt
R5		500,000 ohms, ⅓ watt
R6		1¾ Megohms ⅓ watt
R7		1¾ Megohms, ⅓ watt
R8		2,000 ohms, ⅓ watt
R9	1668	300,000 ohms, Volume Cont.
R10		300,000 ohms, ⅓ watt
R11		250,000 ohms, 1 watt
R12		100,000 ohms, ⅓ watt
R13		500,000 ohms, ⅓ watt
R14		16 ohms, Wire Wound
R15		16 ohms, Wire Wound
R16	1668	300,000 ohms, Tone Cont.

Code	Part No.	CONDENSERS.
C1		10-50 mmf. Mica Trimmer
C2	1515	Variable Condenser
C3		.05 mf. Paper Cond.
C4		.1 mf. Paper Cond.
C5		10-50 mmf. Mica Trimmer
C6	1515	Variable Condenser
C7		.05 mf. Paper Cond.
C8		50 mmf. Mica Cond.
C9		10-50 mmf. Mica Trimmer
C10	1515	Variable Condenser
C11		1050 mmf. Padding Cond.
C12		.1 mf. Paper Cond.
C13		10-50 mmf. Mica Trimmer
C14		85 mmf. Mica Cond.
C15		85 mmf. Mica Cond.
C16		10-50 mmf. Mica Trimmer
C17		.05 mf. Paper Cond.
C18		200 mmf. Mica Cond.
C19		5 mf. 25 V. Elect. Cond.
C20		700 mmf. Mica Cond.
C21		200 mmf. Mica Cond.
C22		.1 mf. Paper Cond.
C23		30-70 mmf. Mica Cond. & Trim.
C24		10-50 mmf. Mica Trimmer
C25		.005 mf. Paper Cond.
C26		700 mmf. Mica Cond.
C27		.05 mf. Paper Cond.

Code	Part No.	CONDENSERS.
C28		.005 mf. Paper Cond.
C29		.1 mf. Paper Cond.
C30		.5 mf. Paper Cond.
C31		.5 mf. Paper Cond.

Fig. 20.—Circuit data (156).

Radiola 157

ELECTRICAL SPECIFICATIONS.

"A" Battery	2 Volts (0.72 Amps) (Dial lamp off 0.66 Amps.)
"B" Battery	135 Volts 12-14 M.A.
"C" Battery	4½ Volts Bias
Tuning Range	1500-550 Kilocycles
Intermediate Frequency	175KC.
Loudspeaker .... (Permanent Magnet)	Type D51
Loudspeaker audio Transformer	Type T.A.31Y

VALVES AND CIRCUITS.

1C4 R.F. Amplifier.
1C6 Detector Oscillator.
1C4 I.F. Amplifier.
1B5 Detector, AVC and Audio Amplifier.
1D4 Output Pentode.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 157 is a "Medium Wave" five valve battery operated superheterodyne receiver with a tuning coverage of 1500-550 kilocycles (200-550) metres.

The input from the aerial is coupled to the grid circuit of the 1C4 R.F. amplifier through the aerial coil (T-1), the secondary of which is tuned by the rear unit of the variable condenser (C-2). The output of the 1C4 is coupled to the grid circuit of the 1C6 converter by the radio frequency coil (T-2). The secondary of T-2 is tuned by the centre unit of the variable condenser (C-5). A local signal, which is 175 kilocycles higher in frequency than the incoming signal, is generated within the oscillator elements of the 1C6, the oscillator coil (T-3), in conjunction with the variable condenser (C-9) and padding condenser (C-10), has been designed to maintain this frequency separation.

The combining of these two frequencies produces the I.F. signal (175 K.C.) which appears in the plate circuit of the

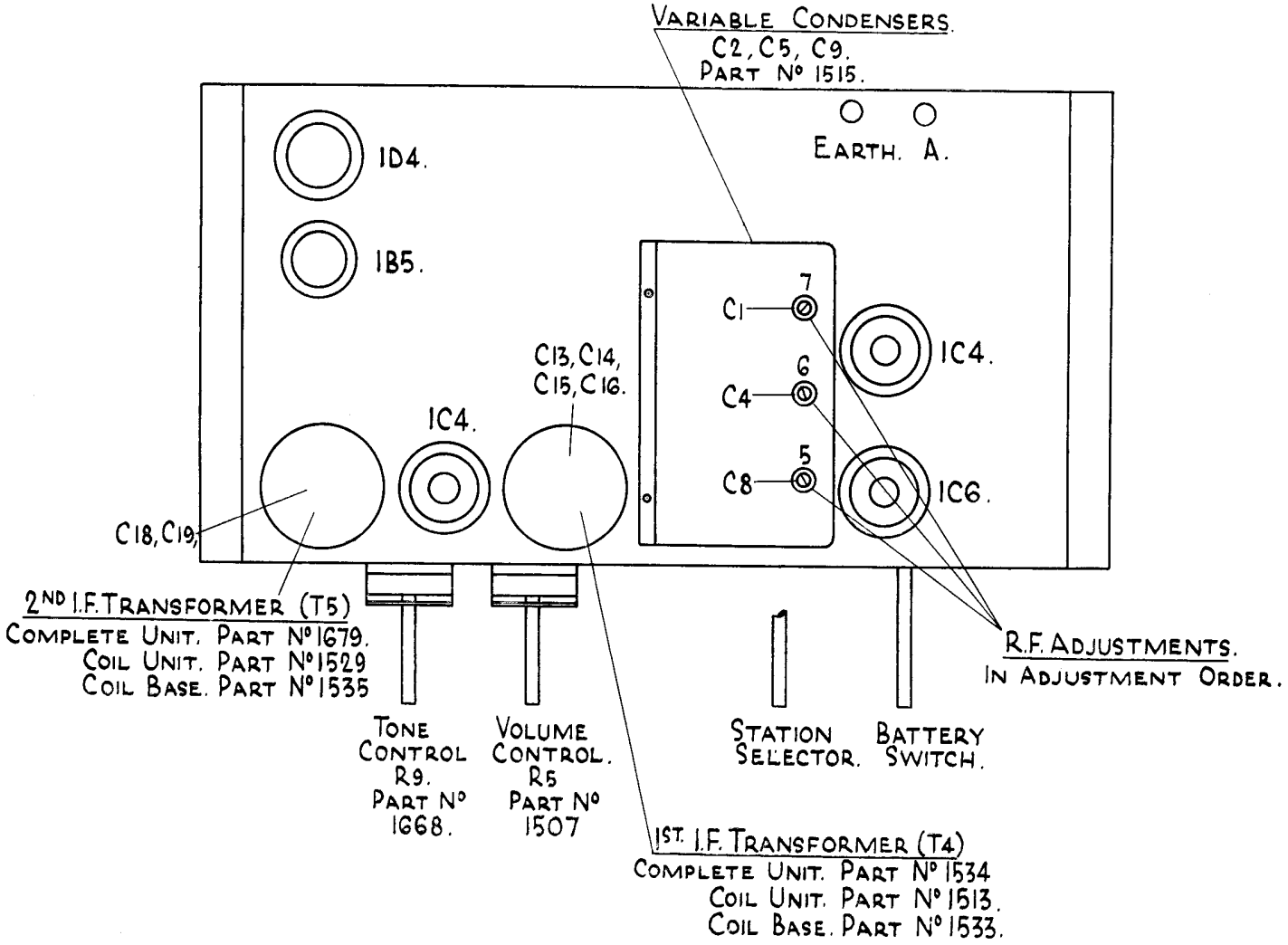


Fig. 21.—Layout diagram (top view), (157).

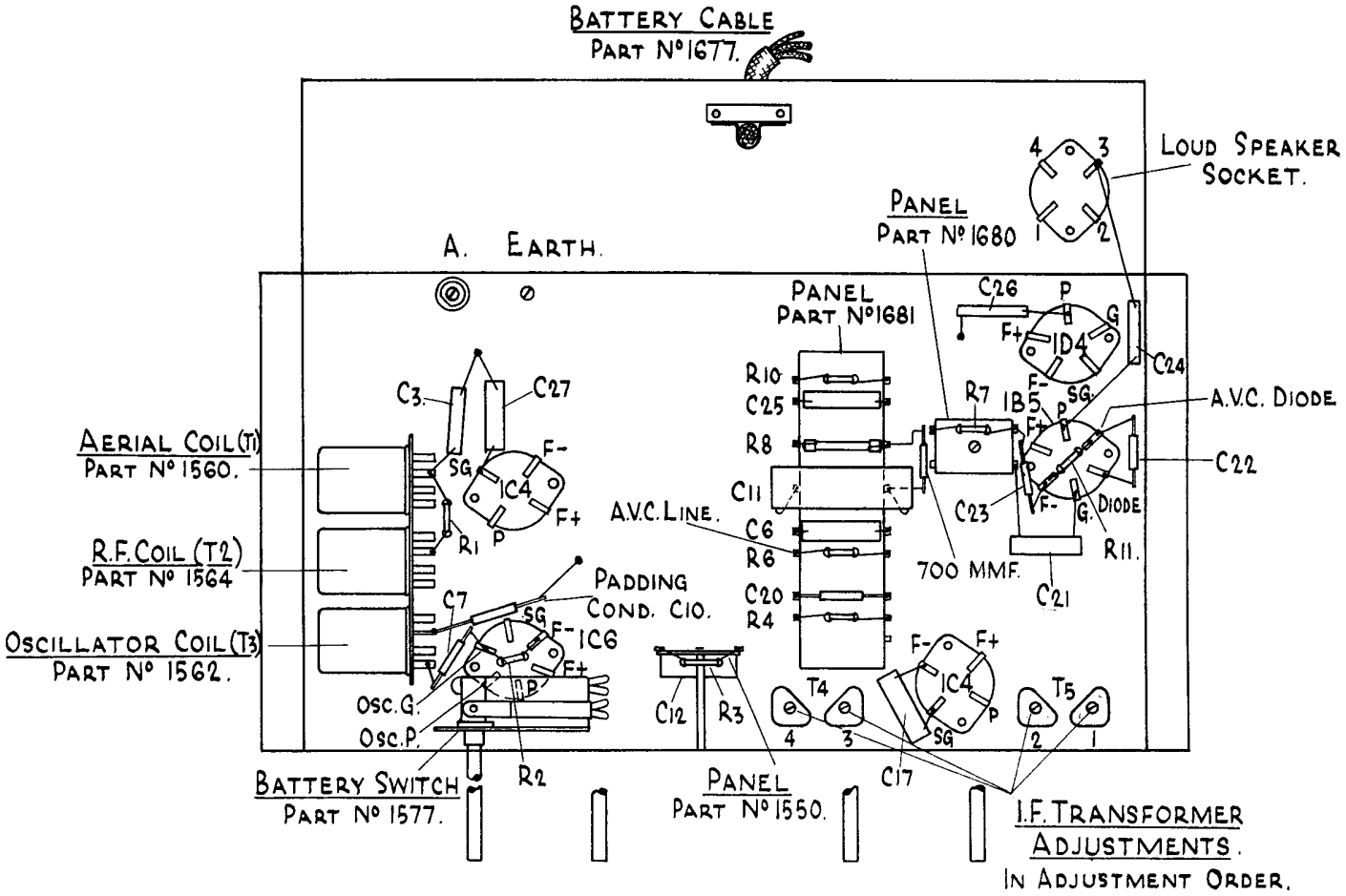


Fig. 22.—Layout diagram (underneath view), (157).

1C6 converter. The plate circuit of the converter, the grid circuit of the I.F. amplifier, the plate circuit of the I.F. amplifier, and the diode rectifier circuit of the second detector are all tuned to 175 K.C. The I.F. signal in the plate circuit of the 1C6 converter is applied to the control grid of the 1C4 I.F. amplifier by the secondary of the first I.F. transformer (T-4). Amplified by this valve the I.F. signal is applied by the secondary of the second I.F. transformer (T-5), to one diode of the 1B5 second detector for rectification across resistors R-4 and R-5.

A signal is applied (via C-22) to the second diode of the 1B5 in order to produce a D.C. voltage in this circuit (across R-11), proportional to the signal being received, and this voltage is applied (via filter R-6 and C-6) to the control grid circuits of the 1C4 R.F. amplifier and 1C6 converter, as an automatic grid bias, to give automatic volume control.

An audio signal is produced across R-5 (volume control), and since R-5 is a variable resistance control the magnitude of the audio signal conducted through its variable arm to the control grid of the 1B5 (via C-21) may be adjusted at will. The audio signal applied to the 1B5 is amplified within the valve and is resistance-capacity coupled to the 1D4 output pentode to be amplified again to a suitable level for reproduction.

The output of the 1D4 is matched to the loudspeaker by the transformer T.A.31Y. A two lead cable delivers the output of the 1D4 to the loudspeaker.

The tone control is a variable control (R-9) in series with a .01 mfd. paper condenser (C-24), connected between the plate of the 1B5 and earth.

I.F. ALIGNMENT.

Four trimmer condensers tune the I.F. transformers to resonance (175 K.C.). Fig. 22 shows the adjustments in their adjustment order—1, 2, 3, 4. Refer to page 6 for full I.F. alignment instructions.

R.F. ALIGNMENT.

The R.F. adjustments can be seen through three holes in the variable condenser shield. Fig. 21 shows the adjustments in their alignment order—5, 6, 7. Full R.F. alignment instructions appear on page 7.

SOCKET VOLTAGES.

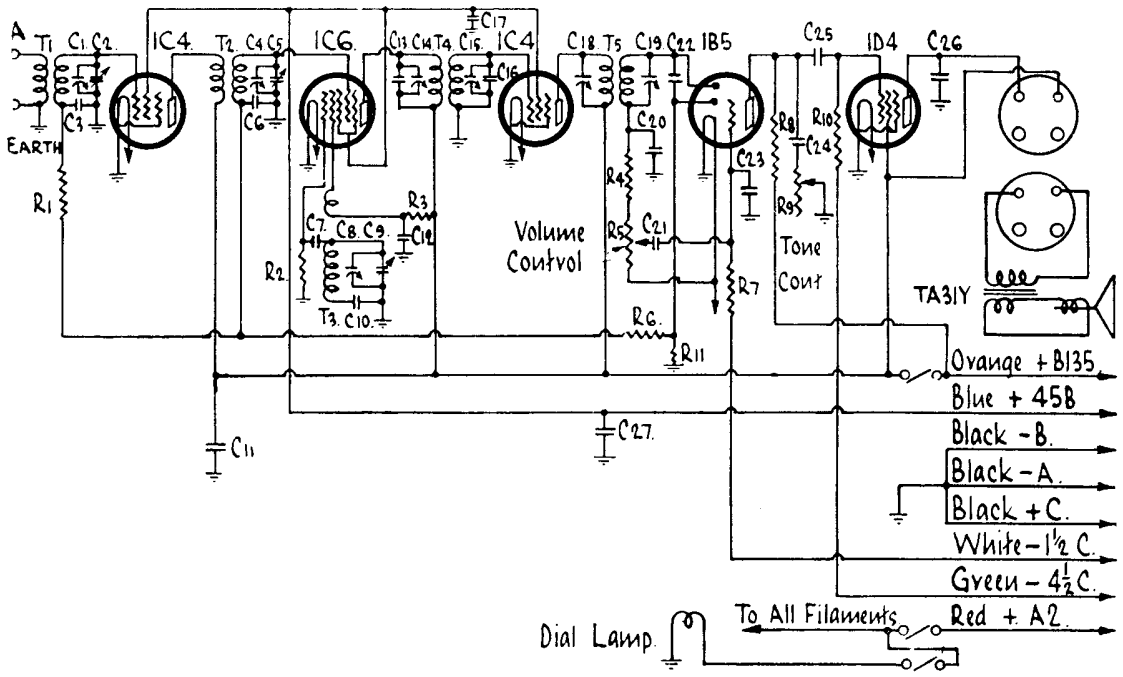
Valve.	Chassis to Control Grid Volts	Chassis to ScreenGrid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A	Filament Volts
1C4 R.F. Amplifier ...	0	45	135	1.5	2.0
1C6 Converter	0	45	135	1.0	2.0
,, Oscillator	—	—	70	1.5	—
1C4 I.F. Amplifier ...	0	45	135	1.5	2.0
1B5 Second Detector	—1.5*	—	70*	0.25	2.0
1D4 Pentode	—4.5*	135	125	6.0	2.0

* Cannot be measured accurately with ordinary voltmeter. Measured with controls in maximum clockwise position. No signal input. D.C. Voltmeter used as suggested on page 3.

CONTINUITY TESTING SCHEDULE RADIOLA 157.

N.B.—All readings to be made with the batteries disconnected, valves and loud speaker withdrawn and battery switch **on**, unless stated to the contrary.

TEST BETWEEN	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to A— (black) battery cable.	Continuity.	Wiring open circuit.
Chassis to B+ 135V (orange) battery cable.	No reading.	C-11, C-12 short circuit. Wiring short circuit to chassis.
Chassis to B+ 45V (blue) battery cable.	No reading.	C-17, C-27 short circuit. Wiring short circuit to chassis.
Chassis to B— (black) battery cable.	Continuity.	Wiring open circuit.
Chassis to C+ (black) battery cable.	Continuity.	Wiring open circuit.
Chassis to AVC diode 1B5 (see fig. 22).	No reading. ($1\frac{3}{4}$ megohms).	R-11 short circuit or open circuit.
Chassis to control grid clip 1C4 I.F. amplifier.	Continuity.	T-4 secondary open circuit.
Chassis to frame of variable condensers.	Continuity.	Earth connections to C-2, C-5, C-9 open circuit.
Chassis to plate 1D4 output pentode.	No reading.	C-26 short circuit.
Chassis to AVC line (see fig. 22).	No reading. (over 3 megohms).	C-3, C-6 short circuit.
Chassis to No. 3 loudspeaker socket.	Continuity — 250,000 ohms with rotation of tone control.	Tone control R-9 faulty.
Chassis to grid oscillator section 1C6 converter.	60,000 ohms.	R-2 short circuit or open circuit.
Chassis to aerial terminal.	Continuity.	T-1 primary open circuit.
B+ 135V (orange) battery cable to plate 1C4 R.F. amplifier.	Continuity.	Faulty battery switch. T-2 primary open circuit. B+ 135V cable open circuit.
B+ 135V (orange) battery cable to plate oscillator section 1C6 converter.	50,000 ohms.	T-3 primary open circuit. R-3 short circuit or open circuit.
B+ 135V (orange) battery cable to plate detector section 1C6.	Continuity.	T-4 primary open circuit.
B+ 135V (orange) battery cable to plate 1C4 I.F. amplifier.	Continuity.	T-5 primary open circuit.
B+ 135V (orange) battery cable to screen grid 1D4 output pentode.	Continuity.	Wiring open circuit.
B+ 135V (orange) battery cable to plate 1B5 2nd detector with switch off.	250,000 ohms.	R-8 short circuit or open circuit.
B+ 135V (orange) battery cable to No. 2 loudspeaker socket (see fig. 22).	Continuity.	Wiring open circuit.
B+ 45V (blue) battery cable to screen grid 1C4 R.F. amplifier.	Continuity.	Wiring open circuit.
B+ 45V (blue) battery cable to screen grid 1C6 converter.	Continuity.	Wiring open circuit.
B+ 45V (blue) battery cable to screen grid 1C4 I.F. amplifier.	Continuity.	Wiring open circuit.
A+ (red) battery cable to F+ all valves.	Continuity.	Wiring open circuit. Battery switch faulty.
A+ (red) battery cable to centre contact of dial lampholder (with dial lamp section of switch on).	Continuity.	Faulty dial lamp section of switch.
C—$1\frac{1}{2}$V (white) battery cable to control grid 1B5.	No reading. ($1\frac{3}{4}$ megohms).	R-7 short circuit or open circuit.
C—$4\frac{1}{2}$V (green) battery cable to control grid 1D4.	No reading ($\frac{1}{2}$ megohm).	R-10 short circuit or open circuit.
Diode rectifier 1B5 to F+ 1B5 2nd detector.	600,000 ohms.	T-5 secondary open circuit. Faulty volume control R-5, R-4 short circuit or open circuit.
AVC line to AVC diode 1B5 2nd detector (see fig. 22).	No reading. ($1\frac{3}{4}$ megohms).	R-6 short circuit or open circuit.
AVC line to control grid clip 1C4 R.F. amplifier.	100,000 ohms.	T-1 secondary open circuit. R-1 short circuit or open circuit.
AVC line to control grid clip 1C6 converter.	Continuity.	T-2 secondary open circuit.
Fixed plates variable condenser C-9 to coil of end of padding condenser C-10.	Continuity.	T-3 secondary open circuit.
Plate 1D4 output pentode to No. 1 loudspeaker socket (see fig. 22).	Continuity.	Wiring open circuit.
Plate 1B5 2nd detector to control grid 1D4 output pentode.	No reading.	C-25 short circuit.
Across thin pins of loudspeaker plug.	700 ohms (approx).	T.A. 31Y primary open circuit (loudspeaker transformer).



Code	Part No.	COILS.
T1	1560	Aerial Coil
T2	1564	R.F. Coil
T3	1562	Oscillator Coil
T4	1534	First I.F. Transformer
T5	1679	Second I.F. Transformer
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		60,000 ohms, ⅓ watt
R3		50,000 ohms, ⅓ watt
R4		100,000 ohms, ⅓ watt
R5	1507	500,000 ohms, Vol. Cont.
R6		1¾ Megohms, ⅓ watt
R7		1¾ Megohms, ⅓ watt
R8		250,000 ohms, 1 watt
R9	1668	300,000 ohms, Tone Cont.
R10		500,000 ohms, ⅓ watt
R11		1¾ Megohms, ⅓ watt

Code	Part No.	CONDENSERS.
C1		10-50 mmf. Mica Trimmer
C2	1515	Variable Condenser
C3		.05 mf. Paper Cond.
C4		10-50 mmf. Mica Trimmer
C5	1515	Variable Condenser
C6		.05 mf. Paper Cond.
C7		50 mmf. Mica Cond.
C8		10-50 mmf. Mica Trimmer
C9	1515	Variable Condenser
C10		1050 mmf. Padding Cond.
C11		.5 mf. Paper Cond.
C12		.05 mf. Paper Cond.
C13		85 mmf. Mica Cond.
C14		10-50 mmf. Mica Trimmer
C15		10-50 mmf. Mica Trimmer
C16		85 mmf. Mica Cond.
C17		.1 mf. Paper Cond.
C18		30-70 mmf. Mica Cond. and Trimmer
C19		10-50 mmf. Mica Trimmer
C20		200 mmf. Mica Cond.
C21		.05 mf. Paper Cond.
C22		700 mmf. Mica Cond.
C23		200 mmf. Mica Cond.

Code	Part No.	CONDENSERS.
C24		.01 mf. Paper Cond.
C25		.05 mf. Paper Cond.
C26		.005 mf. Paper Cond.
C27		.1 mf. Paper Cond.

Fig. 23.—Circuit data (157).

Radiola 158

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190-260 Volts
Frequency Rating	50-60 Cycles.
(Special instruments made for other voltage and frequency ratings)	
Power Consumption	70 Watts.
Tuning Range	1500-550 Kilocycles.
Intermediate Frequency	175 K.C.
Loudspeaker	Type D42
Loudspeaker Field Coil Resistance	2000 ohms
Loudspeaker Audio Transformer	Type T.A.13Y.

VALVES AND CIRCUITS.

6K7 R.F. Amplifier.
6A8 Detector-oscillator
6K7 I.F. Amplifier.
6H6 Detector and A.V.C.
6F5 Audio Amplifier.
6F6 Output Pentode.
80 Rectifier.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 158 is a "Medium Wave" seven valve A.C. operated receiver using metal envelope valves.

This instrument has a tuning range from 1500-550 kilocycles (200-550 meters).

The incoming signal is applied to the control grid of the 6K7 R.F. amplifier, after step-up by the aerial coil (T-1), the secondary of which is tuned by the rear section of the variable condenser (C-4). After amplification by the 6K7, the signal is impressed on the control grid of the 6A8 converter by the secondary of the R.F. coil (T-2), which is tuned by the centre section of the variable condenser (C-10). In the 6A8, the R.F. signal is combined (heterodyned) with the oscillator signal, which is 175 kilocycles higher in frequency than the signal being received; this difference in frequency is maintained throughout the tuning range of the receiver by the front section of the variable condenser (C-12) in conjunction with the oscillator coil (T-3) and padding condenser (C-13). The combination of the two signals produces the intermediate frequency of 175 kilocycles to which both the primaries and secondaries of the I.F. transformers (T-4 and T-5) are tuned. The heterodyne or

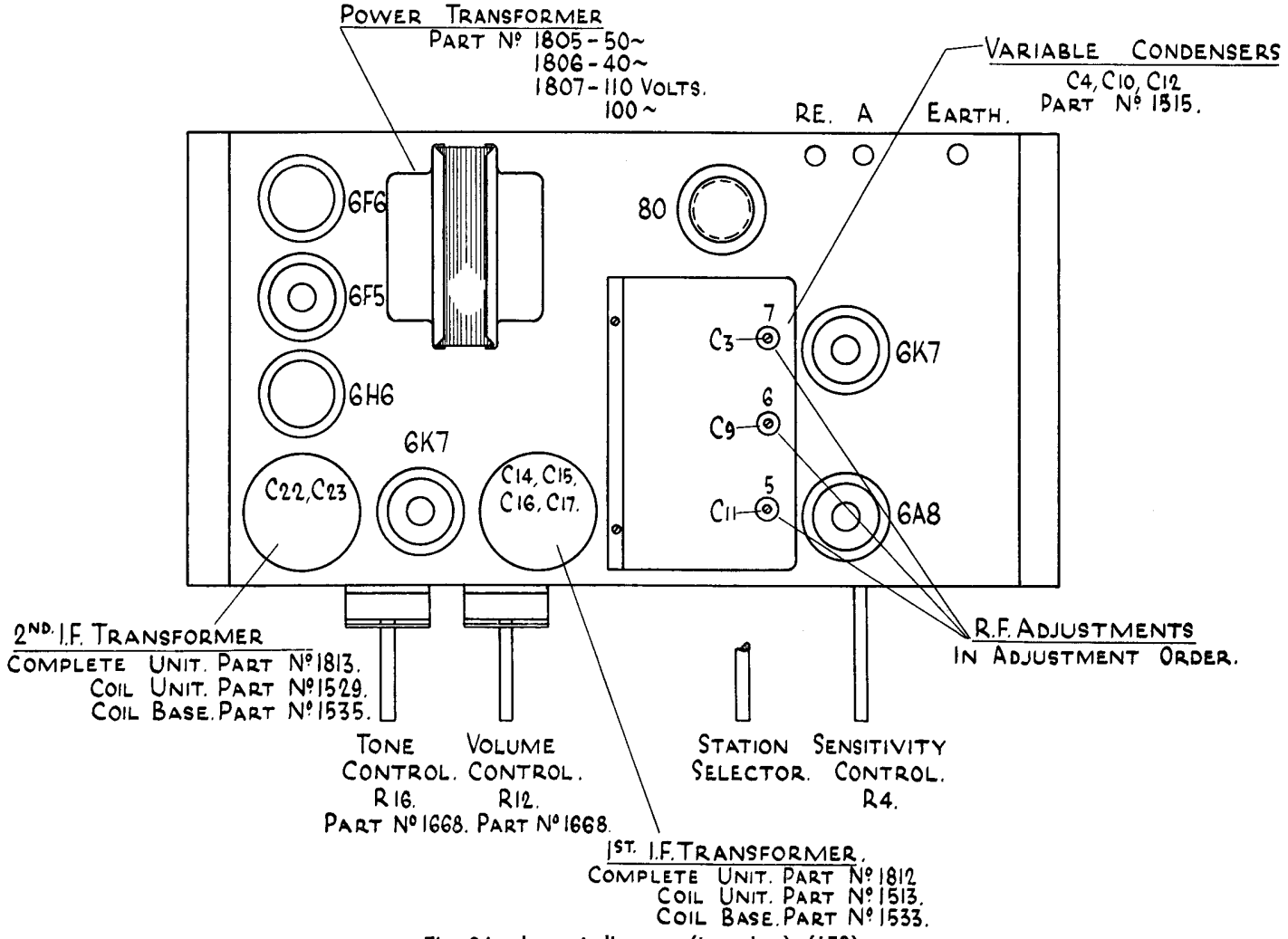


Fig. 24.—Layout diagram (top view), (158).

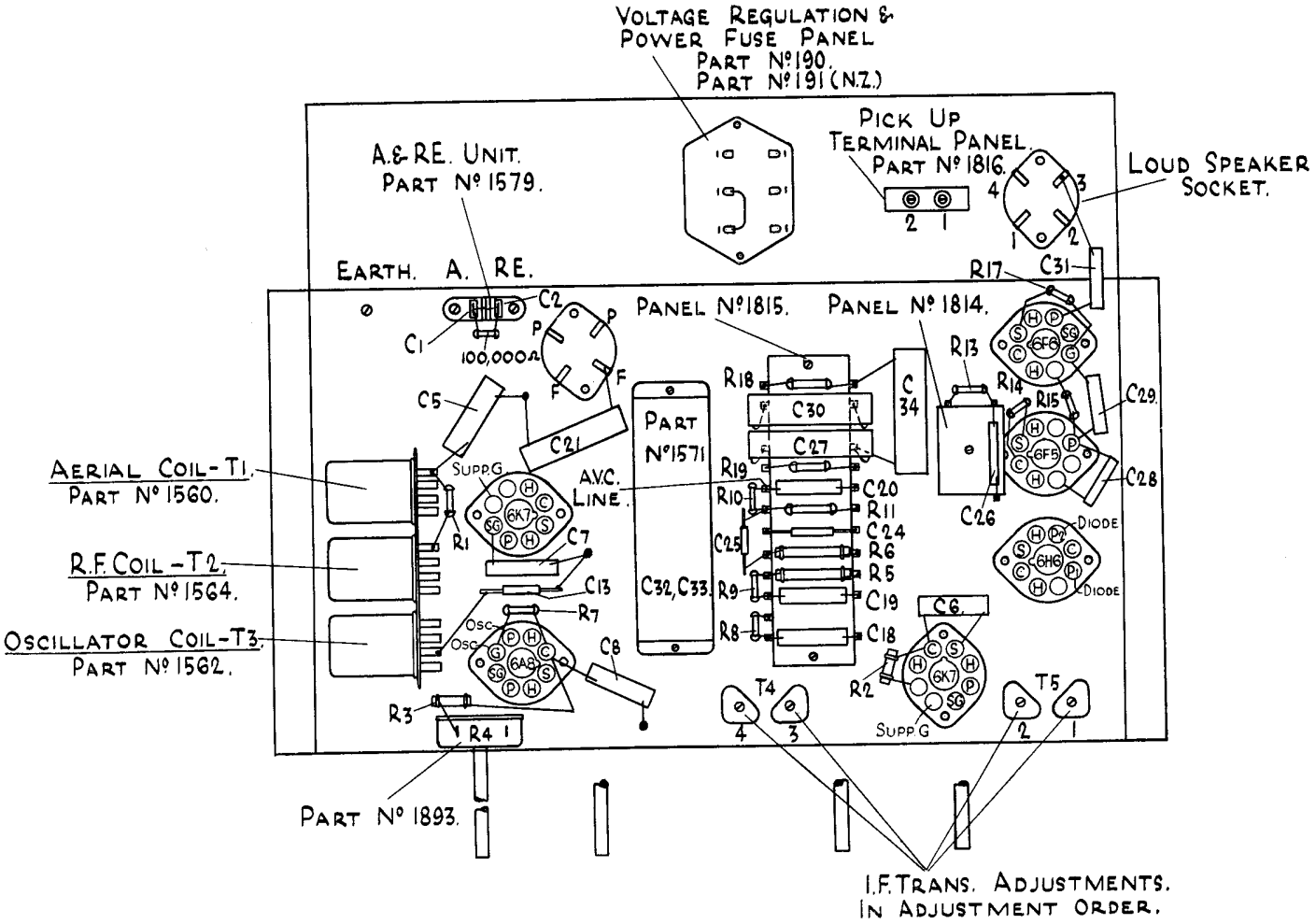


Fig. 25.—Layout diagram (underneath view), (158).

beat note signal, in the plate circuit of the 6A8, is selected by the first I.F. transformer (T-4) to be applied to the control grid of the 6K7 I.F. amplifier. The output of this valve is coupled by the second I.F. transformer (T-5) to the diode plates of the 6H6 second detector for rectification across resistors R-11 and R-12.

A D.C. voltage is produced in the diode circuit of the 6H6 (across R-11 and R-12) proportional to the signal being received. This voltage is applied (via filter R-10 and C-20) to the control grid circuits of the 6K7 R.F. amplifier, 6A8 converter, and 6K7 I.F. amplifier valves to give automatic volume control.

An audio signal is produced across R-12, in the diode circuit of the 6H6, and as R-12 is a variable resistance volume control, the magnitude of the audio signal applied to the control grid of the 6F5 (via C-26) may be adjusted to the desired level. The signal applied to the 6F5 is amplified within the valve and is resistance-capacity coupled to the 6F6 output pentode, where it is amplified again for reproduction by the loudspeaker. Transformer T.A.13Y. matches the output of the 6F6 to the loudspeaker.

The sensitivity control (R-4) is a 1000 ohms wire wound variable control connected in the cathode circuits of the 6A8 converter, 6K7 R.F. amplifier and 6K7 I.F. amplifier.

The tone control circuit consists of a variable control (R-16) connected in series with a .01 mfd. paper condenser (C-28), between the plate of the 6F5 and earth.

The power unit consists of a transformer (T-6), an 80 valve rectifier, and a smoothing circuit incorporating two high capacity condensers, C-32 and C-33, with the 2000 ohms field of the loudspeaker functioning as a smoothing choke.

I.F. ALIGNMENT.

This receiver has a single I.F. stage including two I.F. transformers. Trimmer condensers are used across both the primary and secondary windings, making a total of four adjustments at 175 kilocycles. Reference to fig. 25 will show the location of these adjustments, also the order in which they should be aligned (1, 2, 3, 4), I.F. alignment instructions in detail appear on page 6.

R.F. ALIGNMENT.

The R.F. adjustments (Nos. 5, 6, 7) are situated on the variable condenser and reference to fig. 24 will show them in their adjustment order. R.F. alignment instructions in detail appear on page 7.

CONTINUITY TESTING SCHEDULE RADIOLA 158.

N.B.—All readings to be made with the valves and loudspeaker withdrawn.

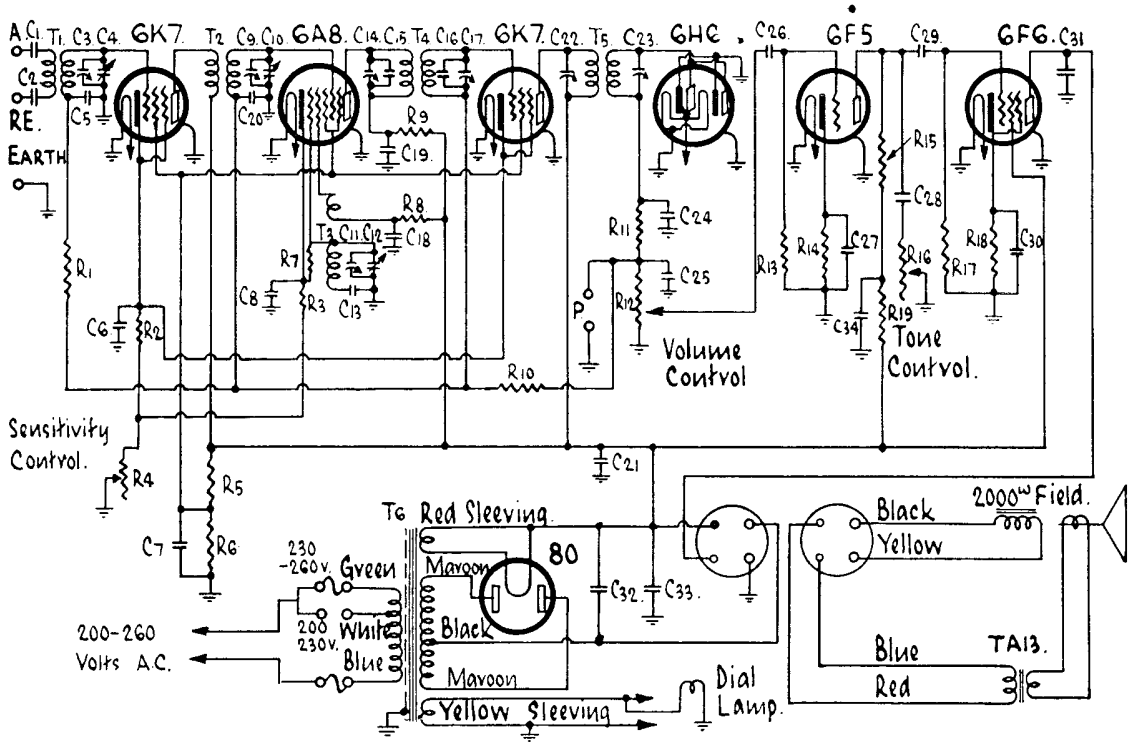
TEST BETWEEN	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to filament 80.	22,000 ohms.	C-18, C-34, C-33, C-21, C-7, C-19 short circuit. Resistors R-5, R-6 short circuit or open circuit. Wiring short circuit to chassis.
Chassis to cathode 6F6 output pentode.	400 ohms.	R-18 short circuit or open circuit. C-30 short circuit.
Chassis to metal shell contact (s) all valves (excepting 80).	Continuity.	Earth connection open circuit.
Chassis to control grid 6F6 output pentode.	No reading (500,000 ohms).	R-17 short circuit or open circuit.
Chassis to control grid clip 6F5 audio amplifier with volume control in minimum (anti-clockwise) position.	No reading (500,000 ohms).	R-13 short circuit or open circuit. C-26 short circuit.
Chassis to AVC line (see fig. 25).	No reading. (over 2 megohms).	C-5, C-20 short circuit.
Chassis to No. 3 loudspeaker socket.	Continuity.	Wiring open circuit.
Chassis to braided lead connection on tone control R-16.	Continuity — 300,000 ohms with rotation of tone control.	Tone control R-16 faulty.
Chassis to plate 6F5 audio amplifier with tone control R-16 in minimum (anti-clockwise) position.	322,000 ohms.	C-28 short circuit.
Chassis to plate 6F6 output pentode.	No reading.	C-31 short circuit.
Chassis to frame of variable condenser.	Continuity.	Earth connections to C-4, C-10, C-12 open circuit.
Chassis to No. 1 pick up terminal (see fig. 25).	Continuity.	Earth connection open circuit.
Chassis to No. 2 pick up terminal (see fig. 25).	300,000 ohms.	Volume control faulty. C-25 short circuit.
Chassis to cathodes 1 and 2 6H6 second detector.	Continuity.	Earth connections on 6H6 open circuit.
Chassis to cathode 6F5 audio amplifier.	3000 ohms.	R-14 short circuit or open circuit. C-27 short circuit.
Chassis to cathode 6K7 R.F. amplifier and 6K7 I.F. amplifier.	900 - 1900 ohms with rotation of sensitivity control.	C-6 short circuit. R-2 short circuit or open circuit. Sensitivity control R-4 faulty.
Chassis to cathode 6A8 converter.	800 - 1800 ohms with rotation of sensitivity control.	R-3 short circuit or open circuit. C-8 short circuit.
Filament 80 to No. 1 loudspeaker socket (see fig. 25).	Continuity.	Wiring open circuit.
Filament 80 to screen grid 6F6 output pentode.	Continuity.	Wiring open circuit.
Filament 80 to plate 6F5 audio amplifier.	300,000 ohms.	R-15, R-19 short circuit or open circuit.
Filament 80 to plate 6K7 I.F. amplifier.	Continuity.	T-5 primary open circuit.
Filament 80 to plate 6A8 converter.	300 ohms.	T-4 primary open circuit. R-9 short circuit or open circuit.
Filament 80 to plate 6K7 R.F. amplifier.	Continuity.	T-2 primary open circuit.
Filament 80 to oscillator plate 6A8 converter.	20,000 ohms.	T-3 primary open circuit. R-8 short circuit or open circuit.
Filament 80 to screen grid 6K7 R.F. amplifier.	11,000 ohms.	R-5 short circuit or open circuit.
AVC line to control grid clip of 6K7 R.F. amplifier.	100,000 ohms.	T-1 secondary open circuit. R-1 short circuit or open circuit.
AVC line to control grid clip of 6K7 I.F. amplifier.	Continuity.	T-4 secondary open circuit.
AVC line to control grid clip 6A8 converter.	Continuity.	T-2 secondary open circuit.
Diodes 6H6 second detector to No. 2 pick-up terminal.	100,000 ohms.	R-11 short circuit. T-5 secondary open circuit.
Cathode 6A8 converter to oscillator grid 6A8.	60,000 ohms.	R-7 short circuit or open circuit.
Plate 6F5 audio amplifier to control grid 6F6 output pentode.	No reading (1 megohm).	C-29 short circuit.
Across orange and black connections on aerial and radio earth unit.	Continuity.	T-1 primary open circuit.
Fixed plates C-12 to coil end of padding condenser C-13.	Continuity.	T-3 secondary open circuit.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Plate 6F6 to No. 2 loudspeaker socket (see fig. 25).	Continuity.	Wiring open circuit.
No. 4 loudspeaker socket to each plate 80 separately.	300 ohms.	T-6 secondary open circuit.
Across power cable.	Continuity.	T-6 primary open circuit. Power cable open circuit. Power fuse open circuit.
Across filament 80.	Continuity.	T-6 filament winding open circuit.
Across heaters 6A8 converter.	Continuity.	T-6 heater winding open circuit.
Across thick pins loudspeaker plug.	2000 ohms.	Loudspeaker field short circuit or open circuit.
Across thin pins loudspeaker plug.	570 ohms (approx.)	Loudspeaker transformer TA13Y primary open circuit.
Across condensers C-1 and C-2.	No reading.	C-1, C-2 short circuit.

SOCKET VOLTAGES.

Valve.	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate Volts	Plate Current M.A.	Heater
6K7 R.F. Amplifier	6.0	100	240	4.0	6.3
6A8 Converter	6.0	100	240	4.0	6.3
,, Oscillator	—	—	170	2.5	—
6K7 I.F. Amplifier	6.0	100	240	4.0	6.3
6H6 Detector	0.	—	—	—	6.3
6F5 Audio Amplifier	1.5	—	90*	0.4	6.3
6F6 Pentode	14.5	240	220	30.0	6.3
80 Rectifier	680/340 volts, 60 M.A. Total Current				5.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volts A.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	1560	Aerial Coil
T2	1564	R.F. Coil
T3	1562	Oscillator Coil
T4	1812	First I.F. Transformer
T5	1813	Second I.F. Transformer
T6	1805	Power Transformer, 50~
	1806	Power Transformer, 40~
	1807	Power Transformer, 100 Volts
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		900 ohms, ⅓ watt
R3		800 ohms, ½ watt
R4	1893	1,000 ohms, Sensitivity Cont.
R5		11,000 ohms, 3 watt
R6		11,000 ohms, 3 watt
R7		60,000 ohms, ⅓ watt
R8		20,000 ohms, ⅓ watt
R9		300 ohms, ⅓ watt
R10		1¾ Megohms, ⅓ watt
R11		100,000 ohms, ⅓ watt
R12	1668	300,000 ohms, Volume Control
R13		500,000 ohms, ⅓ watt
R14		3,000 ohms, ⅓ watt
R15		250,000 ohms, 1 watt
R16	1668	300,000 ohms, Tone Cont.
R17		500,000 ohms, ⅓ watt
R18		400 ohms, 1 watt
R19		50,000 ohms, ⅓ watt

Code	Part No.	CONDENSERS.
C1		500 mmf. Mica High Volt Test.
C2		500 mmf. Mica High Volt Test.
C3		10-50 mmf. Mica Trimmer
C4	1515	Variable Condenser
C5		.05 mf. Paper Cond.
C6		.1 mf. Paper Cond.
C7		.1 mf. Paper Cond.
C8		.1 mf. Paper Cond.
C9		10-50 mmf. Mica Trimmer
C10	1515	Variable Condenser
C11		10-50 mmf. Mica Trimmer
C12	1515	Variable Condenser
C13		1050 mmf. Padding Cond.
C14		10-50 mmf. Mica Trimmer
C15		85 mmf. Mica Cond.
C16		85 mmf. Mica Cond.
C17		10-50 mmf. Mica Trimmer
C18		.05 mf. Paper Cond.
C19		.05 mf. Paper Cond.
C20		.05 mf. Paper Cond.
C21		.5 mf. Paper Cond.
C22		30-70 mmf. Mica Trimmer
C23		10-50 mmf. Mica Trimmer
C24		200 mmf. Mica Cond.
C25		200 mmf. Mica Cond.
C26		.05 mf. Paper Cond.
C27		5 mf. 25 V. Elect. Cond.
C28		.01 mf. Paper Cond.
C29		.05 mf. Paper Cond.

Code	Part No.	CONDENSERS.
C30		25 mf. 25 V. Elect. Cond.
C31		.005 mf. Paper Cond.
C32	1571	8 mf. 500 V. Elect. Cond.
C33	1571	8 mf. 500 V. Elect. Cond.
C34		.5 mf. Paper Cond.

Fig. 26.—Circuit data (158).

Radiola 159

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190-260 Volts.
Frequency Rating	Universal A.C. or D.C.
Power Consumption	90 Watts.
Tuning Range	1500-550 Kilocycles
Intermediate Frequency	175 K.C.
Loudspeaker	Type D40.
Loudspeaker Field Coil Resistance	2000 ohms.
Loudspeaker Audio Transformer	Type T.A. 16Y.

VALVES AND CIRCUITS.

6D6 R.F. Amplifier.
6A7 Detector Oscillator.
6B7 I.F. Amplifier, Detector, A.V.C. and Audio Amplifier.
43 Output Pentode.
12Z3 Rectifier.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 159 is a "Medium Wave" five valve superheterodyne receiver designed to operate on either A.C. or D.C. power supplies. The tuning range of this receiver is from 1500-550 kilocycles (200-550 meters).

The signal from the aerial is applied to the control grid of the 6D6 R.F. amplifier, after magnification by the aerial coil, the secondary of which is tuned to the incoming signal frequency by the rear unit of the variable condenser (C-6). After amplification by the 6D6, the signal is applied to the control grid of the 6A7 converter by the secondary of the R.F. coil (T-2), which is tuned by the centre unit of the variable condenser (C-12). Combined with the R.F. signal in the 6A7 converter is the local oscillator signal, which is 175 kilocycles higher in frequency than the signal being received; this frequency difference of 175K.C. remains throughout the tuning range of the instrument, owing to the design of the oscillator coil (T-3), the variable condenser (C-18) and the padding condenser (C-19).

The I.F. signal (175 K.C.), produced by the combination of the signals within the 6A7, appears in the plate circuit of this valve, where it is selected by the first I.F. transformer (T-4) and applied to the control grid of the 6B7 valve. The I.F. signal is amplified by this valve and is transferred by the second I.F. transformer (T-5) to the diode plates of the 6B7 for rectification across resistors R-12 and R-13. The primary and the secondary of the 1st I.F. transformer (T-4), and the primary of the 2nd I.F. transformer (T-5) are all tuned, by trimmer condensers, to the intermediate frequency (175 K.C.).

The rectification of the I.F. signal in the diode circuit of the 6B7 produces a D.C. voltage, which is applied (via filter R-14 and C-10) as a grid bias to the control grid circuits of

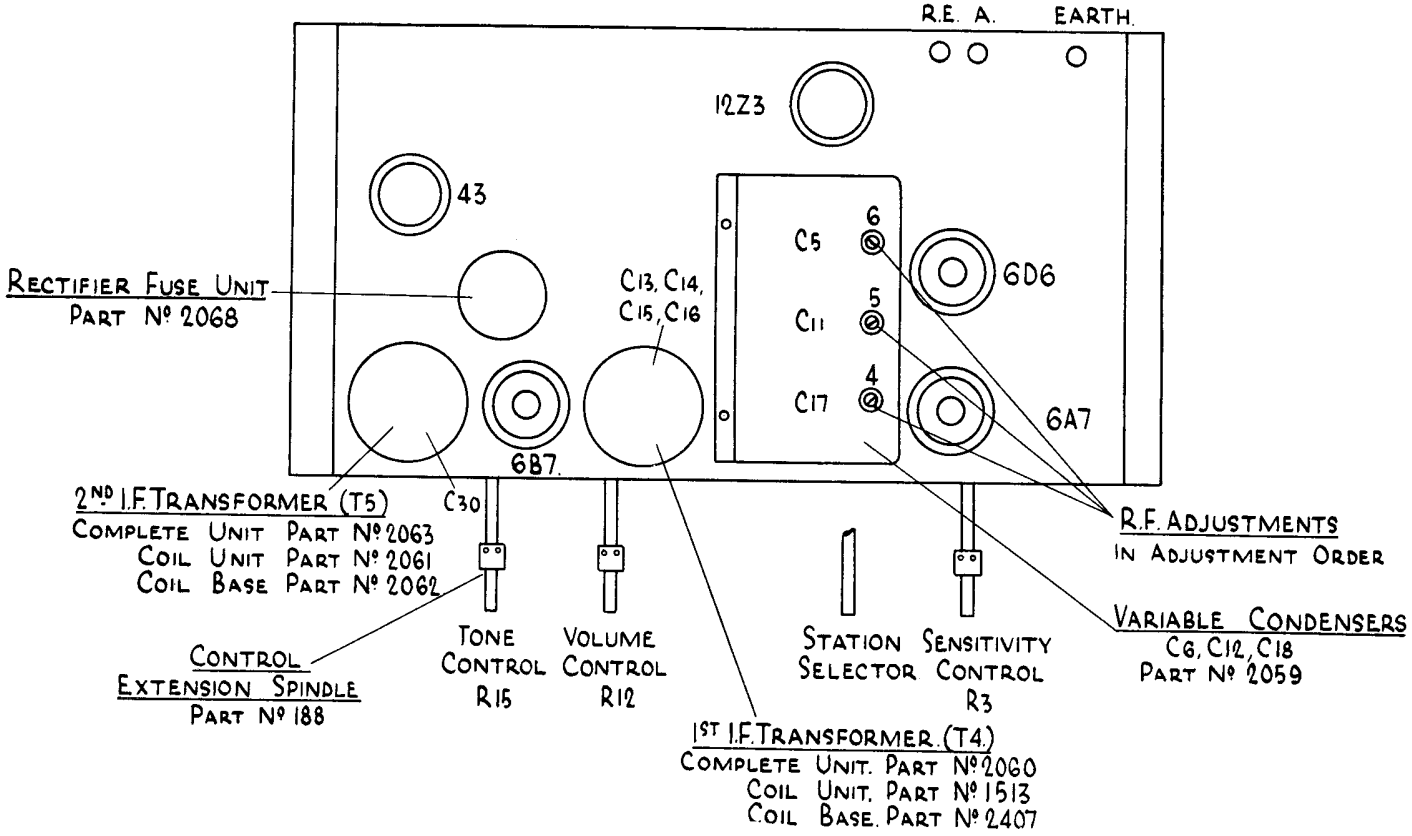


Fig. 27.—Layout diagram (top view), (159)

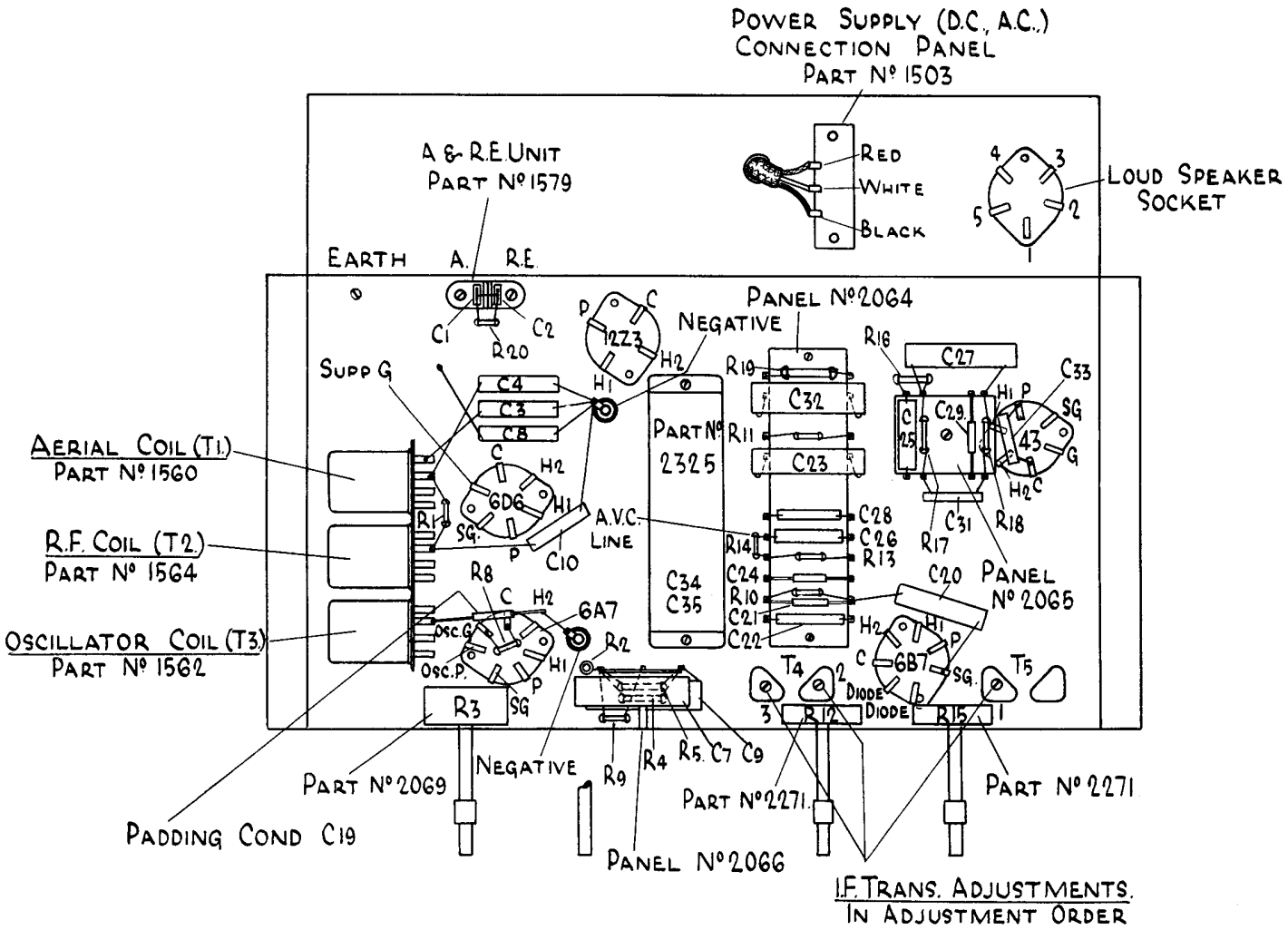


Fig. 28.—Layout diagram (underneath view), (159).

the 6D6 R.F. amplifier and 6A7 converter for automatic volume control.

The volume control (R-12) selects the amount of audio signal, in the diode circuit of the 6B7, to be applied to the control grid of the same valve for amplification. The output of the 6B7 is resistance-capacity coupled to the 43 output pentode to be amplified again for reproduction by the loudspeaker. Correct matching between the output valve and the loudspeaker is carried out by the transformer T.A. 16Y mounted on the loudspeaker.

Included in the equipment of this receiver is a mains filter unit (fig. 29), which consists of a ballast resistor (R-7 and R-6), two line chokes (T-6 and T-7), and two by-pass condensers (C-36 and C-37). The heaters of all the valves, and the dial lamp filament are connected in series with the ballast resistor across the power supply. The ballast resistors (R-7 and R-6) are designed to give the correct heater voltage for each valve when the power supply is above 230 volts. When it is desired to operate the receiver below this voltage, the connecting link on the mains filter unit (see fig. 29) should be closed, thus short-circuiting R-6 to maintain the heater voltage at the correct rating.

A 12Z3 rectifier is used, and reference to the circuit diagram will show a $\frac{3}{8}$ amp fuse inserted in the plate circuit of this valve in order to safeguard the remaining valves in the event of a fault arising within the 12Z3. The smoothing circuit consists of two high capacity condensers (C-34 and C-35), with the 2000 ohms field of the loudspeaker functioning as a smoothing choke.

As this receiver is designed to operate on both A.C. and D.C. power supplies, reference to the circuit diagram (fig. 30) will show that one side of the power supply is connected to the high tension negative circuit of the receiver; this circuit is connected to the chassis frame through a .05 mfd. paper condenser (C-8). The controls of the receiver are also insulated. If these precautions were not followed, the chassis frame and the controls could be at a dangerous electrical pressure (200-260 volts) above earth.

The sensitivity control (R-3) is a 1000 ohm variable control connected in the cathode circuits of the 6A7 converter and 6D6 R.F. amplifier valves.

The tone control circuit consists of a variable control (R-15) connected in series with a .01 mfd. paper condenser, C-28, between the plate of the 6B7 and negative.

I.F. ALIGNMENT.

This receiver employs two I.F. transformers (T-4 and T-5) for which there are three adjustments. These adjustments are shown on Fig. 28 in their adjustment order, 1, 2 and 3. Refer to page 6 for full I.F. alignment instruction.

R.F. ALIGNMENT.

Fig. 27 shows the R.F. adjustments in their correct adjustment order (4, 5, 6). Complete R.F. alignment instructions are given on page 7.

NOTE.

A $\frac{3}{8}$ amp fuse, which is housed in a small can on the top of the chassis (see fig. 27) is connected in the plate circuit of the 12Z3 rectifier to protect the other valves in the event of a fault arising within the rectifier. If, in servicing the receiver, it is found that there is no plate voltage, this fuse should be inspected by unscrewing the can. Before replacing the fuse, it would be advisable to ascertain if the 12Z3 is faulty.

It is important that the variable condenser be mounted by means of the rubber bushes and kept insulated from the chassis since the frame of the variable condenser is connected to the high tension negative circuit.

CONTINUITY TEST.

Unlike the A.C. operated models, the high tension negative circuit of this receiver is not connected directly to the chassis frame. In the continuity testing schedule, the high tension negative circuit is referred to as power cable (black).

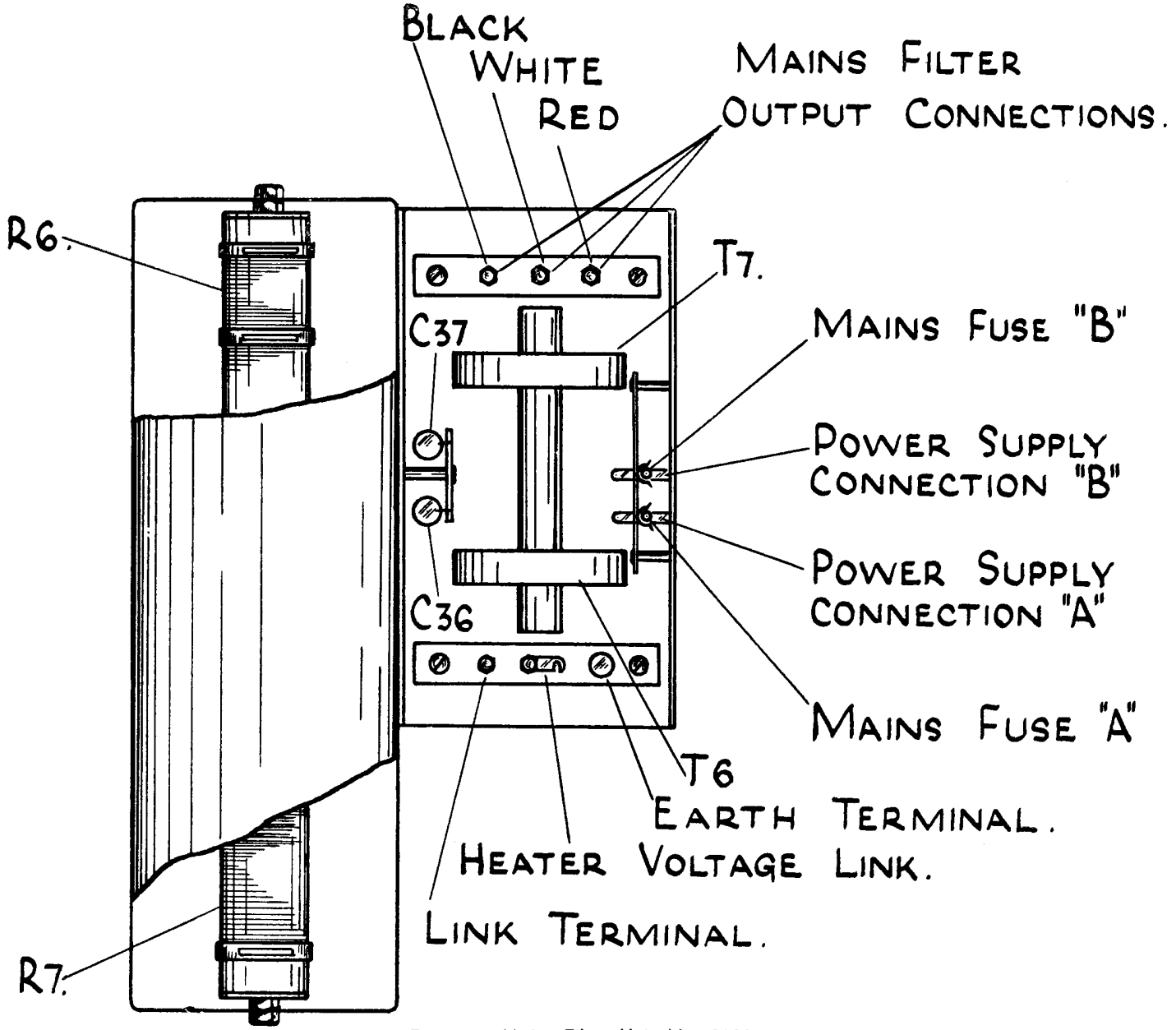


Fig. 29.—Mains Filter Unit No. 2181.

CONTINUITY TESTING SCHEDULE RADIOLA 159

N.B.—All readings to be made with valves and loudspeaker withdrawn and mains filter unit disconnected.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to No. 1 loudspeaker socket (see fig. 28).	Continuity.	Wiring open circuit.
Chassis to power cable (black).	No reading.	C-8 short circuit. Wiring short circuit.
Power cable (black) to frame of variable condenser.	Continuity.	Wiring open circuit.
Power cable (black) to cathodes 6D6 R.F. amplifier, 6A7 converter.	900-1900 ohms with rotation of sensitivity control.	Sensitivity control R-3 faulty. R-2 short circuit or open circuit. C-7 short circuit.
Power cable (black) to cathode 6B7 second detector.	2000 ohms.	R-11 short circuit or open circuit. C-23 short circuit.
Power cable (black) to diode plates 6B7 second detector.	300,000 — 600,000 ohms with rotation of volume control.	T-5 secondary open circuit. Volume control R-12 faulty. R-13 short circuit or open circuit.
Power cable (black) to cathode 43 output pentode.	500 ohms.	R-19 short circuit or open circuit. C-32 short circuit.
Power cable (black) to control grid 43 output pentode.	300,000 ohms.	R-18 short circuit or open circuit.
Power cable (black) to control grid clip 6B7 second detector.	No reading (500,000 ohms).	R-10 short circuit or open circuit. C-21 short circuit.
Power cable (black) to No. 3 loudspeaker socket (see fig. 28).	60,000 ohms.	C-9, C-20, C-25, C-27, C-34 short circuit. R-4, R-5 short circuit or open circuit. Wiring short circuit to chassis.
Power cable (black) to AVC line (see fig. 28).	No reading (over 2 megohms).	C-4, C-10, C-26 short circuit.
Power cable (black) to plate 43 output pentode.	No reading.	C-33 short circuit.
Power cable (black) to plate 6B7 second detector with tone control R-15 in minimum (anti-clockwise) position.	180,000 ohms.	C-28, C-29 short circuit.
Power cable (black) to screen grid 6B7 second detector.	40,000 ohms.	C-9, C-20, short circuit.
Power cable (white) to H-1 12Z3 rectifier.	Continuity.	Dial lamp filament open circuit. Power cable open circuit.
H-2 12Z3 to H-1 43 output pentode.	Continuity.	Wiring open circuit.
H-2 43 output pentode to H-2 6D6 R.F. amplifier.	Continuity.	Wiring open circuit.
H-1 6D6 R.F. amplifier to H-2 6A7 converter.	Continuity.	Wiring open circuit.
H-1 6A7 converter to H-2 6B7 second detector.	Continuity.	Wiring open circuit.
H-1 6B7 second detector to power cable (black).	Continuity.	Wiring open circuit. Power cable open circuit.
Power cable (red) to plate 12Z3.	Continuity.	$\frac{3}{8}$ amp fuse in rectifier fuse unit open circuit. Power cable open circuit.
Cathode 12Z3 to No. 4 loudspeaker socket (see fig. 28).	Continuity.	Wiring open circuit.
No. 3 loudspeaker socket to screen grid 6D6 R.F. amplifier and 6A7 converter.	40,000 ohms.	R-4 short circuit or open circuit.
No. 3 loudspeaker socket to plate 6D6 R.F. amplifier.	Continuity.	T-2 primary open circuit.
No. 3 loudspeaker socket to plate 6A7 converter.	Continuity.	T-4 primary open circuit.
No. 3 loudspeaker socket to oscillator plate 6A7 converter.	Continuity.	T-3 primary open circuit.
No. 3 loudspeaker socket to screen grid 6B7 second detector.	60,000 ohms.	R-4, R-9 short circuit or open circuit.
No. 3 loudspeaker to plate 6B7 second detector.	120,000 ohms.	T-5 primary open circuit. R-16, R-17 short circuit or open circuit.
No. 3 loudspeaker socket to screen grid 43 output pentode.	Continuity.	Wiring open circuit.
No. 5 loudspeaker socket to plate 43 output pentode.	Continuity.	Wiring open circuit.
Green connection on volume control to diode plates 6B7 second detector.	300,000 ohms.	T-5 secondary open circuit. R13 short circuit or open circuit.
AVC line to control grid 6D6 R.F. amplifier.	100,000 ohms.	T-1 secondary open circuit. R-1 short circuit or open circuit.
AVC line to control grid clip 6A7 converter.	Continuity.	T-2 secondary open circuit.

TEST BETWEEN	CORRECT READING	PROBABLE CAUSE OF IRREGULAR READING.
Cathode 6A7 converter to oscillator grid 6A7.	60,000 ohms.	R-8 short circuit or open circuit.
Fixed plates of C-18 to coil end of padding condenser C-19.	Continuity.	T-3 secondary open circuit.
Plate 6B7 second detector to control grid 43 output pentode.	No reading ($\frac{1}{2}$ megohm).	C-31 short circuit.
Yellow wire to black wire loudspeaker cable.	2,000 ohms.	Loudspeaker field open circuit or short circuit.
Red wire to blue wire loudspeaker cable.	450 ohms (approx.).	TA 16Y primary open circuit or short circuit.

CONTINUITY TESTING SCHEDULE FOR MAINS FILTER UNIT NO. 2181.

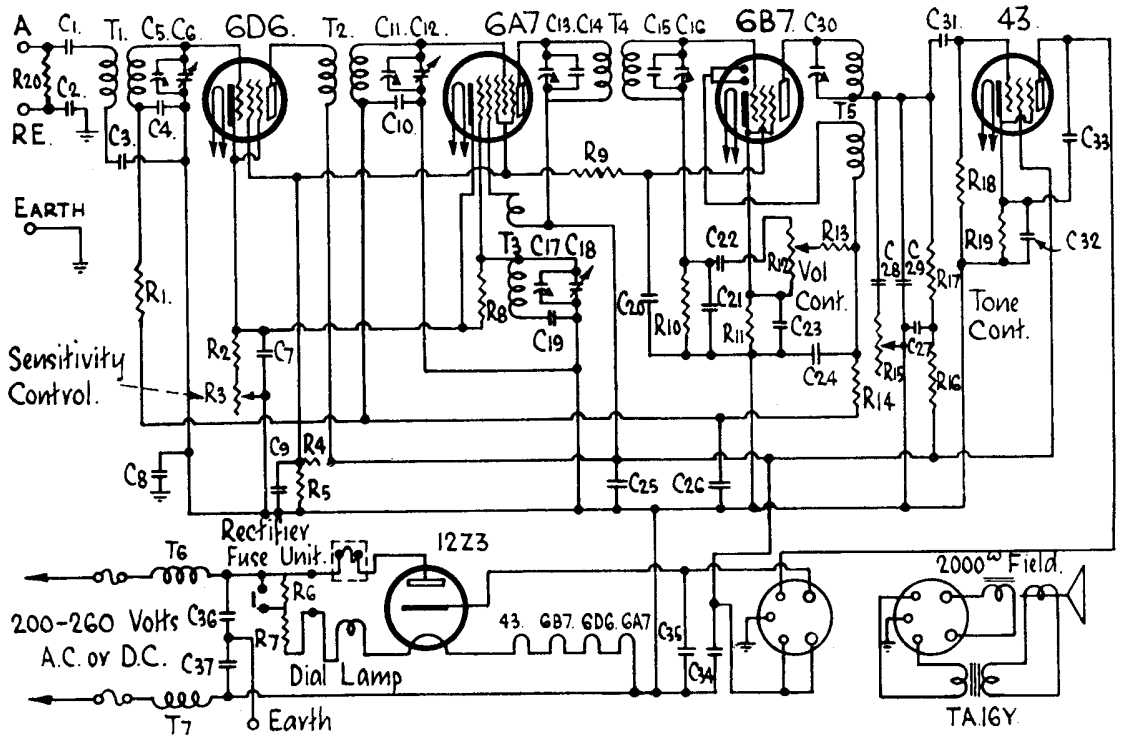
N.B.—All readings to be taken with the unit disconnected from the receiver, and with the heater link open.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Power supply connection "A" to Red output connection.	Continuity.	Mains fuse "A" open circuit. T-6 open circuit.
Black output connection to earth terminal.	No reading.	C-37 short circuit.
Power supply connection "B" to black output connection.	Continuity.	Mains fuse "B" open circuit. T-7 open circuit.
Red output connection to earth terminal.	No reading.	C-36 short circuit.
White output connection to link terminal.	510 ohms.	R-7 short circuit or open circuit.
Red output connection to link terminal.	100 ohms.	R-6 short circuit or open circuit.

SOCKET VOLTAGES.

Valve.	Negative to Cathode (C) Volts	Negative to Screen Grid (SG) Volts	Negative to Plate Volts	Plate Current M.A.	Heater Volts
6D6 R.F. amplifier	4.0	40	150	1.0	6.3
6A7 Converter	4.0	40	150	0.5	6.3
" Oscillator	—	—	150	2.0	—
6B7 Reflex amplifier	1.5	30	60*	1.0	6.3
43 Pentode	20	150	150	30.0	25.0
12Z3 Rectifier	268	—	—	45	12.6

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volt A.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	1560	Aerial Coil
T2	1564	R.F. Coil
T3	1562	Oscillator Coil
T4	2060	First I.F. Transformer
T5	2063	Second I.F. Transformer
T6	2191	Line Choke
T7	2191	Line Choke
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		900 ohms, ⅓ watt
R3	2069	1000 ohms Sensitivity Cont.
R4		40,000 ohms, 1 watt
R5		20,000 ohms, 1 watt
R6		100 ohms, Wire Wound
R7		510 ohms, Wire Wound
R8		60,000 ohms, ⅓ watt
R9		20,000 ohms, ⅓ watt
R10		500,000 ohms, ⅓ watt
R11		2,000 ohms, ⅓ watt
R12	2271	300,000 ohms, Vol Cont.
R13		300,000 ohms, ½ watt
R14		1½ Megohms, ⅓ watt
R15	2271	300,000 ohms, Tone Cont.
R16		20,000 ohms, ⅓ watt
R17		100,000 ohms, ⅓ watt
R18		300,000 ohms, ⅓ watt
R19		500 ohms, 1 watt
R20		100,000 ohms, ⅓ watt

Code	Part No.	CONDENSERS.
C1		500 mmf. Mica High Volt. Test
C2		500 mmf. Mica High Volt. Test
C3		.05 mf. Paper Cond.
C4		.05 mf. Paper Cond.
C5		10-50 mmf. Trimmer
C6	2059	Variable Condenser
C7		.25 mf. Paper Cond.
C8		.05 mf. Paper Cond.
C9		.25 mf. Paper Cond.
C10		.05 mf. Paper Cond.
C11		10-50 mf. Mica Trimmer
C12	2059	Variable Condenser
C13		10-50 mmf. Mica Trimmer
C14		85 mmf. Mica Cond.
C15		85 mmf. Mica Cond.
C16		10-50 mmf. Mica Trimmer
C17		10-50 mmf. Mica Trimmer
C18	2059	Variable Condenser
C19		1050 mmf. Mica Cond.
C20		.25 mf. Paper Cond.
C21		200 mmf. Mica Cond.
C22		.01 mf. Paper Cond.
C23		5 mf. 25 V. Elect. Cond.
C24		200 mmf. Mica Cond.
C25		.1 mf. Paper Cond.
C26		.05 mf. Paper Cond.
C27		.5 mf. Paper Cond.
C28		.01 mf. Paper Cond.
C29		700 mmf. Mica Cond.

Code	Part No.	CONDENSERS.
C30		10-50 mmf. Mica Cond.
C31		.01 mf. Paper Cond.
C32		25 mf. 25 V. Elect. Cond.
C33		.005 mf. Paper Cond.
C34	2325	8 mf. 500 V. Elect. Cond.
C35	2325	8 mf. 500 V. Elect. Cond.
C36		.1 mf. Paper Cond.
C37		.1 mf. Paper Cond.

Fig. 30.—Circuit data (159).

Radiola 248

ELECTRICAL SPECIFICATIONS.

Voltage Rating		190-260 Volts
Frequency Rating		50-60 Cycles
(Special instruments made for other voltage and frequency ratings)		
Power Consumption		50 Watts
Tuning Ranges	(a) 1500-550	Kilocycles
	(b) 19-50	Metres
Intermediate Frequency		460 K.C.
Loudspeaker		Type D40
Loudspeaker Field Coil Resistance		2000 ohms.
Loudspeaker Audio Transformer		Type T.A.13Y.

VALVES AND CIRCUITS.

6A7 Detector-oscillator.
6D6 I.F. Amplifier.
6B7 I.F. Amplifier, Detector, A.V.C. and Audio Amplifier.
42 Output Pentode.
80 Rectifier.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 248 is a "World Range" five valve A.C. operated superheterodyne receiver.

This instrument has two tuning ranges

(1) 1500-550 kilocycles (200-550 meters) covering the standard medium wave broadcasting band.

(2) 19-50 meters, covering the four short wave broadcasting bands.

Range selection is accomplished by a dual position range switch.

The signal from the aerial is impressed on the control grid of the 6A7 converter, after magnification by the aerial coil (T-1 or T-2), the secondary of which is tuned to the signal frequency by the rear unit of the variable condenser (C-5). Combined with this signal in the 6A7 converter is the local oscillator signal, which is 460 kilocycles higher in frequency than the incoming signal; this difference is maintained throughout the tuning range of the receiver by the oscillator coils (T-3 and T-4) in conjunction with the variable condenser (C-14), and padding condensers (C-9—C-10 and C-12).

The combination of the two signals produces the intermediate frequency of 460 kilocycles, to which both the primaries and the secondaries of the I.F. transformers T-5, T-6 and T-7 are tuned. The I.F. signal is applied to the control grid of the 6D6 I.F. amplifier by the secondary of the first I.F. transformer (T-5), and after amplification by this valve it is applied, via the secondary of the second I.F. transformer (T-6), to the control grid of the 6B7 valve. Amplified in the 6B7 the I.F. signal is transferred by the third I.F. transformer

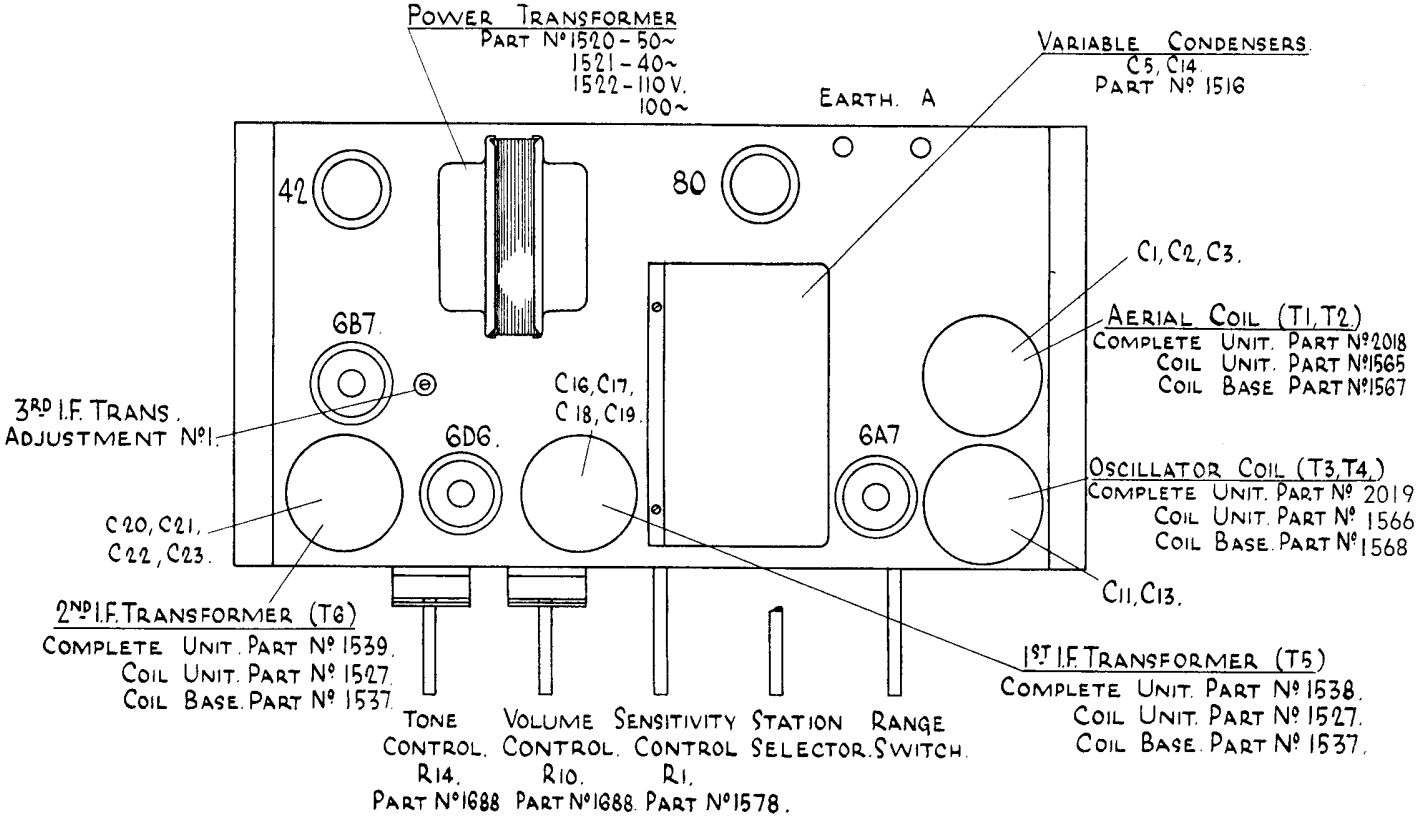


Fig. 31.—Layout diagram (top view), (248).

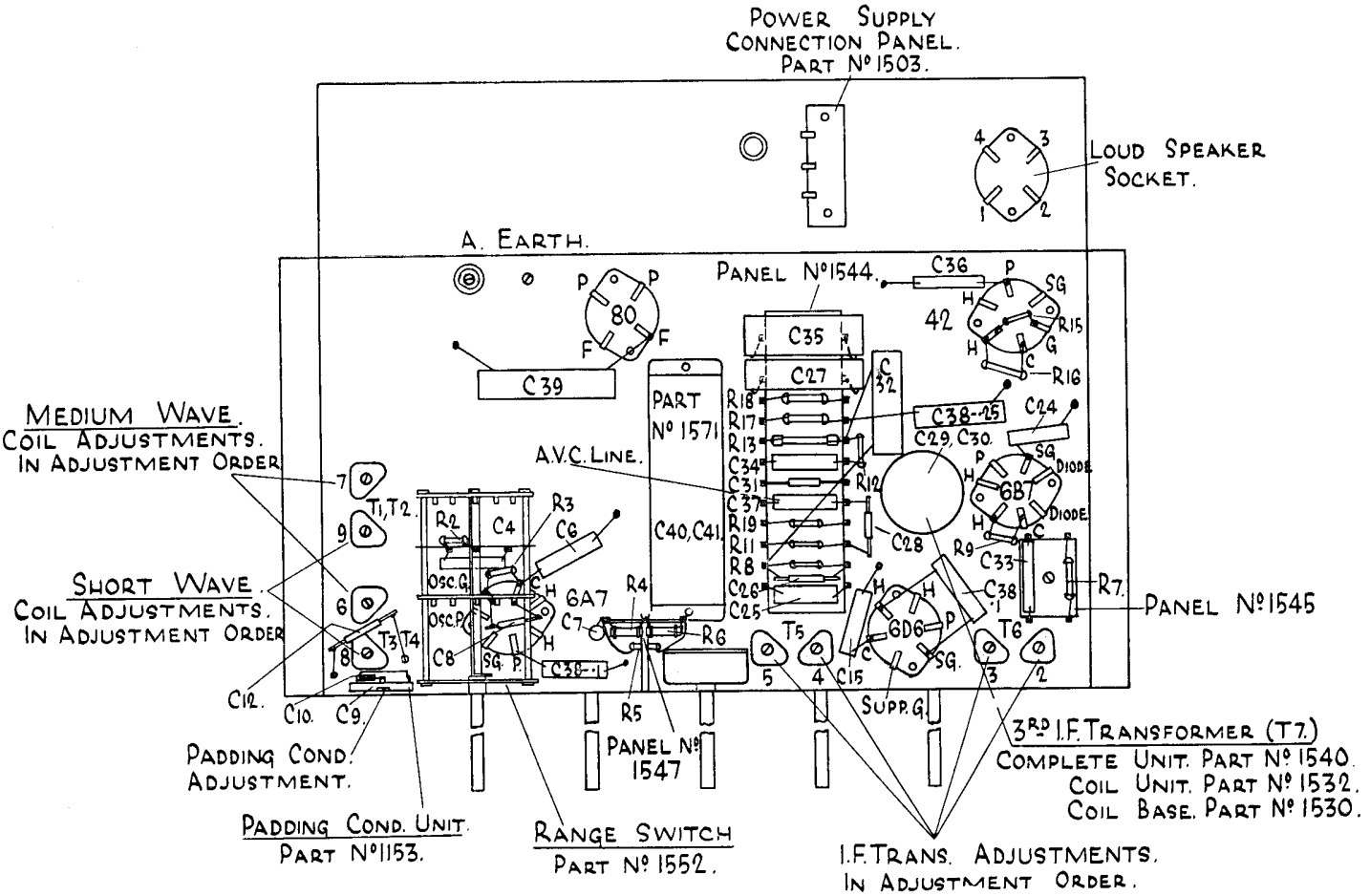


Fig. 32.—Layout diagram (underneath view), (248).

to the diode plates of the same valve for rectification across resistors R-10 and R-11.

The I.F. signal is bypassed in the grid and plate circuits of the 6B7 by C-26 and C-31, respectively. After rectification, the I.F. signal carrier is filtered by resistor R-11, and condensers C-28 and C-26 (via C-25).

A D.C. voltage is produced by the rectified signal in the diode circuit of the 6B7 (across R-10 and R-11) proportional to the incoming signal and this voltage is applied as a bias voltage to the control grid circuits of the 6A7 converter and 6D6 I.F. amplifier to give automatic volume control.

The audio signal across R-10 (volume control) is applied to the control grid of the 6B7 (via coupling condenser C-25), and as R-12 is a variable resistance control, the strength of the audio signal applied to the 6B7 may be adjusted as desired. The series and parallel impedances of T-6 and C-26, respectively, are negligible to audio frequencies.

The audio signal after amplification by the 6B7 is resistance-capacity coupled to the 42 output pentode; I.F. transformer T-7 and condenser C-31 have negligible impedances to audio frequencies.

A four lead cable delivers the output of the 42 to the loudspeaker, which is matched to the output valve by a transformer (T.A.13Y.).

The tone control circuit consists of a variable control (R-14) in series with a .01mfd. paper condenser (C33), connected between the plate of the 6B7 and earth.

Sensitivity is controlled by a 3,000 ohms wire wound variable control (R-1), connected in the cathode circuits of the 6A7 and 6D6 valves to increase or decrease the cathode bias as desired.

The socket voltages are supplied by a power unit which consists of a transformer (T-8), an 80 valve rectifier, and a smoothing circuit consisting of two high capacity condensers (C-40) and (C-41), with the 2000 ohms. field of the loudspeaker functioning as a smoothing choke.

I.F. ALIGNMENT.

This receiver employs two I.F. stages, which include three I.F. transformers (T-5, T-6, T-7). Five trimmer condensers align these transformers to resonance (460 K.C.). Align first the third I.F. transformer adjustment (No. 1) situated on the top of the chassis (see fig. 31), and continue with adjustments 2, 3, 4, and 5 located below the chassis. See fig. 32. Full I.F. alignment instructions appear on page 6.

R.F. ALIGNMENT. MEDIUM WAVE.

Reference to fig. 32 will show the location of the medium wave coil adjustments (Nos. 6, 7 and 600 K.C. padding condenser). Beginning with No. 6 (oscillator trimmer) refer to page 7 for full alignment instructions.

SHORT WAVE.

Refer to fig. 32 for the location of the Short Wave Coil adjustments (Nos. 8 and 9). Beginning with No. 8 (oscillator trimmer) refer to page 8 for full alignment instructions.

CONTINUITY TESTING SCHEDULE RADIOLA 248.

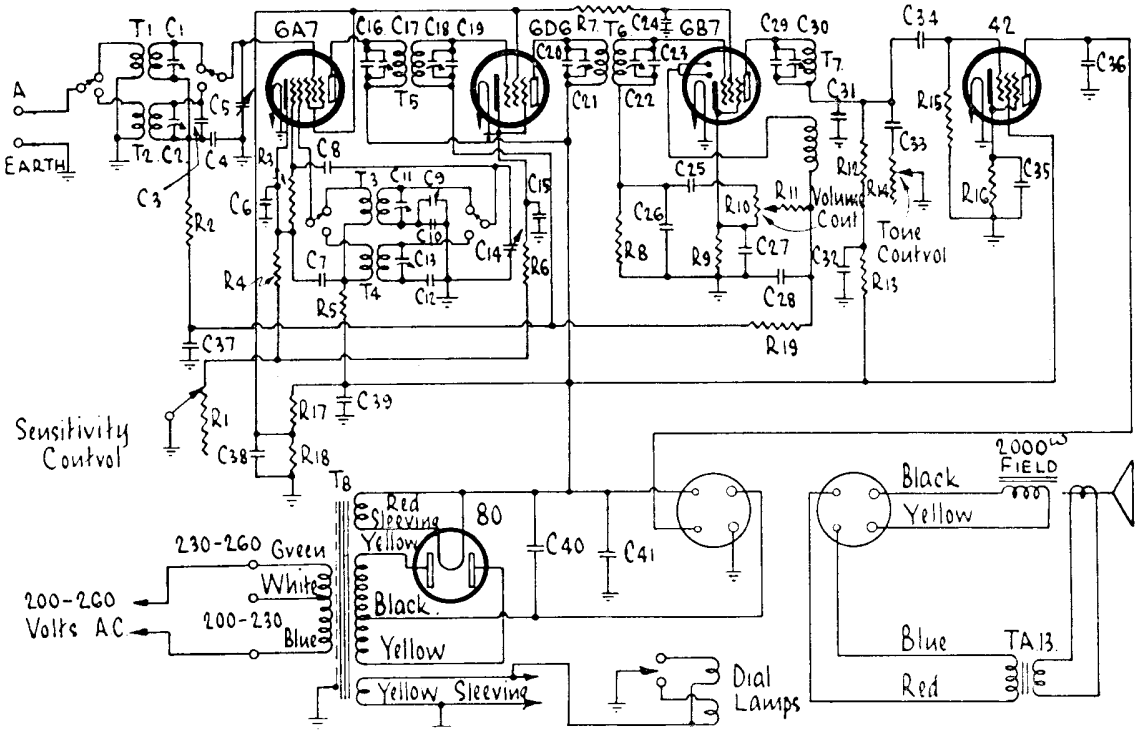
N.B.—All readings to be made with valves and loudspeaker withdrawn.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF INCORRECT READING.
Chassis to cathode 42 output pentode.	400 ohms.	R-16 short circuit or open circuit. C-35 short circuit.
Chassis to diode plates 6B7 second detector.	300,000-600,000 ohms with rotation of volume control.	T-7 secondary open circuit. R-9, R-11 short circuit or open circuit. Volume control R-10 faulty.
Chassis to cathode 6B7 second detector.	2000 ohms.	R-9 short circuit or open circuit. C-27 short circuit.
Chassis to cathode 6D6 I.F. amplifier.	900-3900 ohms with rotation of sensitivity control.	Sensitivity control R-1 faulty. R-6 short circuit or open circuit. C-15 short circuit.
Chassis to cathode 6A7 converter.	800-3800 ohms with rotation of sensitivity control.	Sensitivity control R-1 faulty. R-4 short circuit or open circuit. C-6 short circuit.
Chassis to filament 80.	60,000 ohms.	R-17, R-18 short circuit or open circuit, C-38, C-39, C-41, C-7, or C-32, short circuit. Wiring short circuit to chassis.
Chassis to control grid clip 6B7 second detector.	No reading (500,000 ohms).	T-6 secondary open circuit. R-8 short circuit or open circuit. C-26 short circuit. Wiring short circuit to chassis.
Chassis to control grid 42 output pentode.	300,000 ohms.	R-15 short circuit or open circuit.
Chassis to frame of variable condenser.	Continuity.	Earth connection to C-5, C-14 open circuit.
Chassis to orange lead on panel No. 1545 near front of chassis.	Continuity-300,000 ohms.	Tone control R-14 faulty.
Chassis to plate 42 output pentode.	No reading.	C-36 short circuit.
Chassis to screen grid 6B7 second detector.	70,000 ohms.	C-24 short circuit.
Chassis to A.V.C. line (see fig. 32).	No reading. (over 2 megohms).	C-4, C-37 short circuit.
Filament 80 to plate 6A7 converter.	Continuity.	T-5 primary open circuit.
Filament 80 to plate 6D6 I.F. amplifier	Continuity.	T-6 primary open circuit.
Filament 80 to screen grid 42 output pentode.	Continuity.	Wiring open circuit.
Filament 80 to No. 1 loudspeaker socket (see fig. 32).	Continuity.	Wiring open circuit.
Filament 80 to oscillator plate 6A7 in both positions of range switch.	20,000 ohms.	T-3 or T-4 primary open circuit. R-5 short circuit or open circuit. Range switch faulty.
Filament 80 to plate 6B7 second detector.	125,000 ohms.	T-7 primary open circuit. R-12, R-13 short circuit or open circuit.
Filament 80 to screen grid 6A7 converter and 6D6 I.F. amplifier.	40,000 ohms.	R-17 short circuit or open circuit.
Filament 80 to screen grid 6B7 second detector.	90,000 ohms.	R-17, R-7 short circuit or open circuit.
A.V.C. line to control grid clip 6A7 converter in both positions of range switch.	100,000 ohms.	T-1 or T-2 secondary open circuit. R-2 short circuit or open circuit. Range switch faulty.
A.V.C. line to control grid clip 6D6 I.F. amplifier.	Continuity.	T-5 secondary open circuit.
Green connection on volume control to diode plates 6B7 second detector.	Continuity.	T-7 secondary open circuit.
Cathode 6A7 converter to oscillator grid 6A7.	60,000 ohms.	R-3 short circuit or open circuit.
Fixed plates of C-14 to coil end of padding condensers C-9—C-10 and C-12. In both positions of range switch.	Continuity.	T-3 or T-4 secondary open circuit. Range switch faulty.
Aerial terminal to chassis in both positions of range switch.	Continuity.	T-1 or T-2 primary open circuit. Range switch faulty.
Across heaters 6A7 converter.	Continuity.	T-8 heater winding open circuit. Wiring open circuit.
Across filament 80.	Continuity.	T-8 filament winding open circuit.
No. 4 loudspeaker socket (see fig. 32) to each plate 80 separately.	300 ohms.	T-8 secondary open circuit. Wiring open circuit.
Across power cable.	Continuity.	T-8 primary open circuit. Power cable open circuit.
Across thin pins loudspeaker plug.	570 ohms (approx.).	T.A.-13Y. primary open circuit or short circuit (loud-speaker transformer).
Across thick pins loudspeaker plug.	2000 ohms.	Loudspeaker field open circuit or short circuit.

SOCKET VOLTAGES.

Valve.	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Heater Volts
6A7 Converter	3.0	55	240	1.5	6.3
" Oscillator	—	—	170	3.0	—
6D6 I.F. amplifier	3.0	55	240	3.0	6.3
6B7 Reflex "	1.5	35	60*	1.0	6.3
42 Pentode	14.5	240	220	30.0	6.3
80 Rectifier	630/315 volts, 50 M.A. total current				5.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volts A.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	2018	Aerial Coil 200-550 Metres
T2	2018	Aerial Coil 19-50 Metres
T3	2019	Osc. Coil 200-550 Metres
T4	2019	Osc. Coil 19-50 Metres
T5	1538	First I.F. Transformer
T6	1539	Second I.F. Transformer
T7	1540	Third I.F. Transformer
T8	1520	Power Transformer 50 ~
	1521	Power Transformer 40 ~
	1522	Power Transformer, 110 Volts
		RESISTORS.
R1	1578	3,000 ohms, Noise Supp. Cont.
R2		100,000 ohms, ½ watt
R3		60,000 ohms, ½ watt
R4		800 ohms, ½ watt
R5		20,000 ohms, ½ watt
R6		900 ohms, ½ watt
R7		50,000 ohms, ½ watt
R8		500,000 ohms, ½ watt
R9		2,000 ohms, ½ watt
R10	1668	300,000 ohms, Volume Cont.
R11		300,000 ohms, ½ watt
R12		100,000 ohms, ½ watt
R13		50,000 ohms, ½ watt
R14	1668	300,000 ohms Tone Cont.
R15		300,000 ohms, ½ watt
R16		400 ohms, 1 watt
R17		40,000 ohms, 1 watt

Code	Part No.	CONDENSERS.
C1		5-20 mmf. Mica Trimmer
C2		5-20 mmf. Mica Trimmer
C3		10 mmf. Mica Cond.
C4		.05 mf. Paper Cond.
C5	1516	Variable Condenser
C6		.1 mf Paper Cond.
C7		.05 mf. Paper Cond.
C8		50 mmf. Mica Cond.
C9		10-50 mmf. Mica Trimmer
C10	1153	**390 mmf. Padding Cond.**
C11		5-20 mmf. Mica Trimmer
C12		2800 mmf. Padding Cond.
C13		5-20 mmf. Mica Trimmer
C14	1516	Variable Condenser
C15		.1 mf. Paper Cond.
C16		120 mmf. Mica Cond.
C17		10-50 mmf. I.F. Trimmer
C18		10-50 mmf. I.F. Trimmer
C19		120 mmf. Mica Cond.
C20		120 mmf. Mica Cond.
C21		10-50 mmf. I.F. Trimmer
C22		10-50 mmf. I.F. Trimmer
C23		120 mmf. Mica Cond.
C24		.1 mf. Paper Cond.
C25		.05 mf. Paper Cond.
C26		200 mmf. Mica Cond.
C27		5 mf. 25 V. Elect. Cond.
C28		200 mmf. Mica Cond.
C29		130 mmf. Mica Cond.

Code	Part No.	CONDENSERS.
C30		10-50 mmf. I.F. Trimmer
C31		700 mmf. Mica Cond.
C32		.5 mf. Paper Cond.
C33		.01 mf. Paper Cond.
C34		.05 mf. Paper Cond.
C35		25 mf. 25 V. Elect. Cond.
C36		.005 mf. Paper Cond.
C37		.05 mf. Paper Cond.
C38		.25, .1 and .1 mf. Paper Cond.
C39		.5 mf. Paper Cond.
C40	1571	8 mf. 500 V. Elect. Cond.
C41	1571	8 mf. 500 V. Elect. Cond.
		RESISTORS.
R18		20,000 ohms, 1 watt.
R19		1¾ Megohms. ½ watt.

Fig. 33.—Circuit data (248).

Radiolas 249 and 302

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190-260 Volts
Frequency Rating	50-60 Cycles
(Special instruments made for other voltage and frequency ratings)	
Power Consumption	75 Watts
Tuning Ranges	(a) 1500-550 Kilocycles. (b) 19-50 Metres.
Intermediate Frequency	460 K.C.
Loudspeaker	Type D42
Loudspeaker Field Coil Resistance	2000 ohms.
Loudspeaker Audio Transformer	Type T.A.13.Y.

VALVES AND CIRCUITS.

6K7 R.F. Amplifier.
6A8 Detector-oscillator.
6K7 I.F. Amplifier.
6H6 Detector and A.V.C.
6F5 Audio Amplifier.
6F6 Output Pentode.
80 Rectifier.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 249 is a seven valve "World Range" A.C. operated superheterodyne receiver using metal envelope valves.

Two distinct tuning ranges, using two separate sets of tuning coils, selected by a two position range switch, are used in this instrument.

1. 1500-550 kilocycles (200-550 meters), which is the standard medium wave broadcasting band.
2. 19-50 meters, which covers four short wave broadcasting bands.

The signal from the aerial enters the receiver through an aerial isolating condenser (C-1), and after magnification by the aerial coil (T-1 or T-2) it is applied to the control grid of the 6K7 R.F. amplifier. The secondary of the aerial coil is tuned by the rear unit of the variable condenser (C-7). The signal is amplified by the 6K7, and is applied to the control grid of the 6A8 converter by the secondary of the R.F. coil (T-3 or T-4), which is tuned by the centre unit of the variable condenser (C-14). A local oscillator signal is generated by the elements of the 6A8, and this signal is always 460 K.C. higher in frequency than the R.F. signal. The oscillator coils

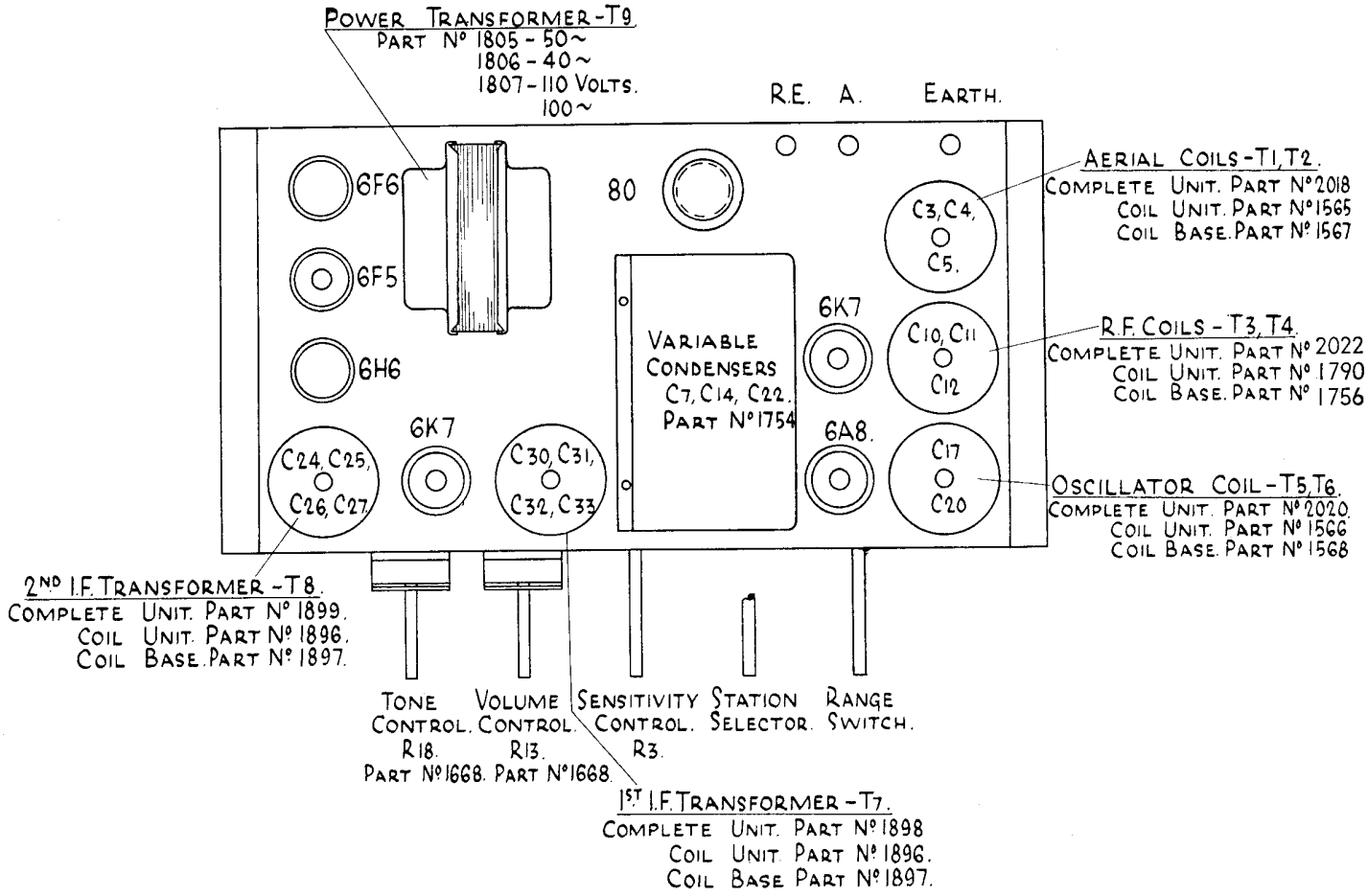


Fig. 34.—Layout diagram (top view), (249).

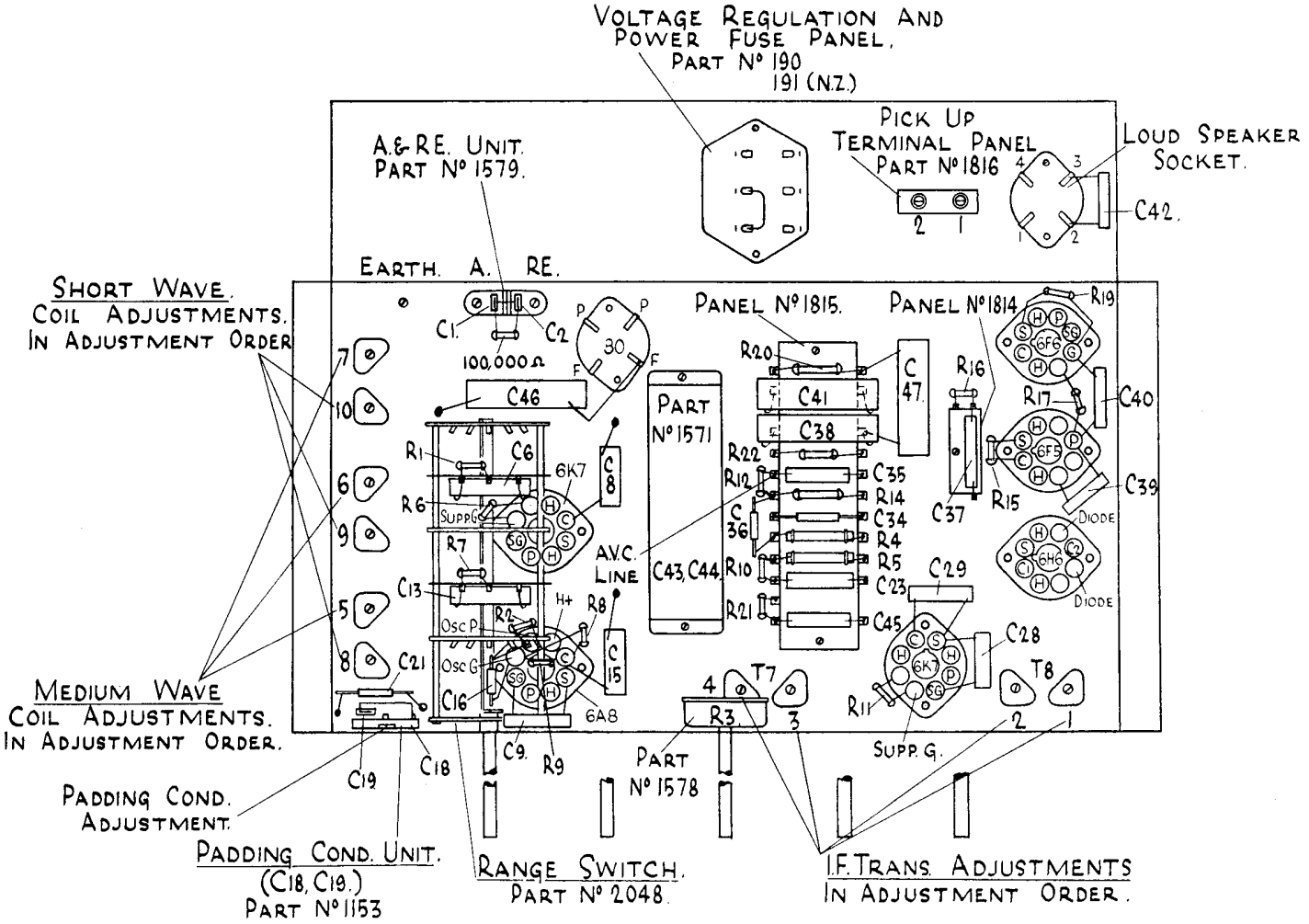


Fig. 35.—Layout diagram (underneath view), (249).

(T-5 and T-6), in conjunction with the variable condenser (C-22) and padding condensers (C-18—C-19 and C-21), have been designed to maintain this frequency difference throughout the tuning ranges of the receiver.

The I.F. signal, produced by the combining of the R.F. and local oscillator signals, appears in the plate circuit of the 6A8. The intermediate frequency stage is coupled to the 6A8 converter (input), and to the 6H6 second detector (output), by two I.F. transformers (T-7 and T-8); these transformers are adjusted to resonate at 460 K.C. by trimmer condensers across both their primary and secondary windings. The output of the I.F. stage is applied, by the secondary of the second I.F. transformer (T-8), to the diode plates of the 6H6 second detector, where it is rectified across resistors R-14 and R-13. A D.C. voltage is produced in the diode circuit (across R-14 and R-13) proportional to the signal being received, and it is applied as a grid bias voltage to the control grids of the 6K7 R.F. amplifier, 6A8 converter, and 6K7 I.F. amplifier for automatic volume control.

An audio signal is developed across R-13, in the diode circuit of the 6H6, and since R-13 is a variable resistance volume control, the magnitude of the audio signal applied to the control grid of the 6F5 audio amplifier (via C-37) may be adjusted as desired. The audio signal applied to the 6F5 is amplified by the valve, and is then resistance capacity coupled to the 6F6 output pentode, where it is amplified again to a suitable level for reproducion by the loudspeaker. Matching between the 6F6 output pentode and the loudspeaker is accomplished by the transformer T.A.13Y.

The tone control circuit consists of a variable control (R-18) connected in series with a .01 mfd. paper condenser (C-39), between the plate of the 6F5 audio amplifier and earth.

The sensitivity control (R-3) is a wire wound variable control connected in the cathode circuits of the 6A8 converter and the 6K7 I.F. amplifier. An additional resistor (R-2) is connected in this circuit by the range switch on medium waves; the short circuiting of this resistor on short waves boosts the sensitivity of the receiver.

The power unit consists of a transformer (T-9), an 80 valve rectifier, and a smoothing circuit incorporating the loudspeaker field winding (2000 ohms) in conjunction with two high capacity condensers (C-43 and C-44).

I.F. ALIGNMENT.

This receiver uses one stage of I.F. amplification, which includes two I.F. transformers. Four condensers align these

transformers to resonance (460 K.C.), and the condenser adjustments are found beneath the chassis in their adjustment order—1, 2, 3, 4. See fig. 35. Full I.F. alignment instructions appear on page 6.

R.F. ALIGNMENT.
MEDIUM WAVE.

Reference to fig. 35 will show the medium wave coil adjustments (5, 6, 7) and the padding condenser adjustment. Beginning with No. 5 (oscillator trimmer) refer to page 7 for full alignment instructions.

SHORT WAVE.

The short wave coil adjustments (8, 9, 10) are situated adjacent to the medium wave adjustments. See fig. 35. Beginning with No. 8 (oscillator trimmer) refer to page 8 for full alignment instructions.

CONTINUITY TESTING SCHEDULE RADIOLA 249.

N.B.—All readings to be made with the valves and loudspeaker withdrawn.

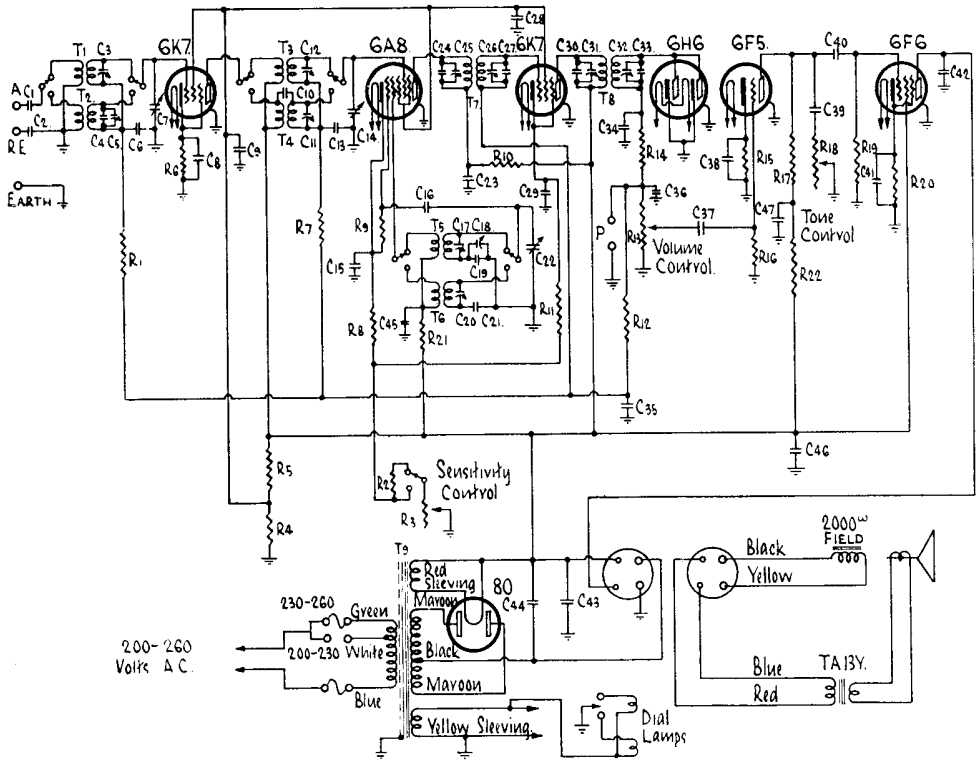
TEST BETWEEN	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to filament 80.	22,000 ohms.	C-45, C-43, C-46, C-23, C-9, C-28 short circuit. Resistors R-4 and R-5 short circuit or open circuit. Wiring short circuit to chassis.
Chassis to cathode 6A8 converter in both positions of range switch.	600-3600 ohms medium wave. 300-3300 ohms short wave with rotation of sensitivity control.	Sensitivity control R-3 faulty. R-8, R-2 short circuit or open circuit. C-15 short circuit. Range switch faulty.
Chassis to cathode 6K7 I.F. amplifier in both positions of range switch.	900-3,900 ohms medium wave. 600-3600 ohms short wave with rotation of sensitivity control.	Sensitivity control R-3 faulty. R-11, R-2 short circuit or open circuit. Faulty range switch. C-29 short circuit.
Chassis to cathode 6K7 R.F. amplifier.	600 ohms.	R-6 short circuit or open circuit. C-8 short circuit.
Chassis to cathode 6F5 audio amplifier.	3,000 ohms.	R-15 short circuit or open circuit. C-38 short circuit.
Chassis to cathode 6F6 output pentode.	400 ohms.	R-20 short circuit or open circuit. C-41 short circuit.
Chassis to cathodes 1 and 2 6H6 second detector.	Continuity.	Earth connections on 6H6 open circuit.
Chassis to metal shell contact (S) all valves excepting 80.	Continuity.	Earth connection open circuit.
Chassis to No. 2 pick-up terminal (see fig. 35).	300,000 ohms.	Volume control R-13 faulty. C-36 short circuit.
Chassis to No. 1 pick-up terminal (see fig. 35).	Continuity.	Earth connection open circuit.
Chassis to control grid clip 6F5 audio amplifier with volume control in minimum anti-clockwise position.	No reading (500,000 ohms).	R-16 short circuit or open circuit. C-37 short circuit.
Chassis to control grid 6F6 output pentode.	No reading (500,000 ohms).	R-19 short circuit or open circuit.
Chassis to No. 3 loudspeaker socket (see fig. 35).	Continuity.	Wiring open circuit.
Chassis to plate 6F6 output pentode.	No reading.	C-42 short circuit.
Chassis to H+ 6A8 converter with dial lamps in their holders and in both positions of range switch.	Continuity.	Dial lamp open circuit. Dial lamp section of range switch faulty.
Chassis to plate 6F5 audio amplifier with tone control R-18 in minimum anti-clockwise position.	322,000 ohms.	C-39 short circuit.
Chassis to aerial terminal and radio earth terminal.	No reading.	C-1 or C-2 short circuit.
Chassis to frame of variable condenser.	Continuity.	Earth connections to C-7, C-14, C-22 open circuit.
Chassis to AVC line (see fig. 35).	No reading.	C-35, C-6, C-13 short circuit.
Chassis to braided lead connection on tone control R-18.	Continuity- 300,000 ohms with rotation of tone control.	Tone control R-18 faulty.
Filament 80 to plate 6K7 R.F. amplifier in both positions of range switch.	Continuity.	T-3 or T-4 primary open circuit. Range switch faulty.
Filament 80 to plate detector section 6A8 converter.	300 ohms.	T-7 primary open circuit. R-10 short circuit or open circuit.
Filament 80 to plate 6K7 I.F. amplifier.	Continuity.	T-8 primary open circuit.
Filament 80 to screen grid 6F6 output pentode.	Continuity.	Wiring open circuit.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Filament 80 to No. 1 loudspeaker socket (see fig. 35).	Continuity.	Wiring open circuit.
Filament 80 to plate 6F5 audio amplifier.	300,000 ohms.	R-17, R-22, short circuit or open circuit.
Filament 80 to screen grid 6K7 R.F. amplifier.	11,000 ohms.	R-5 short circuit or open circuit.
Filament 80 to plate oscillator section of 6A8 converter in both positions of range switch.	20,000 ohms.	T-5 or T-6 primary open circuit. R-21 short circuit or open circuit. Range switch faulty.
Plate 6F6 output pentode to No. 2 loudspeaker socket.	Continuity.	Wiring open circuit.
Diodes 6H6 second detector to No. 2 pick-up terminal.	100,000 ohms.	T-8 secondary open circuit. R-14 short circuit or open circuit.
AVC line to control grid clip 6K7 R.F. amplifier in both positions of range switch.	100,000 ohms.	T-1 or T-2 secondary open circuit. R-1 short circuit or open circuit. Range switch faulty.
AVC line to control grid clip 6K7 I.F. amplifier.	Continuity.	T-7 secondary open circuit.
AVC line to control grid clip 6A8 converter in both positions of range switch.	100,000 ohms.	T-3 or T-4 secondary open circuit. R-7 short circuit or open circuit.
Across filament 80.	Continuity.	T-9 filament winding open circuit. Wiring open circuit.
Across heaters 6A8 converter.	Continuity.	T-9 heater winding open circuit. Wiring open circuit.
No. 4 loudspeaker socket (see fig. 35) to each plate 80 separately.	300 ohms.	T-9 secondary open circuit. Wiring open circuit.
Across power cable.	Continuity.	Power transformer T-9 primary open circuit. Power cable open circuit. Power fuse open circuit.
Cathode 6A8 converter to grid oscillator section 6A8.	60,000 ohms.	R-9 short circuit or open circuit.
Fixed plates C-22 to coil end of padding condenser C-18 (C-19) and C-21 in both positions of range switch.	Continuity.	T-5 or T-6 secondary open circuit. Range switch faulty.
Across orange and black connections on aerial and radio earth unit in both positions of the range switch.	Continuity.	T-1 or T-2 primary open circuit. Range switch faulty.
Aerial terminal to radio earth terminal.	100,000 ohms.	Resistor short circuit or open circuit.
Plate 6F5 audio amplifier to control grid 6F6 output pentode.	No reading.	C-40 short circuit.
Across thick pins loudspeaker plug.	2,000 ohms.	Loudspeaker field short circuit or open circuit.
Across thin pins loudspeaker plug.	570 ohms (approx.).	Loudspeaker transformer T.A. 13Y primary open circuit.

SOCKET VOLTAGES.

Valve.	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Heater Volts
6K7 R.F. Amplifier ...	3.0	100	240	6.0	6.3
6A8 Converter M.W.	6.0	100	240	3.0	6.3
S.W.	3.0	100	240	4.0	—
,, Oscillator	—	—	170	2.5	—
6K7 I.F. Amplifier M.W.	6.0	100	240	4.0	6.3
S.W.	3.0	100	240	6.0	—
6H6 Detector	—	—	—	—	6.3
6F5 Audio Amplifier	1.5	—	90*	0.4	6.3
6F6 Pentode	14.5	235	220	30.0	6.3
80 Rectifier	.....680/340 Volts, 60 M.A. total current				5.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volt A.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	2018	Aerial Coil 200-550 Met.
T2	2018	Aerial Coil 19-50 Met.
T3	2022	R.F. Coil 200-550 Met.
T4	2022	R.F. Coil 19-50 Met.
T5	2020	Oscillator Coil 200-550 Met.
T6	2020	Oscillator Coil 19-50 Met.
T7	1898	First I.F. Transformer
T8	1899	Second I.F. Transformer
T9	1805	Power Transformer 50 ~
	1806	Power Transformer 40 ~
	1807	Power Transformer 110 Volts
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		300 ohms, ⅓ watt
R3	1578	3,000 ohms, Sensitivity Cont.
R4		11,000 ohms, 3 watts
R5		11,000 ohms, 3 watts
R6		600 ohms, ⅓ watt
R7		100,000 ohms, ⅓ watt
R8		300 ohms, ⅓ watt
R9		60,000 ohms, ⅓ watt
R10		300 ohms, ⅓ watt
R11		600 ohms, ⅓ watt
R12		1¾ megohms, ⅓ watt
R13	1668	300,000 ohms, Volume Cont.
R14		100,000 ohms, ⅓ watt

Code	Part. No.	CONDENSERS
C1		500 mmf. Mica Cond.
C2		500 mmf. Mica Cond.
C3		5-20 mmf. Mica Trimmer
C4		10 mmf. Mica Cond.
C5		5-20 mmf. Mica Trimmer
C6		.05 mf. Paper Cond.
C7	1754	Variable Condenser
C8		.1 mf. Paper Cond.
C9		.1 mf. Paper Cond.
C10		10 mmf. Mica Cond.
C11		5-20 mmf. Mica Trimmer
C12		5-20 mmf. Mica Trimmer
C13		.05 mf. Paper Cond.
C14	1754	Variable Condenser
C15		.1 mf. Paper Cond.
C16		50 mmf. Mica Cond.
C17		5-20 mmf. Mica Trimmer
C18	1153	10-50 mmf. Mica Trimmer
C19	1153	390 mmf. Padding Cond.
C20		5-20 mmf. Mica Trimmer
C21		2800 mmf. Padding Cond.
C22	1754	Variable Condenser
C23		.05 mf. Paper Cond.
C24		50 mmf. Mica Cond.
C25		10-50 mmf. Mica Trimmer
C26		10-50 mmf. Mica Trimmer
C27		50 mmf. Mica Cond.
C28		.1 mf. Paper Cond.
C29		.1 mf. Paper Cond.

Code	Part No.	CONDENSERS.
C30		50 mmf. Mica Cond.
C31		10-50 mmf. Mica Trimmer
C32		10-50 mmf. Mica Trimmer
C33		50 mmf. Mica Cond.
C34		200 mmf. Mica Cond.
C35		.05 mf. Paper Cond.
C36		100 mmf. Mica Cond.
C37		.05 mf. Paper Cond.
C38		5 mf. 25 V. Elect. Cond.
C39		.01 mf. Paper Cond.
C40		.05 mf. Paper Cond.
C41		25 mf. 25 V. Elect. Cond.
C42		.005 mf. Paper Cond.
C43	1571	8 mf. 500 V. Elect. Cond.
C44	1571	8 mf. 500 V. Elect. Cond.
C45		.05 mf. Paper Cond.
C46		.5 mf. Paper Cond.
C47		.5 mf. Paper Cond.
		RESISTORS.
R15		3,000 ohms, ⅓ watt
R16		500,000 ohms, ⅓ watt
R17		250,000 ohms, 1 watt
R18	1668	300,000 ohms, Tone Control
R19		500,000 ohms, ⅓ watt
R20		400 ohms, 1 watt
R21		20,000 ohms, ⅓ watt
R22		50,000 ohms, ⅓ watt

Fig. 36.—Circuit data (249).

Radiola 250

ELECTRICAL SPECIFICATIONS.

"A" Battery	2 Volts (0.84 amps.). (Dial lamp off 0.78 amps.)
"B" Battery	135 Volts 14-16 M.A.
"C" Battery	(a) 4½ Volts Bias. (b) 2-4½ Volts Bias.
Tuning Range	(a) 1500-550 Kilocycles (b) 19-50 Metres.
Intermediate Frequency	460 K.C.
Loudspeaker (Permanent Magnet)	Type D51.
Loudspeaker Audio Transformer	Type T.A. 31Y.

VALVES AND CIRCUITS.

1C4 R.F. Amplifier.
1C6 Detector Oscillator.
1C4 I.F. Amplifier.
1C4 I.F. Amplifier.
1B5 Detector, AVC and Audio Amplifier.
1D4 Output Pentode.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 250 is "World Range" six valve battery operated superheterodyne receiver.

Two distinct tuning ranges are covered by this instrument.

1. The standard medium wave broadcasting band of 1500-550 kilocycles (200-550 meters).
2. Four short wave broadcasting bands (19-50 meters).

A two position range switch is employed to select the range in which the desired signal is located, and two different groups of tuned circuits are used, one group for each range. The signal enters the receiver and is applied to the control grid of the 1C4 R.F. amplifier through the aerial coupling coil (T-1 or T-2). The secondary of this coil is tuned by the rear unit of the variable condenser (C-5). The output of the 1C4 is coupled to the control grid of the 1C6 converter by the R.F. coupling coil (T-3 or T-4), the secondary of which is tuned by the centre unit of the variable condenser (C-11). The oscillator elements of the 1C6 converter generate a local oscillator signal, which is always 460 K.C. higher in frequency than the R.F. signal. The oscillator coils (T-5 and T-6) in conjunction with the variable condenser (C-24) and padding condensers (C-20—C-21 and C-23) are designed to maintain this frequency difference throughout the tuning ranges of the receiver.

The combination of the local oscillator signal with the R.F. signal produces the intermediate frequency of 460 K.C. The primary and secondary of the first I.F. transformer (T-7), the primary and secondary of the second I.F. transformer (T-8), and the primary of the third I.F. transformer (T-9) are all tuned to 460 K.C. by compression type trimmer condensers. The I.F. signal, in the plate circuit of the 1C6 converter, is amplified by two I.F. stages, and is applied, by the secondary of the third I.F. transformer (T-9), to a diode of the 1B5 second detector to be rectified across resistors R-8 and R-9.

A signal is transferred (via C-35) to the other diode of the 1B5, and a D.C. voltage is developed across R-11 in relation to the strength of the incoming signal. This D.C. voltage is impressed (via R-12) on the control grid of the 1C4 I.F. amplifier to give automatic volume control on the short wave range. For medium wave reception, the A.V.C. is disconnected (by the range switch) and fixed zero bias is applied to this valve. A.V.C. is applied to the control grids of the 1C4 R.F. amplifier and the 1C6 converter through bias battery B; the 1C6 has an initial negative bias on the control grid of —3 volts on the short wave range, and —6 volts on the medium wave range. This change of bias voltage is made by the range switch. The lower bias voltage on the short wave range increases the sensitivity of the receiver. An initial negative bias voltage of —1.5 volts is supplied to the 1C4 R.F. amplifier by bias battery B, on both tuning ranges.

An audio signal is developed across R-9, in the diode circuit of the 1B5, and since R-9 is a variable resistance volume control, the magnitude of the audio signal applied to the control grid of the 1B5 (via C-34) may be adjusted as desired. The audio signal applied to the 1B5 is amplified by the valve and is transferred by a resistance-capacity-coupling network to the 1D4 output pentode.

The permanent magnet loudspeaker receives the output of the 1D4 through a two lead cable, the necessary matching between the 1D4 and the loudspeaker being accomplished by the transformer T.A.31Y.

The tone control is a variable resistance control (R-13) connected in series with a .01 mfd. paper condenser (C-39), between the plate of the 1B5 and earth.

I.F. ALIGNMENT.

This receiver uses two stages of I.F. amplification, which include three I.F. transformers (T-7, T-8, T-9). Five compression type trimmer condensers tune the I.F. transformers to resonance 460 K.C., and the location of these adjustments together with their adjustment order is shown on figs. 37 and 38. Align first the third I.F. transformer adjustment (No. 1), which is situated on the top of the chassis (see fig. 37) and follow with 2, 3, 4, 5, situated below the chassis (see fig. 38).

Refer to page 6 for full I.F. alignment instructions.

R.F. ALIGNMENT.

MEDIUM WAVE.

Refer to fig. 38 for the location of the medium wave coil adjustments (Nos. 6, 7, 8), and the padding condenser adjustment. Beginning with No. 6 (oscillator trimmer), refer to page 7 for detailed alignment instructions.

SHORT WAVE.

Locate the short wave coil adjustments (Nos. 9, 10, 11) on fig. 38 and beginning with No. 9 (oscillator trimmer), refer to page 8 for full alignment instructions.

NOTE.

It will be noticed on fig. 37 that the R.F. coil has two complete unit numbers. When either of these numbers is quoted it will be satisfactory for identification.

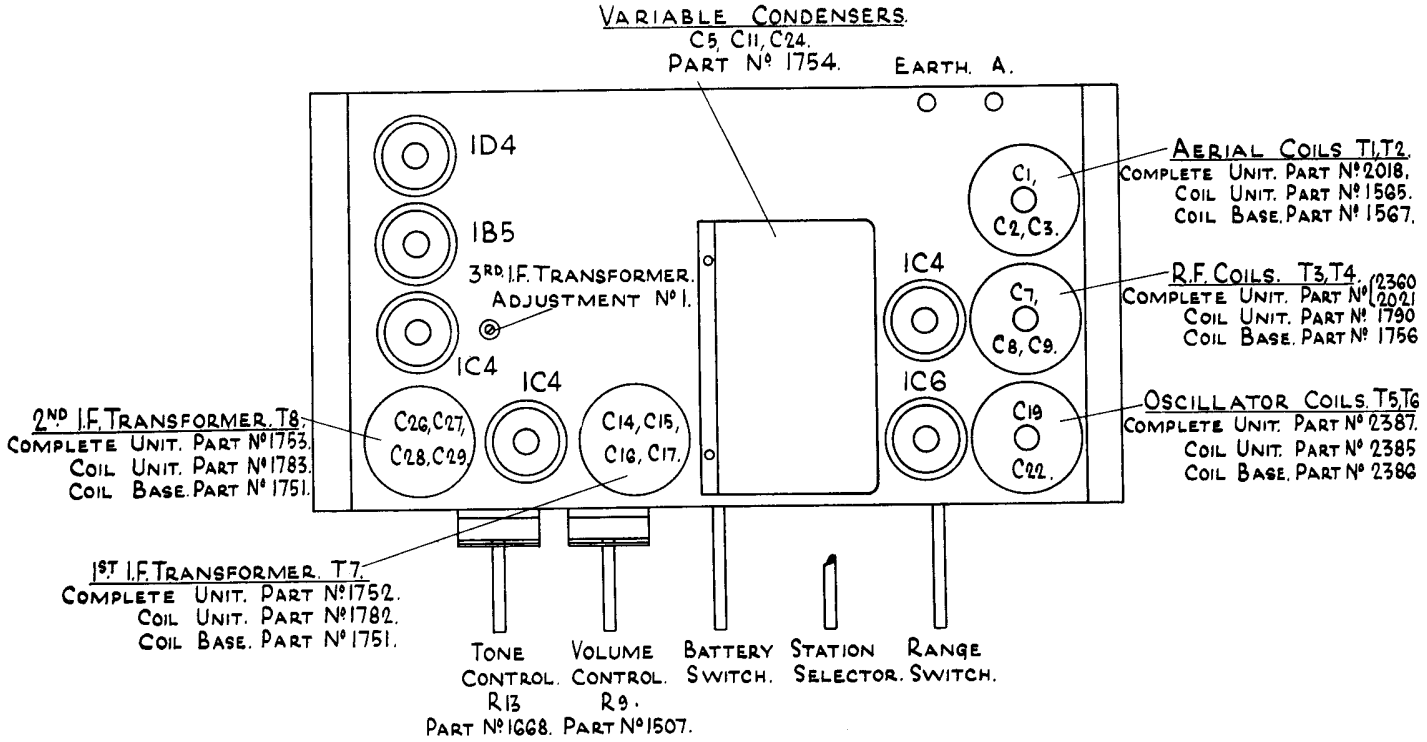


Fig. 37.—Layout diagram (top view), (250).

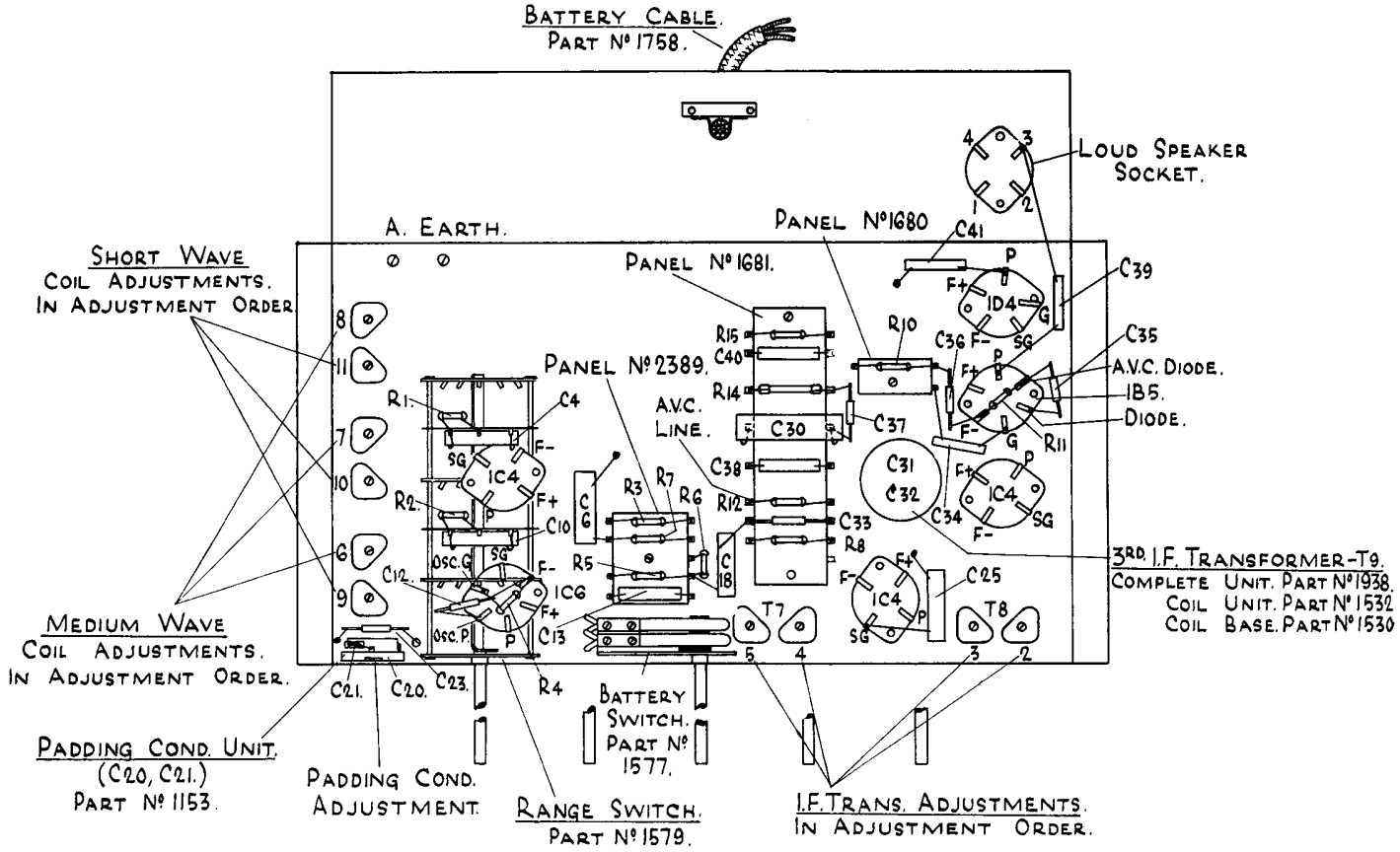


Fig. 38.—Layout diagram (underneath view), (250).

CONTINUITY TESTING SCHEDULE R250.

N.B.—All readings to be made with the batteries disconnected, valves and loudspeaker withdrawn, and battery switch **on**, unless stated to the contrary.

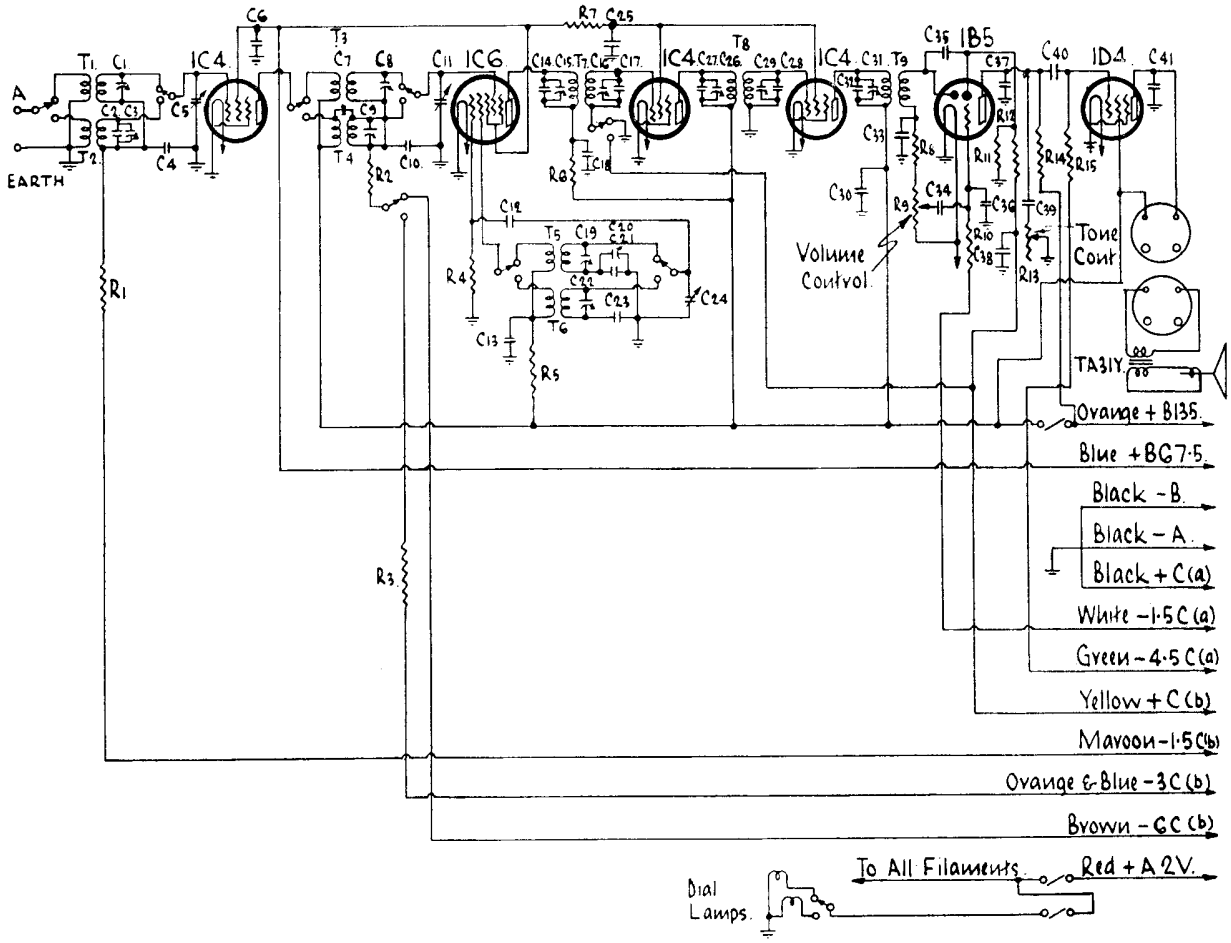
TEST BETWEEN	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
A— (black) battery cable to chassis.	Continuity.	A— cable open cable.
B— (black) battery cable to chassis.	Continuity.	Wiring open circuit.
AVC diode 1B5 second detector (see fig. 38) to chassis.	No reading ($1\frac{3}{4}$ megohms).	R11 short circuit or open circuit.
C+ (A) (black) battery cable to chassis.	Continuity.	Wiring open circuit.
Control grid clip 1C4 1st I.F. amplifier to chassis on medium waves.	Continuity.	T-7 secondary open circuit. Faulty range switch.
Control grid clip 1C4 2nd I.F. amplifier to chassis.	Continuity.	T-8 secondary open circuit.
Oscillator grid 1C6 converter to chassis.	60,000 ohms.	R-4 short circuit or open circuit.
Aerial terminal to chassis in both positions of range switch.	Continuity.	T-1 or T-2 primary open circuit. Range switch faulty.
No. 3 loudspeaker socket (see fig. 38) to chassis.	Continuity–300,000 ohms with rotation of tone control.	Faulty tone control R-13.
B+ $67\frac{1}{2}$V (blue) battery cable to chassis.	No reading.	C6, C25 short circuit. Wiring short circuit to chassis.
B+ 135V (orange) battery cable to chassis.	No reading.	C-30, C-18, C-13 short circuit. Wiring short circuit to chassis.
Frame of variable condenser to chassis.	Continuity.	Earth connections to C-5, C-11, C-24 open circuit.
Plate 1D4 output pentode to chassis.	No reading.	C-41 short circuit.
B+ 135V (orange) battery cable to plate 1C4 R.F. amplifier in both positions of range switch.	Continuity.	Battery switch faulty. T-3 or T4 primary open circuit. Faulty range switch. B+ 135V cable open circuit.
B+ 135V (orange) battery cable to plate oscillator section 1C6 converter in both positions of range switch.	10,000 ohms.	T-5 or T-6 primary open circuit. Faulty range switch. R-5 short circuit or open circuit.
B+135V (orange) battery cable to plate detector section 1C6 converter.	300 ohms.	R-6 short circuit or open circuit. T-7 primary open circuit.
B+ 135V (orange) battery cable to plate 1C4 1st I.F. amplifier.	Continuity.	T-8 primary open circuit.
B+ 135V (orange) battery cable to plate 1C4 2nd I.F. amplifier.	Continuity.	T-9 primary open circuit.
B+ 135V (orange) battery cable to plate 1B5 second detector **with battery switch off.**	250,000 ohms.	R-14 short circuit or open circuit.
B+ 135V (orange) battery cable to screen grid 1D4 output pentode.	Continuity.	Wiring open circuit.
B+ 135V (orange) battery cable to No. 2 loudspeaker socket (see fig. 38).	Continuity.	Wiring open circuit.
B+ $67\frac{1}{2}$V (blue) battery cable to screen grid 1C4 R.F. amplifier.	Continuity.	Wiring open circuit.
B+ $67\frac{1}{2}$V (blue) battery cable to screen grids of 1C4 1st I.F. amplifier and 1C4 2nd I.F. amplifier.	50,000 ohms.	R-7 short circuit or open circuit.
A+ (red) battery cable to F+ all valves.	Continuity.	Battery switch faulty.
A+ (red) battery cable to centre contact of each dial lamp holder, with dial lamp section of battery switch **on**, and dependent on position of range switch.	Continuity.	Dial lamp open circuit. Dial lamp section of battery switch faulty. Range switch faulty.
C— $1\frac{1}{2}$V (A) (white) battery cable to control grid of 1B5 second detector.	No reading ($1\frac{3}{4}$ megohms).	R-10 short circuit or open circuit.
C— $4\frac{1}{2}$V (A) (green) battery cable to control grid 1D4 output pentode.	No reading (500,000 ohms).	R-15 short circuit or open circuit.
C+ (B) (yellow) battery cable to control grid clip 1C4 1st I.F. amplifier on short waves.	Continuity.	T-7 secondary open circuit. Faulty range switch.
C— $1\frac{1}{2}$V (B) (maroon) battery cable to grid clip 1C4 R.F. amplifier.	100,000 ohms.	T-1 or T-2 secondary open circuit. R-1 short circuit or open circuit.
C— 3V (B) (orange and blue) to control grid clip 1C6 converter on short waves.	200,000 ohms.	T-4 secondary open circuit. R-2, R-3 short circuit or open circuit. Range switch faulty.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
C— 6V (B) (brown) to control grid clip 1C6 converter on medium waves.	100,000 ohms.	T-3 secondary open circuit. Faulty range switch. R-2 short circuit or open circuit.
Diode rectifier plate 1B5 second detector to F+ 1B5.	No reading (600,000 ohms).	Volume control R-9 faulty. T-9 secondary open circuit. R-8 short circuit or open circuit.
Plate 1B5 second detector to control grid 1D4 output pentode.	No reading.	C-40 short circuit.
Fixed plates C-24 to coil end of padding condensers C-20 (C-21) and C-23 in both positions of range switch.	Continuity.	T-5 or T-6 secondary open circuit. Range switch faulty.
Plate 1D4 output pentode to No. 1 loudspeaker socket (see fig. 38).	Continuity.	Wiring open circuit.
Across thin pins of loudspeaker plug.	700 ohms. (approx.).	T.A.31Y primary open circuit (loudspeaker transformer).

SOCKET VOLTAGES.

Valve.	Chassis to Control Grid Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Filament Volts
1C4 R.A. amplifier	—1.5*	67.5	135	2.0	2.0
1C6 Converter M.W.	—6.0*	67.5	135	0.5	2.0
S.W.	—3.0*	67.5	135	1.5	—
Oscillator	—	—	100	3.0	—
1C4 Amplifier (I.F.)	0	40	135	1.0	2.0
1C4 I.F. amplifier	0	40	135	1.0	2.0
1B5 Detector	—1.5*	—	70*	0.25	2.0
1D4 Pentode	—4.5*	135	125	6.0	2.0

* Cannot be measured accurately with ordinary voltmeter. Measured with controls in maximum clockwise position. No signal input. D.C. voltmeter used as suggested on page 3.



Code.	Part No.	COILS.
T1	2018	Aerial Coil 200-550 Metres
T2	2018	Aerial Coil 19-50 Metres
T3	2360	R.F. Coil 200-550 Metres
T4	2360	R.F. Coil 19-50 Metres
T5	2387	Oscillator Coil 200-550 Metres
T6	2387	Oscillator Coil 19-50 Metres
T7	1752	First I.F. Transformer
T8	1753	Second I.F. Transformer
T9	1938	Third I.F. Transformer
		RESISTORS.
R1		100,000 ohms, $\frac{1}{3}$ watt
R2		100,000 ohms, $\frac{1}{3}$ watt
R3		100,000 ohms, $\frac{1}{3}$ watt
R4		60,000 ohms, $\frac{1}{3}$ watt
R5		20,000 ohms, $\frac{1}{3}$ watt or 10,000 ohms, $\frac{1}{3}$ watt
R6		300 ohms, $\frac{1}{3}$ watt
R7		50,000 ohms, $\frac{1}{3}$ watt
R8		100,000 ohms, $\frac{1}{3}$ watt
R9	1507	500,000 ohms, Volume Control
R10		$1\frac{1}{2}$ megohms, $\frac{1}{3}$ watt
R11		$1\frac{1}{2}$ megohms, $\frac{1}{3}$ watt
R12		$1\frac{1}{4}$ megohms, $\frac{1}{3}$ watt
R13	1668	300,000 ohms, Tone Control
R14		250,000 ohms, 1 watt
R15		500,000 ohms, $\frac{1}{3}$ watt

Code.	Part No.	CONDENSERS
C1		5-20 mmf. Mica Trimmer
C2		10 mmf. Mica Condenser
C3		5-20 mmf. Mica Trimmer
C4		.05 mf. Paper Cond.
C5	1754	Variable Condenser
C6		.1 mf. Paper Cond.
C7		10 mmf. Mica Cond.
C8		5-20 mmf. Mica Trimmer
C9		5-20 mmf. Mica Trimmer
C10		.05 mf. Paper Cond.
C11	1754	Variable Condenser
C12		50 mmf. Mica Cond.
C13		.05 mf. Paper Cond.
C14		180 mmf. Mica Cond.
C15		10-50 mmf. Mica Trimmer
C16		10-50 mmf. Mica Trimmer
C17		180 mmf. Mica Cond.
C18		.05 mf. Paper Cond.
C19		5-20 mmf. Mica Trimmer
C20	1153	10.50 mmf. Mica Trimmer
C21	1153	390 mmf. Padding Cond.
C22		5-20 mmf. Mica Trimmer
C23		2800 mmf. Padding Cond.
C24	1754	Variable Condenser
C25		.1 mf. Paper Cond.
C26		10-50 mmf. Mica Trimmer
C27		180 mmf. Mica Cond.
C28		180 mmf. Mica Cond.
C29		10-50 mmf. Mica Trimmer

Code.	Part No.	CONDENSERS.
C30		.5 mf. Paper Cond.
C31		10-50 mmf. Mica Trimmer
C32		130 mmf. Mica Cond.
C33		200 mmf. Mica Cond.
C34		.05 mf. Paper Cond.
C35		700 mmf. Mica Cond.
C36		200 mmf. Mica Cond.
C37		700 mmf. Mica Cond.
C38		.05 mf. Paper Cond.
C39		.01 mf. Paper Cond.
C40		.05 mf. Paper Cond.
C41		.005 mf. Paper Cond.

Fig. 39.—Circuit data (250).

Radiolas 251 and 303

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190-260 Volts
Frequency Rating	40-60 Cycles
Power Consumption	90 Watts
Tuning Ranges	(a) 1500-550 Kilocycles (b) 19-50 Metres
Intermediate Frequency	460 K.C.
Loudspeaker	Type D42
Loudspeaker Field Coil Resistance	1000 ohms.
Loudspeaker Audio Transformer	Type TA14Y

VALVES AND CIRCUITS.

6K7 R.F. Amplifier.
6A8 Detector-oscillator.
6K7 I.F. Amplifier.
6H6 Detector and A.V.C.
6F5 Audio Amplifier.
Two 6F6's Class A Pentodes.
80 Rectifier.
6E5 Tuning Indicator.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 251 is an eight-valve "World Range" A.C. operated superheterodyne receiver incorporating such features as metal envelope valves, 6F6 output pentodes in Class "A" push pull, and a 6E5 "Visual Tuning Indicator".

Two distinct tuning ranges, using two separate sets of tuning coils, selected by a two position range switch, are used by this instrument.

(1) 1500-550 kilocycles (200-550 meters), which is the standard medium wave broadcasting band.

(2) 19-50 meters, which covers four short wave broadcasting bands.

The signal from the aerial enters the receiver, through the aerial isolating condenser (C-1), and after step-up by the aerial coil (T-1 or T-2) it is applied to the control grid of the 6K7 R.F. amplifier. The secondary of the aerial coil is tuned by the rear unit of the variable condenser (C-7). The signal is amplified by the 6K7 and is applied to the control grid of the 6A8 converter by the secondary of the R.F. coil (T-3 or T-4), which is tuned by the middle unit of the variable condenser (C-14). The oscillator elements of the 6A8 converter generate a local oscillator signal, which is always 460 K.C. higher in frequency than the R.F. signal. The oscillator coils (T-5 and T-6), and padding condensers (C-19—C20 and C-22) have been designed in conjunction with the variable condenser (C-29) to maintain this frequency difference throughout the tuning ranges of the receiver.

The I.F. signal, produced by the combining of the R.F. and local oscillator signals, appears in the plate circuit of the 6A8. The intermediate frequency stage is coupled to the 6A8 converter (input) and to the 6H6 second detector (output) by means of two I.F. transformers (T-7 and T-8). These transformers are adjusted to resonate at 460 K.C. by trimmer

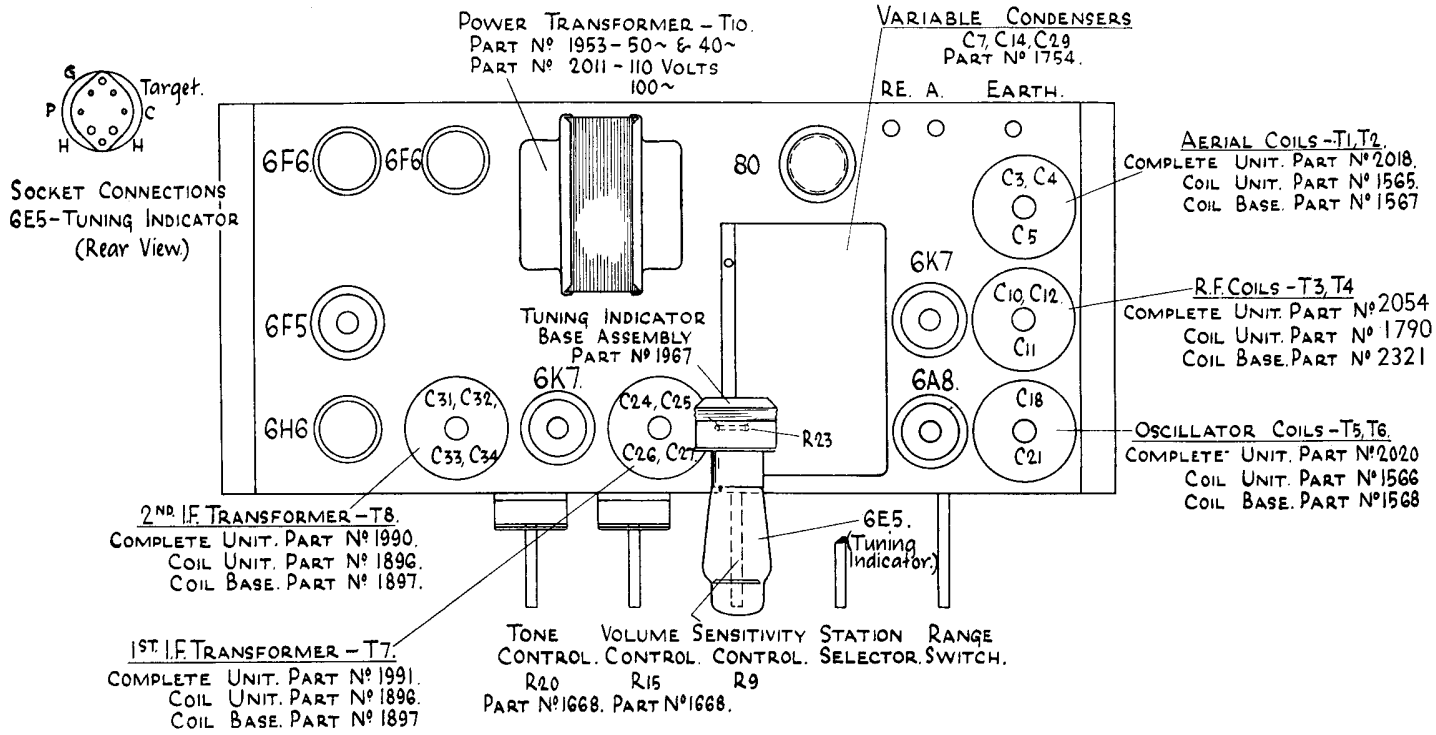


Fig. 40.—Layout diagram (top view), (251).

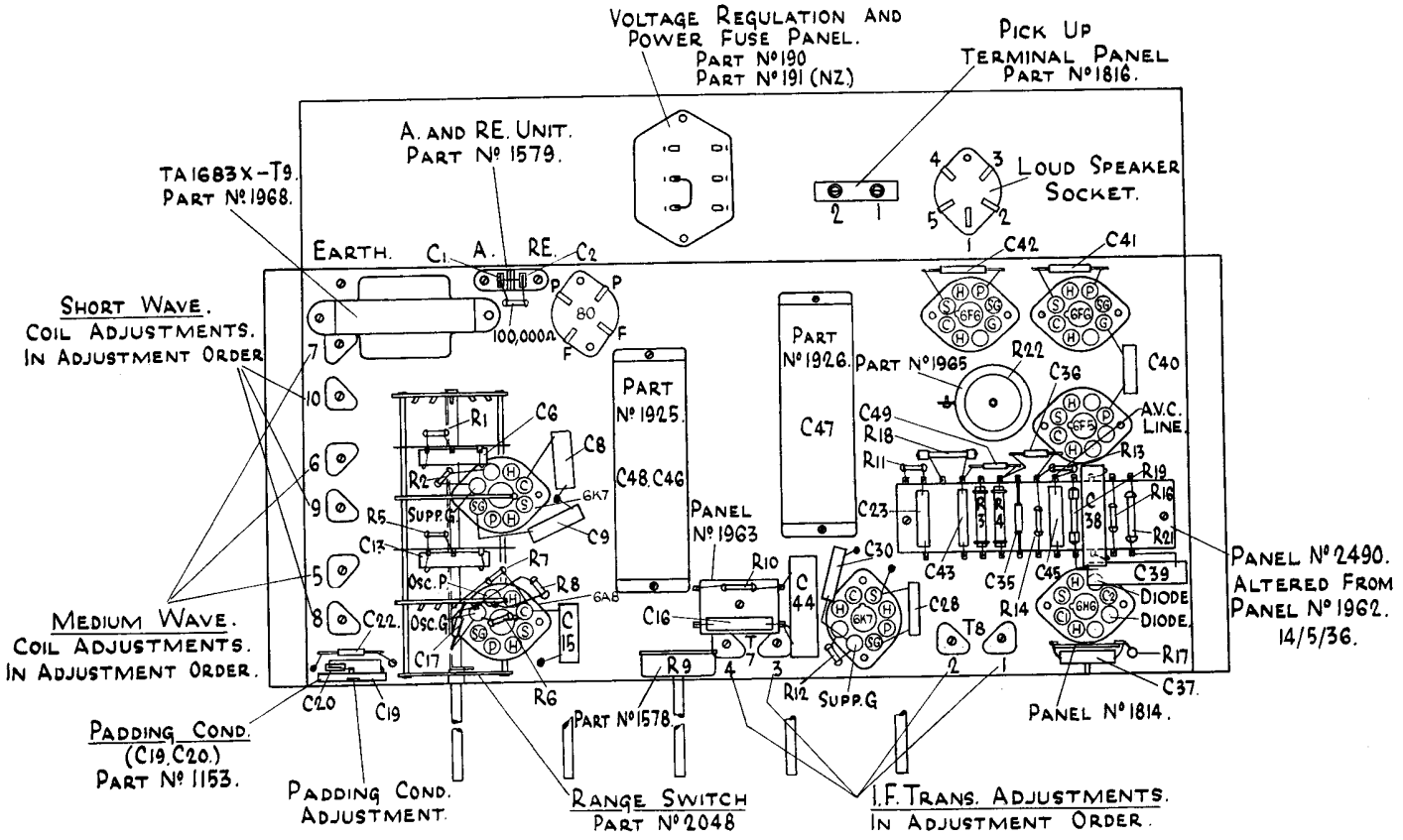


Fig. 41.—Layout diagram (underneath view), (251).

condensers across both their primary and secondary windings. The output of the I.F. stage is applied by the secondary of the second I.F. transformer (T-8) to the diodes of the 6H6 second detector where it is rectified across resistors R-14 and R-15.

An audio signal is developed in the diode circuit of the 6H6 across R-15, which has a dual function (diode load resistor and volume control), and as R-15 is a variable resistance control, the magnitude of the audio signal carried through its variable arm to the control grid of the 6F5 audio amplifier (via C-37) may be adjusted to the desired level. A D.C. voltage is produced in the diode circuit of the 6H6 (across R-14 and R-15) proportional to the incoming signal, and it is applied as a grid bias voltage to the control grid circuits of the 6K7 R.F. amplifier, 6A8 converter, and 6K7 I.F. amplifier for automatic volume control.

The output of the 6F5 is resistance-capacity coupled to two 6F6 output pentodes in Class "A" push-pull, where it is amplified again for reproduction by the loudspeaker; the necessary matching between the push-pull output stage and the loudspeaker being accomplished by the transformer T.A.14Y.

The voltage produced in the A.V.C. circuit is applied to the control arid of the 6E5 "Visual Tuning Indicator", and variations in this voltage are visible on a luminous screen within the indicator. The control voltage applied to the 6E5 is independent of the audio signal from the volume control, hence the receiver may be tuned-in visually, with the volume control in the minimum (anticlockwise) position.

The tone control circuit consists of a variable control (R-20) connected in series with a .01 mfd. paper condenser (C-43), between the plate of the 6F5 audio amplifier and earth.

NOTE.

Radiola receivers of this model produced prior to 20.5.36 have the tone control connected between the control grids of the 6F6 output pentodes.

The sensitivity control (R-9) is a wire wound variable control connected in the cathode circuits of the 6A8 converter and the 6K7 I.F. amplifier. An additional resistor (R-8) is connected in this circuit by the range switch on medium waves; the short circuiting of this resistor on short waves boosts the sensitivity of the receiver.

The power unit consists of a transformer (T-10), an 80 valve rectifier, and a smoothing circuit incorporating the loudspeaker field winding (1000 ohms) in conjunction with two high capacity condensers (C-47 and C-48).

I.F. ALIGNMENT.

This receiver uses one stage of I.F. amplification, which includes two I.F. transformers. Four condensers align these transformers to resonance (460 K.C.), and the condenser adjustments are found beneath the chassis in their adjustment order—1, 2, 3, 4. See fig. 41. Full I.F. alignment instructions appear on page 6.

R.F. ALIGNMENT.
MEDIUM WAVE.

Reference to fig. 41 will show the medium wave coil adjustments (5, 6, 7) and the padding condenser adjustment. Beginning with No. 5 (oscillator trimmer) refer to page 7 for full alignment instructions.

SHORT WAVE.

The short wave coil adjustments (8, 9, 10) are situated adjacent to the medium wave adjustments. See fig. 41. Beginning with No. 8 (oscillator trimmer) refer to page 8 for full alignment instructions.

CONTINUITY TESTING SCHEDULE RADIOLA 251.

N.B.—All readings to be made with valves and loudspeaker withdrawn.

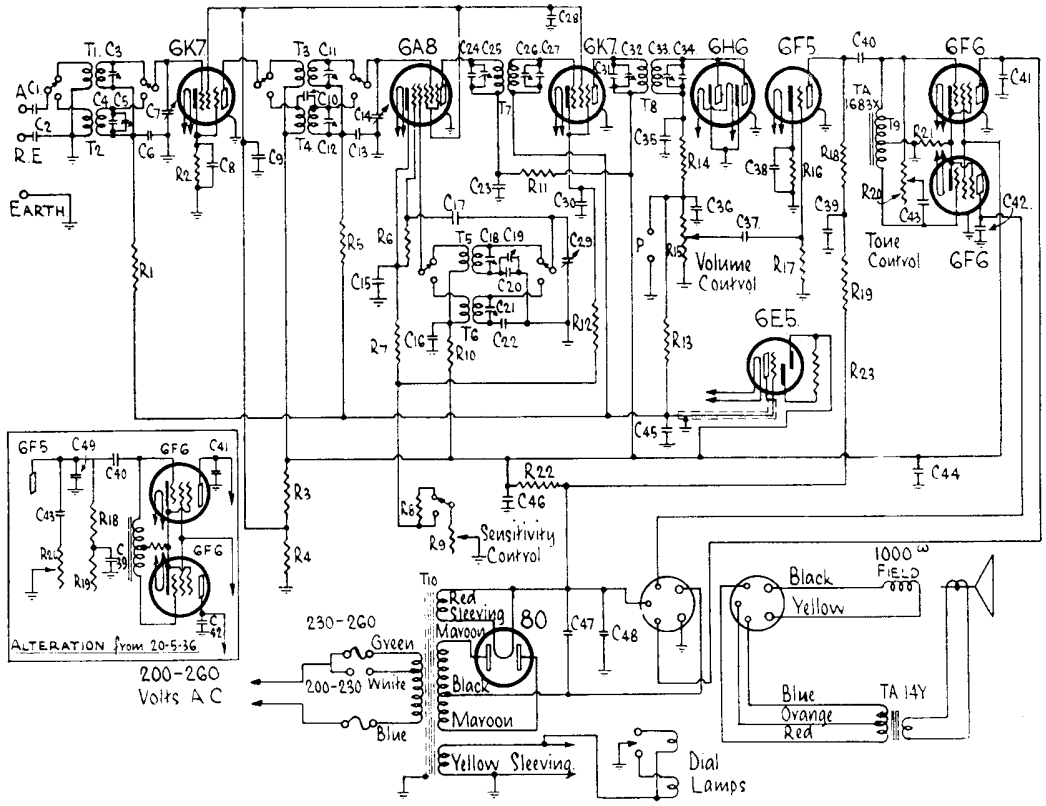
TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to filament 80.	24,000 ohms.	R-3, R-4, R-22 short circuit or open circuit. C-48, C-46, C-44, C-23, C-9, C-28 short circuit. Wiring short circuit to chassis.
Chassis to cathode 6A8 converter in both positions of range switch.	600-3600 ohms medium wave. 300-3300 ohms short wave, with rotation of sensitivity control.	Sensitivity control R-9 faulty. R-7, R-8 short circuit or open circuit. C-15 short circuit. Range switch faulty.
Chassis to cathode 6K7 I.F. amplifier in both positions of range switch.	900-3900 ohms medium wave. 600-3600 ohms short wave, with rotation of sensitivity control.	R-9 faulty. R-8, R-12 short circuit or open circuit. C-30 short circuit. Range switch faulty.
Chassis to cathode 6K7 R.F. amplifier.	600 ohms.	R-2 short circuit or open circuit. C-8 short circuit.
Chassis to cathode 6F5 audio amplifier.	3000 ohms.	R-16 short circuit or open circuit. C-38 short circuit.
Chassis to cathodes 6F6 output pentodes.	400 ohms.	R-21 short circuit or open circuit.
Chassis to cathodes 1 and 2 6H6 second detector.	Continuity.	Earth connections on 6H6 open circuit.
Chasis to metal shell contact (S) on all valves excepting 80 (see fig. 41).	Continuity.	Earth connections to metal shell (S) open circuit.
Chassis to No. 2 pick-up terminal.	300,000 ohms.	R-15 faulty. C-36 short circuit.
Chassis to control grid clip 6F5 audio amplifier with volume control in minimum or anticlockwise position.	No reading ($\frac{1}{2}$ megohm).	R-17 short circuit or open circuit. C-37 short circuit.
Chassis to control grids of 6F6 output pentodes (each grid separately).	3000 ohms (approx.).	T-9 open circuit.
Chassis to AVC line (see fig. 41).	No reading.	C-6, C-13, C-45 short circuit.
Chassis to orange connection on tone control R-20.	Continuity — 300,000 ohms with rotation of tone control.	Tone control R-20 faulty.
Chassis to aerial and radio earth terminals.	No reading.	C-1 or C-2 short circuit.
Chassis to each plate of 6F6 output pentodes separately.	No reading.	C-41, C-42, short circuit.
Plate 6F5 audio amplifier to control grid of 6F6 output pentode.	No reading. (300,000 ohms).	C-40 short circuit.
Chassis to plate 6F5 audio amplifier with tone control R-20 in minimum anticlockwise position.	No reading. (300,000 ohms).	C-43 short circuit.
Chassis to H+ 6A8 converter with dial lamps in their holders and in both positions of range switch.	Continuity.	Dial lamp open circuit. Dial lamp section of range switch faulty.
Filament 80 to plate 6K7 R.F. amplifier in both positions of range switch.	2000 ohms.	T-3 or T-4 primary open circuit. Range switch faulty. R-22 short circuit or open circuit.
Filament 80 to plate detector section 6A8 converter	2300 ohms.	T-7 primary open circuit. R-11 short circuit or open circuit.
Filament 80 to plate 6K7 I.F. amplifier.	2000 ohms.	T-8 primary open circuit.
Filament 80 to screen grid. 6K7 R.F. amplifier, 6A8 converter and 6K7 I.F. amplifier.	13,000 ohms.	R-3 short circuit or open circuit.
Filament 80 to plate 6F5 audio amplifier.	277,000 ohms.	R-18, R-19, R-22 short circuit or open circuit.
Filament 80 to screen grid each 6F6 output pentode.	2000 ohms.	Wiring open circuit.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Filament 80 to plate oscillator section 6A8 converter in both positions of range switch.	22,000 ohms.	T-5 or T-6 primary open circuit. R-10, R-22 short circuit or open circuit. Range switch faulty.
Across filament 80.	Continuity.	T-10 filament winding open circuit. Wiring open circuit.
Across heaters 6A8 converter.	Continuity.	T-10 heater winding open circuit. Wiring open circuit.
Filament 80 to target contact of 6E5 tuning indicator (see fig. 40).	Continuity.	Wiring open circuit.
Filament 80 to plate 6E5 tuning indicator.	No reading (1 megohm).	R-23 short circuit or open circuit.
AVC line to No. 2 pick-up terminal (see fig. 41).	No reading. ($1\frac{3}{4}$ megohms.)	R-13 short circuit or open circuit.
AVC line to control grid clip 6K7 R.F. amplifier in both positions of range switch.	100,000 ohms.	T-1 or T-2 secondary open circuit. R-1 short circuit or open circuit. Range switch faulty.
AVC line to control grid clip 6K7 I.F. amplifier.	Continuity.	T-7 secondary open circuit.
AVC line to grid 6E5 tuning indicator.	Continuity.	Wiring open circuit.
AVC line to control grid clip 6A8 converter in both positions of range switch.	100,000 ohms.	T-3 or T-4 secondary open circuit. R-5 short circuit or open circuit. Range switch faulty.
Cathode 6A8 converter to grid oscillator section 6A8.	60,000 ohms.	R-6 short circuit or open circuit.
Diode plates 6H6 second detector to No. 2 pick-up terminal.	100,000 ohms.	R-14 short circuit or open circuit. T-8 secondary open circuit.
Fixed plates C-29 to coil end of padding condensers C-19 (C-20) and C-22 in both positions of range switch.	Continuity.	T-5 or T-6 secondary open circuit. Range switch faulty.
Across orange and black connections on aerial and radio earth unit in both positions of range swtich.	Continuity.	T-1 or T-2 primary open circuit.
Aerial terminal to radio earth terminal.	100,000 ohms.	100,000 ohms resistor short circuit or open circuit.
No. 4 loudspeaker socket (see fig. 41) to each plate 80 separately.	300 ohms.	T-10 secondary open circuit. Wiring open circuit.
Across power cable.	Continuity.	Power transformer T-10 primary open circuit. Power cable open circuit. Power fuse open circuit.
Orange wire to red and blue wires separately, of loudspeaker cable.	335-350 ohms (approx.).	T.A.14Y primary open circuit (loudspeaker transformer).
Yellow wire to black wire loudspeaker cable.	1000 ohms.	Loudspeaker field short circuit or open circuit.

SOCKET VOLTAGES.

Valve.	Chassis to Cathode (C) Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Heater Volts *
6K7 R.F. Amplifier	3.0	100	225	6.0	6.3
6A8 Converter M.W.	6.0	100	225	3.0	6.3
S.W.	3.0	100	225	4.0	—
,, Oscillator	—	—	170	2.5	—
6K7 I.F. Amplifier M.W.	6.0	100	225	4.0	6.3
S.W.	3.0	100	225	6.0	—
6F5 Audio	2.0	—	100*	0.6	6.3
Each 6F6 Pentode	20	225	280	30.0	6.3
6E5 (Tuning Indicator)	0	—	225	1.0	6.3
80 Rectifier	720/360 volts		100 M.A. total current		5.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 420 volts A.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code.	Part. No.	COILS.
T1	1567	Aerial Coil 200-550 Metres
T2	1567	Aerial Coil 19-50 Metres
T3	1756	R.F. Coil 200-550 Metres
T4	1756	R.F. Coil 19-50 Metres
T5	1568	Osc. Coil 200-550 Metres
T6	1568	Osc. Coil 19-50 Metres
T7	1990	1st I.F. Transformer
T8	1991	2nd I.F. Transformer
T9	1968	Audio Choke TA1683X
T10	1953	Power Transformer
	2011	" " 110 volts

Code.	Part. No.	RESISTORS.
R1		100,000 ohms, ½ watt
R2		600 ohms, ⅓ watt
R3		11,000 ohms, 3 watt
R4		11,000 ohms, 3 watt
R5		100,000 ohms, ½ watt
R6		60,000 ohms, ⅓ watt
R7		300 ohms, ⅓ watt
R8		300 ohms, ⅓ watt
R9	1578	3,000 ohms, Sensitivity Con.
R10		20,000 ohms, ⅓ watt
R11		300 ohms, ⅓ watt
R12		600 ohms, ⅓ watt
R13		1½ megohms, ½ watt
R14		100,000 ohms, ⅓ watt
R15	1668	300,000 ohms, Vol. Cont.
R16		3,000 ohms, ⅓ watt

Code	Part. No.	CONDENSERS.
C1		500 mmf. Mica Cond.
C2		500 mmf. Mica Cond.
C3		5-20 mmf. Mica Trimmer
C4		10 mmf. Mica Cond.
C5		5-20 mmf. Mica Trimmer
C6		.05 mf. Paper Cond.
C7	1754	Variable Condenser
C8		.1 mf. Paper Condenser
C9		.1 mf. Paper Condenser
C10		10 mmf. Mica Condenser
C11		5-20 mmf. Mica Trimmer
C12		5-20 mmf. Mica Trimmer
C13		.05 mf. Paper Cond.
C14	1754	Variable Condenser
C15		.1 mf. Paper Cond.
C16		.05 mf. Paper Cond.
C17		50 mmf. Mica Cond.
C18		5-20 mmf. Mica Trimmer
C19	1153	10-50 mmf. Mica Trimmer
C20	1153	390 mmf. Padding Cond.
C21		5-20 mmf. Mica Trimmer
C22		2800 mmf. Padding Cond.
C23		.1 mf. Paper Cond.
C24		50 mmf. Mica Cond.
C25		10-50 mmf. Mica Trimmer
C26		10-50 mmf. Mica Trimmer
C27		50 mmf. Mica Condenser
C28		.1 mf. Paper Cond.
C29	1754	Variable Condenser

Code.	Part. No.	CONDENSERS.
C30		.1 mf. Paper Cond.
C31		50 mmf. Mica Cond.
C32		10-50 mmf. Mica Trimmer
C33		10-50 mmf. Mica Trimmer
C34		50 mmf. Mica Cond.
C35		100 mmf. Mica Cond.
C36		100 mmf. Mica Cond.
C37		.05 mf. Paper Cond.
C38		5 mf. 25 V. Elect. Cond.
C39		.5 mf. Paper Cond.
C40		.05 mf. Paper Cond.
C41		.005 mf. Paper Cond.
C42		.005 mf. Paper Cond.
C43		.01 mf. Paper Cond.
C44		.5 mf. Paper Cond.
C45		.05 mf. Paper Cond.
C46		8 mf. 500 V. Elect. Cond.
C47	1926	16 mf. 500 V. Elect. Cond.
C48	1925	8 mf. 500 V. Elect. Cond.

Code.	Part. No.	RESISTORS.
R17		½ megohm, ⅓ watt
R18		250,000 ohms, 1 watt
R19		25,000 ohms, 1 watt
R20	1668	300,000 ohms, Tone Cont.
R21		400 ohms, 1 watt
R22	1965	2,000 ohms, Wire Wound
R23		1 megohm, ⅓ watt

Fig. 42.—Circuit data (251).

Radiola 252

ELECTRICAL SPECIFICATIONS.

Voltage Rating	190-260 Volts.
Frequency Rating	D.C.
Power Consumption	90 Watts.
Tuning Ranges	(a) 1500-550 Kilocycles.
	(b) 19-50 Metres.
Intermediate Frequency	460 K.C.
Loudspeaker	Type D.40.
Loudspeaker Field Coil Resistance	4500 ohms.
Loudspeaker Audio Transformer	Type T.A.16.Y.

VALVES AND CIRCUITS.

6D6 R.F. Amplifier.
6A7 Detector Oscillator.
6D6 I.F. Amplifier.
6B7 Detector, A.V.C. and Audio Amplifier.
43 Output Pentode.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 252 is a "World Range" five valve superheterodyne receiver designed to operate on D.C. power supply.

Two tuning ranges are covered by this receiver.

1. 1500-550 kilocycles (200-550 meters), which is the standard medium wave broadcasting band.
2. 19-50 meters, which covers four short wave broadcasting bands.

Selection of the range it is desired to tune is accomplished by a two position range switch in conjunction with two separate groups of tuned circuits, one group for each range.

The signal enters the receiver, through the aerial isolating condenser (C-2), and is applied to the control grid of the 6D6 R.F. amplifier through the aerial coil (T-1 or T-2), the secondary of which is tuned by the rear section of the variable condenser (C-8). After amplification by the 6D6, the R.F. signal is coupled to the control grid of the 6A7 converter by the R.F. coil (T-3 or T-4). The secondary of the R.F. coil is tuned by the centre section of the variable condenser (C-49). In the 6A7, the R.F. signal is combined (heterodyned) with the local oscillator signal, which is 460 K.C. higher in frequency than the incoming signal; this difference in frequency is established throughout the tuning ranges of the receiver by the inherent design of the oscillator coil (T-5 or T-6) in conjunction with the variable condenser (C-25) and padding condensers (C-23—C-24 and C-20).

The intermediate frequency (460 K.C.) is produced by the combining of the R.F. signal with the local oscillator signal, within the 6A7, and to this frequency the primaries and secondaries of the I.F. transformers (T-7 and T-8) are tuned by trimmer condensers. The I.F. signal, in the plate circuit of the 6A7, is selected by the first I.F. transformer (T-7) to be applied to the control grid of the 6D6 I.F. amplifier for amplification. The output of this valve is coupled, by the second I.F. transformer (T-8), to one diode of the 6B7 second detector for rectification across R-12 and R-13.

A signal is transferred through C-30 to the other diode of the 6B7, and a D.C. voltage is developed in this circuit (across resistor R-15) proportional to the incoming signal. This voltage is impressed (via filter R-14 and C-38) on the control grids of the R.F. amplifier, converter, and I.F. amplifier valves to give automatic volume control.

In the diode circuit of the 6B7, an audio signal is produced across R-13 (volume control), and it is conveyed (via C-39) by the arm of the volume control to the control grid of the 6B7 for amplification. The audio output of the 6B7 is resistance-capacity coupled to the 43 output pentode, where it is amplified to a suitable level for reproduction by the loudspeaker. The loudspeaker is matched to the output of the 43 by the stepdown transformer T.A.16Y.

The equipment of this instrument includes a mains filter which consists of two line chokes (T-10 and T-11), a ballast resistor (R-25), and two by pass condensers (C-50 and C-51). The ballast resistor is designed to give the correct heater voltage for each valve, and the correct filament voltage for each dial lamp when the D.C. power supply is 230 volts or above. When it is desired to operate this receiver on voltages below 230 volts D.C., the connecting link on the mains filter unit should be closed (see fig. 45), thus short circuiting a section of R-25 to adjust the heater voltage to the correct rating.

The output of the mains filter unit passes through a smoothing circuit consisting of a smoothing choke (T-9), which is by-passed by condenser C-48. The loudspeaker field (4500 ohms) is connected across the power supply for field excitation.

Since this receiver is designed to operate on a D.C. power supply, one side of the power supply is connected to the high tension negative circuit of the receiver; this circuit is connected to the chassis frame by a .5 condenser (C-9) and the controls of the receiver are insulated. If these precautions were not followed, the chassis frame and the controls could be at a dangerous electrical pressure (200-260 volts) above earth.

The sensitivity control (R-11) is a 3000 ohms variable control connected in the cathode circuit of the 6D6 I.F. amplifier. An increase is given to the sensitivity of the receiver, on the short wave range, by the short circuiting of register R-9 in the cathode circuit of the 6A7 converter.

The tone control circuit consists of a variable control (R-8) in series with a .01 mfd. condenser C-43, between the plate of the 6B7 and negative.

I.F. ALIGNMENT.

This receiver uses one stage of I.F. amplification, which includes two I.F. transformers. Four condensers align these transformers to resonance (460 K.C.), and the condenser adjustments are found beneath the chassis in their adjustment order —1, 2, 3, 4. See fig. 44. I.F. alignment instructions in detail appear on page 6.

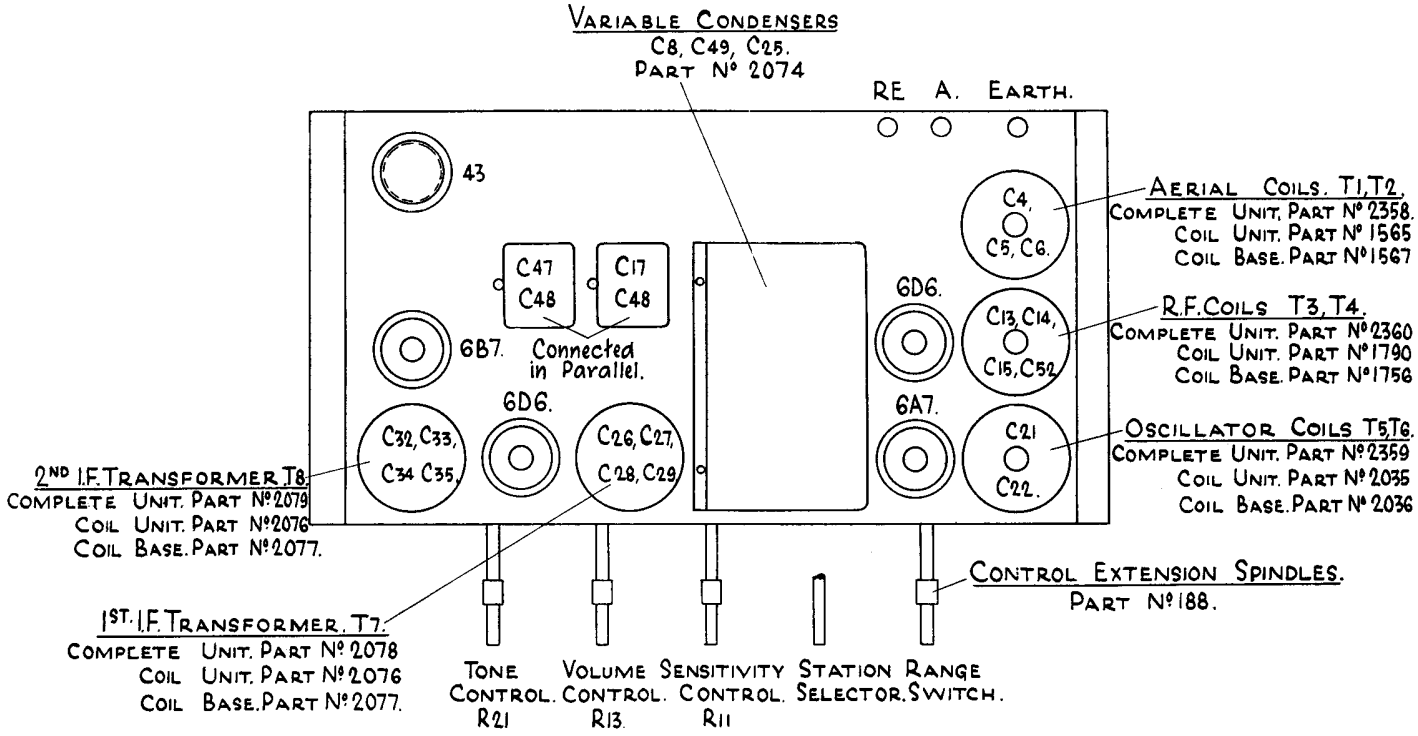


Fig. 43.—Layout diagram (top view), (252).

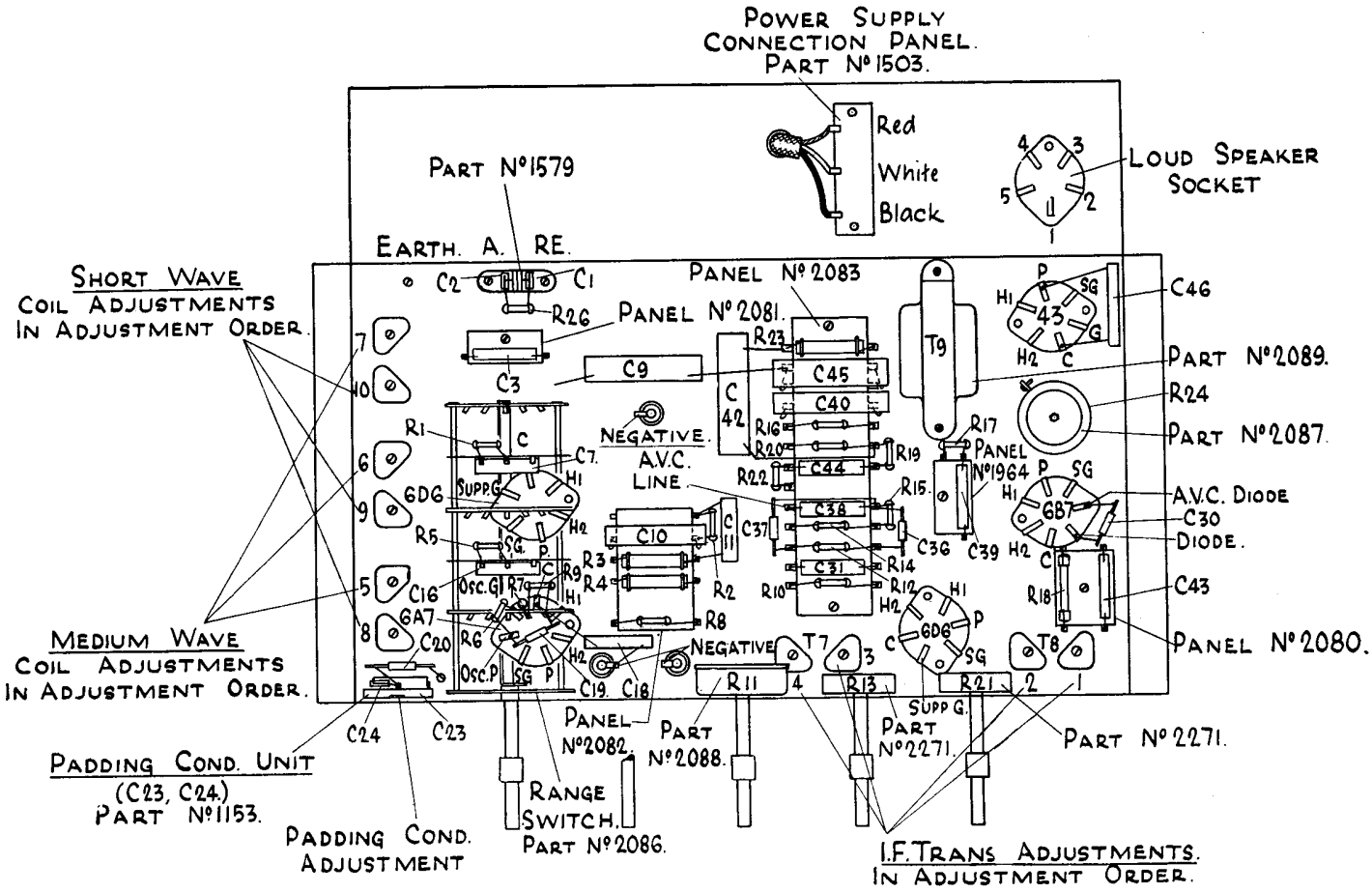


Fig. 44.—Layout diagram (underneath view), (252).

R.F. ALIGNMENT.
MEDIUM WAVE.

Reference to fig. 44 will show the medium wave coil adjustments (5, 6, 7) and the padding condenser adjustment. Beginning with No. 5 (oscillator trimmer) refer to page 7 for full alignment instructions.

SHORT WAVE.

The short wave coil adjustments (8, 9, 10) are situated adjacent to the medium wave adjustments. See fig. 44. Beginning with No. 8 (oscillator trimmer) refer to page 8 for full alignment instructions.

NOTE.

It is important that the variable condenser be mounted by means of the rubber bushes and kept insulated from the chassis since the frame of the variable condenser is connected to the high tension negative circuit.

CONTINUITY TEST.

Unlike A.C. operated models, the high tension negative of this receiver is not connected directly to the chassis frame. In the continuity testing schedule, the high tension negative circuit is referred to as power cable (black).

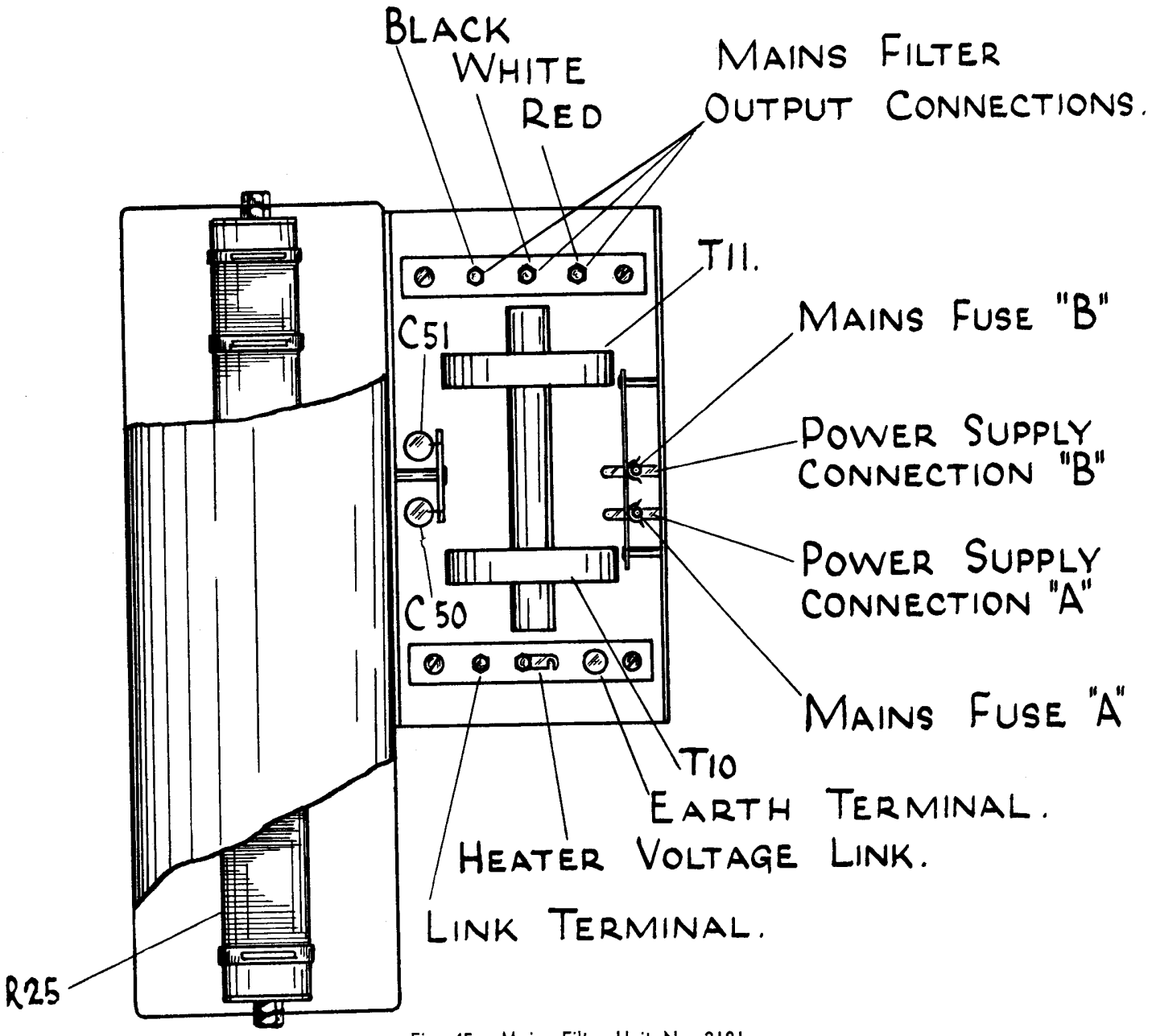


Fig. 45.—Mains Filter Unit No. 2181.

CONTINUITY TESTING SCHEDULE RADIOLA 252.

N.B.—All readings to be made with valves and loudspeaker withdrawn and mains filter unit disconnected.

TEST BETWEEN	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to No. 1 loudspeaker socket (see fig. 44).	Continuity.	Wiring open circuit.
Chassis to power cable (black).	No reading.	C-9 short circuit. Wiring short circuit.
Power cable (black) to frame of variable condenser.	Continuity.	Wiring open circuit.
Power cable (black) to cathode 6D6 R.F. amplifier.	600 ohms.	R-2 short circuit or open circuit. C-11 short circuit.
Power cable (black) to cathode 6A7 converter in both positions of range switch.	900 ohms medium wave. 300 ohms short wave.	R-7, R-9 short circuit or open circuit. C-18 short circuit. Range switch faulty.
Power cable (black) to cathode 6D6 I.F. amplifier.	600-3,600 ohms with rotation of sensitivity control.	Sensitivity control (R-11) faulty. R-10 short circuit or open circuit. C-31 short circuit.
Power cable (black) to cathode 6B7 second detector.	3000 ohms.	R-16 short circuit or open circuit. C-40 short circuit.
Power cable (black) to cathode 43 output pentode.	500 ohms.	R-23 short circuit or open circuit. C-45 short circuit.
Power cable (black) to rectifier diode 6B7 second detector.	400,000 ohms.	Volume control (R-13) faulty. R-12, R-16 short circuit or open circuit. C-36, C-37 short circuit. T-8 secondary open circuit.
Power cable (black) to control grid 43 output pentode.	300,000 ohms.	R-22 short circuit or open circuit.
Power cable (black) to No. 5 loudspeaker socket (see fig. 44).	23,500 ohms.	R-3, R-4, R-24 short circuit or open circuit. C-48, C-10, C-12, C-17, C-42 short circuit. Wiring short circuit to chassis.
Power cable (black) to A.V.C. line (see fig. 44).	No reading (over 2 megohms).	C-7, C-16, C-38 short circuit.
Power cable (black) to plate 6B7 second detector with control (R-15) in minimum (anti-clockwise) position.	172,000 ohms.	C-43 short circuit.
Power cable (white) to H-1 43 output pentode in both positions of range switch and with dial lamps in holders.	Continuity.	Range switch faulty. Dial lamps open circuit. Wiring open circuit.
H-2 43 output pentode to H-1 6B7 second detector.	Continuity.	Wiring open circuit.
H-2 6B7 second detector to H-1 6D6 I.F. amplifier.	Continuity.	Wiring open circuit.
H-2 6D6 I.F. amplifier to H-1 6D6 R.F. amplifier.	Continuity.	Wiring open circuit.
H-2 6D6 R.F. amplifier to H-1 6A7 Converter.	Continuity.	Wiring open circuit.
H-2 6A7 converter to power cable (black).	Continuity.	Wiring open circuit.
Power cable (red) to plate 6D6 I.F. amplifier.	420 ohms.	T-9 open circuit or short circuit. T-8 primary open circuit.
Power cable (red) to plate 6D6 R.F. amplifier in both positions of range switch.	420 ohms.	T-3, T-4 primary open circiut. Range switch faulty.
Power cable (red) to oscillator plate 6A7 converter in both positions of range switch.	20,420 ohms.	R-8 short circuit or open circuit. T-5, T-6 primary open circuit. Range switch faulty.
Power cable (red) to plate 6A7 converter.	420 ohms.	T-7 primary open circuit.
Power cable (red) to plate 6B7 second detector.	150,420 ohms.	R-19, R-20 short circuit or open circuit.
No. 5 loudspeaker socket (see fig. 44) to screen grid 43 output pentode.	Continuity.	Wiring open circuit.
No. 2 loudspeaker socket (see fig. 44) to plate 43 output pentode.	Continuity.	Wiring open circuit.
A.V.C. line to control grid 6D6 R.F. amplifier in both positions of range switch.	100,000 ohms.	T-1, T-2 secondary open circuit. R-1 short circuit or open circuit. Range switch faulty.
A.V.C. line to control grid 6A7 converter in both positions of range switch.	100,000 ohms.	T-3, T-4 secondary open circuit. R-5 short circuit or open circuit. Range switch faulty.
Fixed plates C-25 to coil end of padding condensers C-23—C-24 and C-20 in both positions of range switch.	Continuity.	T-5, T-6 secondary open circuit. Range switch faulty.
Cathode 6A7 to oscillator grid 6A7 converter.	60,000 ohms.	R-6 short circuit or open circuit.
Plate 6B7 second detector to control grid 43 output pentode.	No reading ($\frac{1}{2}$ megohm).	C-44 short circuit.
Yellow wire to black wire loudspeaker cable.	4500 ohms.	Loudspeaker field open circuit or short circuit.
Red wire to blue wire loudspeaker cable.	450 ohms. (approx.).	T.A.16Y primary open circuit or short circuit.

CONTINUITY TESTING SCHEDULE FOR MAINS FILTER UNIT NO. 2181.

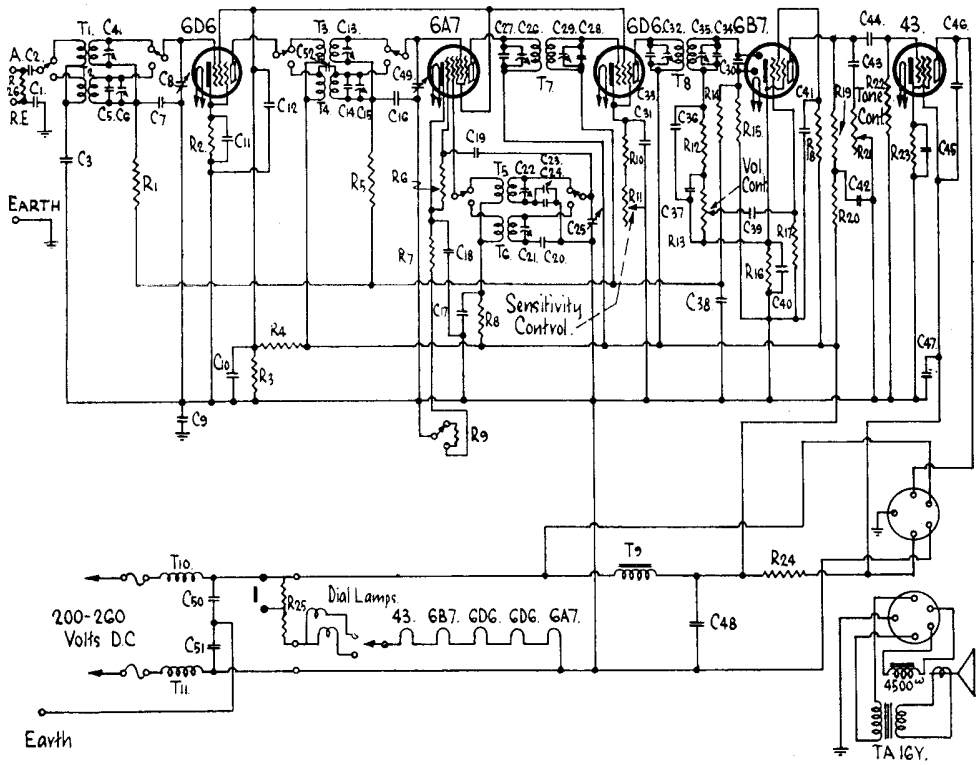
N.B.—All readings to be taken with the unit disconnected from the receiver, and with the heater voltage link open.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Power supply connection "A" to red output connection.	Continuity.	Mains fuse "A" open circuit. T-10 open circuit.
Black output connection to earth terminal.	No reading.	C-51 short circuit.
Power supply connection "B" to black output connection.	Continuity.	Mains fuse "B" open circuit. T-11 open circuit.
Red output terminal to earth terminal.	No reading.	C-51 short circuit.
White output connection to link terminal.	510 ohms.	High resistance section of R-25 short circuit or open circuit.
Red output connection to link terminal.	100 ohms.	Low resistance section of R-25 short circuit or open circuit.

SOCKET VOLTAGES.

Valves.	Negative to Cathode Volts	Negative to Screen Grid (SG) Volts	Negative to Plate (P) Volts	Plate Current M.A.	Heater Volts
6D6 R.F. Amplifier	4.0	80	210	3.0	6.3
6A7 Converter M.W.	6.0	80	210	2.0	6.3
S.W.	3.0	80	210	3.0	—
" Oscillator	—	—	130	3.0	—
6D6 I.F. Amplifier	4.0	80	210	3.0	6.3
6B7 Reflex "	1.5	25*	60*	1.0	6.3
43 Pentode	20.0	150	135	30.0	25.0

* Cannot be measured accurately with ordinary voltmeter. Measured at 240 volts D.C. supply. No signal input. Controls in maximum clockwise position. D.C. voltmeter used as suggested on page 3.



Code.	Part No.	COILS.
T1	2358	Aerial Coil 200-550 Met.
T2	2358	Aerial Coil 19-50 Met.
T3	2360	R.F. Coil 200-550 Met.
T4	2360	R.F. Coil 19-50 Met.
T5	2359	Oscillator Coil 200-550 Met.
T6	2359	Oscillator Coil 19-50 Met.
T7	2078	First I.F. Transformer
T8	2078	Second I.F. Transformer
T9	2089	TA37 Smoothing Choke
T10	2191	Line Filter Choke
T11	2191	Line Filter Choke
		RESISTORS.
R1		100,000 ohms, ⅓ watt
R2		600 ohms, ⅓ watt
R3		11,000 ohms, 3 watt
R4		11,000 ohms, 3 watt
R5		100,000 ohms, ⅓ watt
R6		60,000 ohms, ⅓ watt
R7		300 ohms, ⅓ watt
R8		20,000 ohms, ⅓ watt
R9		600 ohms, ⅓ watt
R10		600 ohms, ⅓ watt
R11	2088	3,000 ohms, Sensitivity Con.
R12		100,000 ohms, ⅓ watt
R13	2271	300,000 ohms, Volume Cont.
R14		1¾ megohm, ⅓ watt
R15		1¾ megohm, ⅓ watt
R16		3,000 ohms, ⅓ watt
R17		1¾ megohms, ⅓ watt
R18		1 megohm, 1 watt

Code.	Part No.	CONDENSERS
C1		500 mmf. Mica Cond.
C2		500 mmf. Mica Cond.
C3		.05 mf. Paper Cond.
C4		5-20 mmf. Mica Trimmer
C5		10 mmf. Mica Cond.
C6		5-20 mmf. Mica Trimmer
C7		.05 mf. Paper Cond.
C8	2074	Variable Condenser
C9		.5 mf. Paper Cond.
C10		.25 mf. Paper Cond.
C11		.1 mf. Paper Cond.
C12		.1 mf. Paper Cond.
C13		5-20 mmf. Mica Trimmer
C14		10 mmf. Mica Cond.
C15		5-20 mmf. Mica Trimmer
C16		.05 mf. Paper Cond.
C17		2.5 mf. Paper Cond.
C18		.1 mf. Paper Cond.
C19		50 mmf. Mica Cond.
C20		2800 mmf. Padding Cond.
C21		5-20 mmf. Mica Trimmer
C22		5-20 mmf. Mica Trimmer
C23	1153	10-50 mmf. Mica Trimmer
C24	1153	890 mmf. Padding Cond.
C25	2074	Variable Condenser
C26		10-50 mmf. Mica Trimmer
C27		30 mmf. Mica Cond.
C28		30 mmf. Mica Cond.
C29		10-50 mmf. Mica Trimmer
C30		700 mmf. Mica Cond.
C31		.1 mf. Paper Cond.

Code.	Part No.	CONDENSERS.
C32		10-50 mmf. Mica Trimmer
C33		30 mmf. Mica Cond.
C34		30 mmf. Mica Cond.
C35		10-50 mmf. Mica Trimmer
C36		200 mmf. Mica Cond.
C37		200 mmf. Mica Cond.
C38		.05 mf. Paper Cond.
C39		.05 mf. Paper Cond.
C40		5 mf. 25 Volt Elect. Cond.
C41		.1 mf. Paper Cond.
C42		.5 mf. Paper Cond.
C43		.01 mf. Paper Cond.
C44		.05 mf. Paper Cond.
C45		25 mf. 25 Volt Elect. Cond.
C46		.005 mf. Paper Cond.
C47		2.5 mf. Paper Cond.
C48		5 mf. Paper Cond.
C49	2074	Variable Condenser
C50		.1 mf. Paper Cond.
C51		.1 mf. Paper Cond.
C52		10 mmf. Mica Cond.
		RESISTORS.
R19		100,000 ohms, ⅓ watt
R20		50,000 ohms, ⅓ watt
R21		300,000 ohms, Tone Cont.
R22		300,000 ohms, ⅓ watt
R23		500 ohms, 1 watt
R24		1,500 ohms, Wire Wound
R25		610 ohms, Wire Wound
R26		100,000 ohms, ⅓ watt

Fig. 46.—Circuit data (252).

Radiola 253

ELECTRICAL SPECIFICATIONS.

"A" Battery	2 volts (0.92 amps.) (Dial lamp off 0.86 amps.)
"B" Battery	135 volts 15 M.A. Average
"C" Battery	(a) 9 Volts Bias (b) 4½ Volts Bias
Tuning Range	(a) 1500-550 Kilocycles (b) 19-50 Metres
Intermediate Frequency	460 K.C.
Loudspeaker (Permanent Magnet)	Type D53
Loudspeaker Audio Transformer	Type T.A.14Y

VALVES AND CIRCUITS.

1G4	R.F. Amplifier.
1C6	Detector Oscillator.
1C4	I.F. Amplifier.
1C4	I.F. Amplifier.
1B5	Detector, AVC and Audio Amplifier.
30	Driver.
19	Class B Output.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 253 is a "World Range" seven-valve battery operated superheterodyne receiver.

Two distinct tuning ranges are covered by this instrument:

1. The standard medium wave broadcasting band of 1500-550 kilocycles (200-550 metres).
2. Four short wave broadcasting bands (19-50 metres).

A two position range switch is employed to select the range in which the desired signal is located, and two different groups of tuned circuits are used, one group for each range.

The signal enters the receiver, and is applied to the control grid of the 1C4 R.F. amplifier through the aerial coupling coil (T-1 or T-2). The secondary of this coil is tuned by the rear unit of the variable condenser (C-5). The output of the 1C4 is coupled to the control grid of the 1C6 converter by the R.F. coupling coil (T-3 or T-4), the secondary of which is tuned by the centre unit of the variable condenser (C-11). The oscillator elements of the 1C6 converter generate a local oscillator signal, which is always 460 K.C. higher in frequency than the R.F. signal. The oscillator coils (T-5 and T-6) in conjunction with the variable condenser (C-24) and padding condensers (C-20, C-21 and C-23) are designed to maintain this frequency difference throughout the tuning ranges of the receiver.

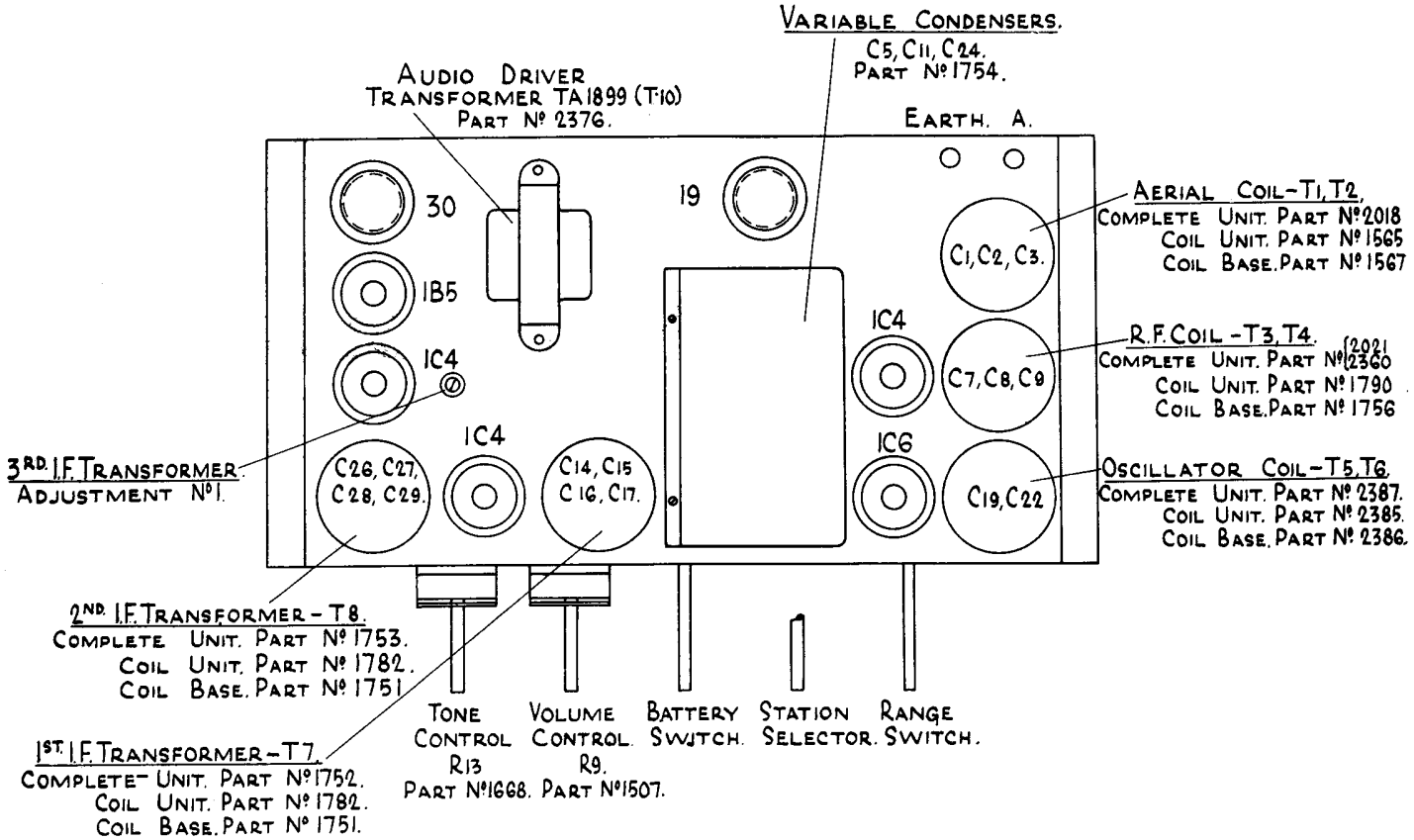


Fig. 47.—Layout diagram (top view), (253).

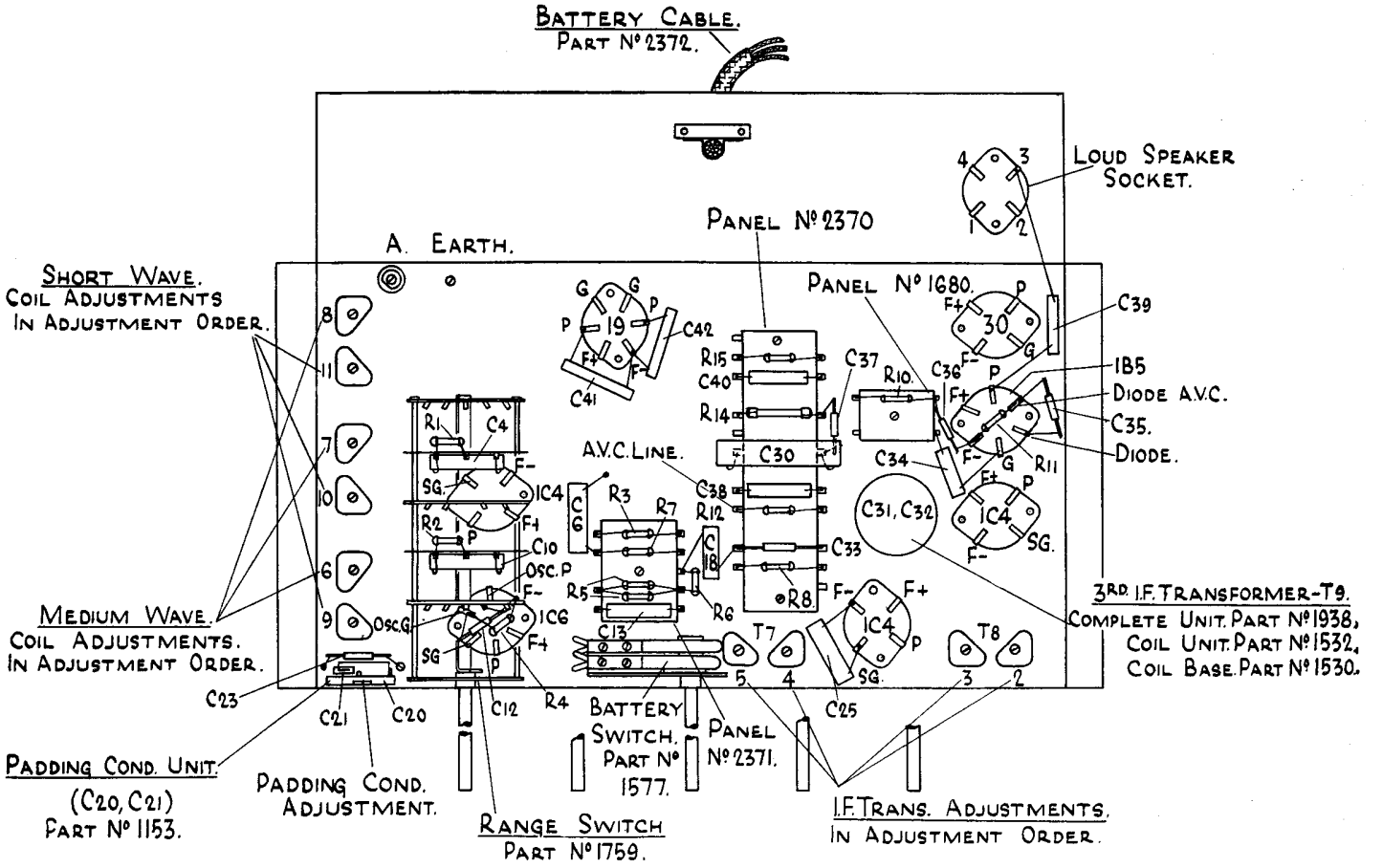


Fig. 48.—Layout diagram (underneath view), (253).

The combination of the local oscillator signal with the R.F. signal produces the intermediate frequency of 460 K.C. The primary and secondary of the first I.F. transformer (T-7), the primary and secondary of the second I.F. transformer (T-8), and the primary of the third I.F. transformer (T-9) are all tuned to 460 K.C. by compression type trimmer condensers. The I.F. signal in the plate circuit of the 1C6 converter is amplified by two I.F. stages, and is applied by the secondary of the third I.F. transformer (T-9) to a diode of the 1B5 second detector to be rectified across resistors R-8 and R-9.

A signal is transferred (via C-35) to the other diode of the 1B5, and a D.C. voltage is developed across R-11 in relation to the strength of the incoming signal. This D.C. voltage is impressed (via R-12) on the control grids of 1C4 R.F. amplifier and 1C4 1st I.F. amplifier to give A.V.C. The control grid of the 1C6 converter is connected to the A.V.C. circuit through bias battery B for medium wave reception, and for short wave reception the positive pole + of bias battery B is switched to earth. This auomatically disconnects the 1C6 converter from the A.V.C. circuit, and places a fixed bias of —3 volts on the control grid of this valve.

An audio signal is produced across R-9 (volume control), and since R-9 is a variable resistance control, the strength of the audio signal conducted through its variable arm to the control grid of the 1B5 may be adjusted as desired. The audio signal applied to the 1B5 is amplified by the valve and is transferred by a resistance capacitance coupling circuit to the 30 audio amplifier. The output of the 30 is transformer coupled to the control grids of the 19 class "B" output valve. Bias battery A supplies a fixed bias voltage of —3 volts to the grids of the 19.

The permanent magnet loudspeaker receives the output of the 19 through a three lead cable, the necessary matching being accomplished by the step down transformer T.A. 14Y.

A variable resistance (R-13) connected in series with a .01 mfd. paper condenser (C-39), between the plate of the 1B5 second detector and earth, constitutes the tone control circuit.

A section of the range switch is utilised to automatically raise the screen grid voltage of the I.F. amplifier valves when the short waves are being tuned. This rise in voltage boosts the sensitivity of the receiver.

I.F. ALIGNMENT.

This receiver uses two stages of I.F. amplification, which include three I.F. transformers (T-7, T-8, T-9). Five compression type trimmer condensers tune the I.F. transformers to resonance 460 K.C., and the location of these adjustments together with their adjustment order is shown on figs. 47 and 48. Align first the third I.F. transformer adjustment (No. 1), which is situated on the top of the chassis (see fig. 47), and follow with 2, 3, 4, 5, situated below the chassis.

Refer to page 6 for full I.F. alignment instructions.

R.F. ALIGNMENT.
MEDIUM WAVE.

Refer to fig. 48 for the location of the medium wave coil adjustments (Nos. 6, 7, 8), and the padding condenser adjustment. Beginning with No. 6 (oscillator trimmer), refer to page 7 for detailed alignment instructions.

SHORT WAVE.

Locate the short wave coil adjustments (Nos. 9, 10, 11) on fig. 48, and beginning with No. 9 (oscillator trimmer), refer to page 8 for full alignment instructions.

NOTE.

It will be noticed on fig. 47 that the R.F. coil has two complete unit numbers. When either of these numbers is quoted it will be satisfactory for identification.

CONTINUITY TESTING SCHEDULE RADIOLA 253.

N.B.—All readings to be made with the batteries disconnected, valves and loudspeaker withdrawn, and battery switch **on**, unless stated to the contrary.

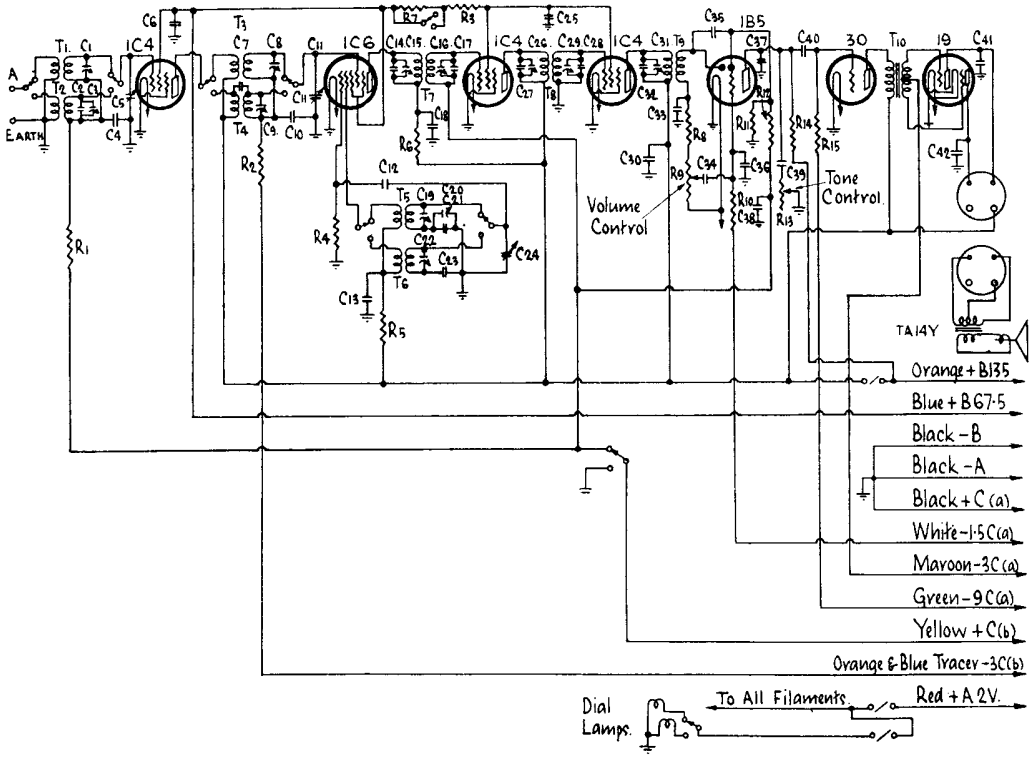
TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
A— (black) battery cable to chassis.	Continuity.	A— battery cable open circuit.
B— (black) battery cable to chassis.	Continuity.	Wiring open circuit.
C+ (A) black battery cable to chassis.	Continuity.	Wiring open circuit.
A.V.C. diode 1B5 second detector to chassis (see fig. 48).	No reading ($1\frac{3}{4}$ megohms).	R-11 short circuit or open circuit.
A.V.C. line to chassis (see fig. 48).	No reading.	C-4, C-38 short circuit.
C— 3V (B) (orange and blue) battery cable to chassis.	No reading.	C-10 short circuit.
Control grid clip 1C4 2nd I.F. amplifier to chassis.	Continuity.	T-8 secondary open circuit.
Oscillator grid 1C6 converter to chassis.	60,000 ohms.	R-4 short circuit or open circuit.
Aerial terminal to chassis in both positions of range switch.	Continuity.	T-1 or T-2 primary open circuit. Range switch faulty.
No. 3 loudspeaker socket (see fig. 48) to chassis.	Continuity — 300,000 ohms, with rotation of tone control.	Tone control R-13 faulty.
Each plate 19 output to chassis separately.	No reading.	C-41, C-42 short circuit.
B+ 135V (orange) battery cable to chassis.	No reading.	C-13, C-18, C-30 short circuit. Wiring short circuit to chassis.
Frame of variable condenser to chassis.	Continuity.	Earth connections to C-5, C-13, C-24, open circuit.
B+ $67\frac{1}{2}$V (blue) battery cable to chassis.	No reading.	C-6, C-25 short circuit.
Plate 1B5 second detector to chassis.	No reading.	C-37, C-39 short circuit.
B+ 135V (orange) battery cable to plate 1C4 R.F. amplifier in both positions of range switch.	Continuity.	Faulty battery switch. T-3 or T-4 primary open circuit. Faulty range switch. B+ 135V cable open circuit.
B+ 135V (orange) battery cable to plate oscillator section 1C6, in both positions of range switch.	10,000 ohms.	T-5 or T-6 primary open circuit. Faulty range switch. R-5 short circuit or open circuit.
B+ 135V (orange) battery cable to plate detector section 1C6.	300 ohms.	T-7 primary open circuit. R-6 short circuit or open circuit.
B+ 135V (orange) battery cable to plate 1C4 1st I.F. amplifier.	Continuity.	T-8 primary open circuit.
B+ 135V (orange) battery cable to plate 1C4 2nd I.F. amplifier.	Continuity.	T-9 primary open circuit.
B+ 135V (orange) battery cable to plate 1B5 second detector with battery switch off.	250,000 ohms.	R-14 short circuit or open circuit.
B+ 135V (orange) battery cable to plate 30 audio frequency amplifier.	460 ohms (approx.).	T-10 primary open circuit or short circiut.
B+ $67\frac{1}{2}$V (blue) battery cable to screen grid 1C4 R.F. amplifier, 1C6 converter.	Continuity.	Wiring open circuit.
B+ $67\frac{1}{2}$V (blue) battery cable to screen grid 1C4 1st I.F. amplifier and screen grid 1C4 2nd I.F. amplifier in both positions of range switch.	200,000 ohms medium wave. 100,000 ohms short wave.	R-7, R-3, short circuit or open circuit. Range switch faulty.
A+ (red) battery cable to F+ all valves.	Continuity.	Faulty battery switch. A+ battery cable open circuit.
C— $1\frac{1}{2}$V (A) (White) battery cable to control grid 1B5 second detector.	No reading ($1\frac{3}{4}$ megohms).	R-10 short circuit or open circuit.

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
C— 9V (A) (green) battery cable to control grid 30 audio frequency amplifier.	No reading (500,000 ohms).	R-15 short circuit or open circuit.
C—3V (A) (maroon) battery cable to each control grid 19 output separately.	200 ohms (approx.).	T-10 secondary open circuit or short circuit.
C— 3V (B) (orange and blue) battery cable to control grid 1C6 converter in both positions of range switch.	100,000 ohms.	T-3 or T-4 secondary open circuit. R-2 short circuit or open circuit. Range switch faulty.
C+ (B) (yellow) battery cable to control grid 1C4 R.F. amplifier with range switch in medium wave position.	100,000 ohms.	T-1 secondary open circuit. R-1 short circuit or open circuit. Range switch faulty.
A.V.C. line to control grid 1C4 R.F. amplifier with range switch in short wave position.	100,000 ohms.	T-2 secondary open circuit. R-1 short circuit or open circuit. Range switch faulty.
A.V.C. line to control grid 1C4 1st I.F. amplifier.	Continuity.	T-7 secondary open circuit.
A.V.C. diode 1B5 second detector to A.V.C. line (see fig. 48).	No reading ($1\frac{3}{4}$ megohms).	R-12 short circuit or open circuit.
Diode rectifier plate to F+ 1B5 second detector.	No reading (600,000 ohms).	T-9 secondary open circuit. R-8, R-9 short circuit or open circuit.
Fixed plates variable condenser C-24 to coil end of padding condensers C-20 (C-21) and C-23 in both positions of range switch.	Continuity.	T-5 or T-6 secondary open circuit. Range switch faulty.
A+ (red) battery cable to centre contact of each dial lamp holder, with dial lamps inserted, and in both positions of range switch.	Continuity.	Dial lamp open circuit. Dial lamp section of range switch faulty.
Plate 1B5 second detector to control grid 30 audio amplifier.	No reading.	C-40 short circuit.
Yellow wire loudspeaker cable to red and blue wires of loudspeaker cable separately.	335-350 ohms. (approx.).	Speaker transformer T.A. 14Y primary open circuit.

SOCKET VOLTAGES.

Valve.	Chassis to Control Grid Volts	Chassis to Screen Grid (SG) Volts	Chassis to Plate (P) Volts	Plate Current M.A.	Filament Volts
1C4 R.F. amplifier	0	67.5	135	3.0	2.0
1C6 Converter	—3*	67.5	135	1.5	2.0
" Oscillator	—	—	100	3.0	—
1C4 I.F. Amplifier	0	40*	135	1.0	2.0
1C4 " "	0	40*	135	1.0	2.0
1B5 Second Detector	—1.5*	—	70*	0.25	2.0
30 Driver	—9*	—	130	3.0	2.0
19 Output	—3	—	130	3.0	2.0

* Cannot be measured accurately with ordinary voltmeter. Measured with controls in maximum clockwise position. No signal input. D.C. voltmeter used as suggested on page 3.



Code	Part No.	COILS.
T1	2018	Aerial Coil, 200-550 Metres
T2	2018	Aerial Coil, 19-50 Metres
T3	2360	R.F. Coil, 200-550 Metres
T4	2360	R.F. Coil, 19-50 Metres
T5	2387	Oscillator Coil, 200-550 Metres
T6	2387	Oscillator Coil, 19-50 Metres
T7	1752	First I.F. Transformer
T8	1753	Second I.F. Transformer
T9	1938	Third I.F. Transformer
T10	2376	Audio Driver Transformer, TA1899
		RESISTORS.
R1		100,000 ohms, $\frac{1}{3}$ watt
R2		100,000 ohms, $\frac{1}{3}$ watt
R3		100,000 ohms, $\frac{1}{3}$ watt
R4		60,000 ohms, $\frac{1}{3}$ watt
R5		10,000 ohms, $\frac{1}{3}$ watt
R6		300 ohms, $\frac{1}{3}$ watt
R7		100,000 ohms, $\frac{1}{3}$ watt
R8		100,000 ohms, $\frac{1}{3}$ watt
R9	1507	500,000 ohms, Volume Control
R10		$1\frac{1}{2}$ megohms, $\frac{1}{3}$ watt
R11		$1\frac{1}{4}$ megohms, $\frac{1}{3}$ watt
R12		$1\frac{1}{4}$ megohms, $\frac{1}{3}$ watt
R13	1668	300,000 ohms, Tone Control
R14		250,000 ohms, 1 watt
R15		500,000 ohms, $\frac{1}{3}$ watt

Code	Part No.	CONDENSERS.
C1		5-20 mmf. Mica Trimmer
C2		10 mmf. Mica Cond.
C3		5-20 mmf. Mica Trimmer
C4		.05 mf. Paper Cond.
C5	1754	Variable Condenser
C6		.1 mf. Paper Cond.
C7		10 mmf. Mica Cond.
C8		5-20 mmf. Mica Trimmer
C9		5-20 mmf. Mica Trimmer
C10		.05 mf. Paper Cond.
C11	1754	Variable Condenser
C12		50 mmf. Mica Cond.
C13		.05 mf. Paper Cond.
C14		180 mmf. Mica Cond.
C15		10-50 mmf. Mica Trimmer
C16		10-50 mmf. Mica Trimmer
C17		180 mmf. Mica Cond.
C18		.05 mf. Paper Cond.
C19		5-20 mmf. Mica Trimmer
C20	1153	10-50 mmf. Mica Trimmer
C21	1153	390 mmf. Padding Cond.
C22		5-20 mmf. Mica Trimmer
C23		2800 mmf. Padding Cond.
C24	1754	Variable Condenser
C25		.1 mf. Paper Cond.
C26		10-50 mmf. Mica Trimmer
C27		180 mmf. Mica Cond.
C28		180 mmf. Mica Cond.
C29		10-50 mmf. Mica Trimmer
C30		.5 mf. Paper Cond.

Code	Part No.	CONDENSERS.
C31		10-50 mmf. Mica Trimmer
C32		130 mmf. Mica Cond.
C33		200 mmf. Mica Cond.
C34		.05 mf. Paper Cond.
C35		700 mmf. Mica Cond.
C36		200 mmf. Mica Cond.
C37		700 mmf. Mica Cond.
C38		.05 mf. Paper Cond.
C39		.01 mf. Paper Cond.
C40		.05 mf. Paper Cond.
C41		.005 mf. Paper Cond
C42		.005 mf. Paper Cond

Fig. 49.—Circuit data (253).

Radiola 254

ELECTRICAL SPECIFICATIONS.

Voltage Rating	32 volts D.C.
	1.5 amps.
Power Consumption	48 watts.
Tuning Ranges	(a) 1500-550 kilocycles.
	(b) 19-50 metres.
Loudspeaker	Type D42.
Loudspeaker Field Coil Resistance	200 ohms (32V.).
Loudspeaker Audio Transformer	Type T.A.16Y.

VALVES AND CIRCUITS.

6D6 R.F. Amplifier.
6A7 Detector Oscillator.
6D6 I.F. Amplifier.
6B7 Detector, A.V.C., and Audio Amplifier.
43 Output.

GENERAL CIRCUIT DESCRIPTION.

The Radiola 254 is a "World Range" five valve super heterodyne receiver designed to operate on 32 volt D.C. power supply.

Two tuning ranges are covered by this receiver.

1. 1500-550 kilocycles (200-550 metres), which is the standard medium wave broadcasting band.

2. 19-50 metres, which covers four short wave broadcasting bands.

Range selection is accomplished by a two position range switch in conjunction with two separate groups of tuned circuits, one group for each range.

The signal enters the receiver and is applied to the control grid of the 6D6 R.F. amplifier through the aerial coil (T-1 or T-2), the secondary of which is tuned by the rear of the variable condenser (C-51). After amplification by the 6D6 the R.F. signal is coupled to the control grid of the 6A7 converter by the R.F. coil (T-3 or T-4). The secondary of the R.F. coil is tuned by the centre unit of the variable condenser (C-15). In the 6A7 the R.F. signal is combined (heterodyned) with the local oscillator signal, which is 460 K.C. higher in frequency than the incoming signal; this difference is established throughout the tuning ranges of the receiver by the inherent design of the oscillator coil (T-5 or T-6) in conjunction with the variable condenser (C-23) and padding condensers (C-21-C-22 and C-19).

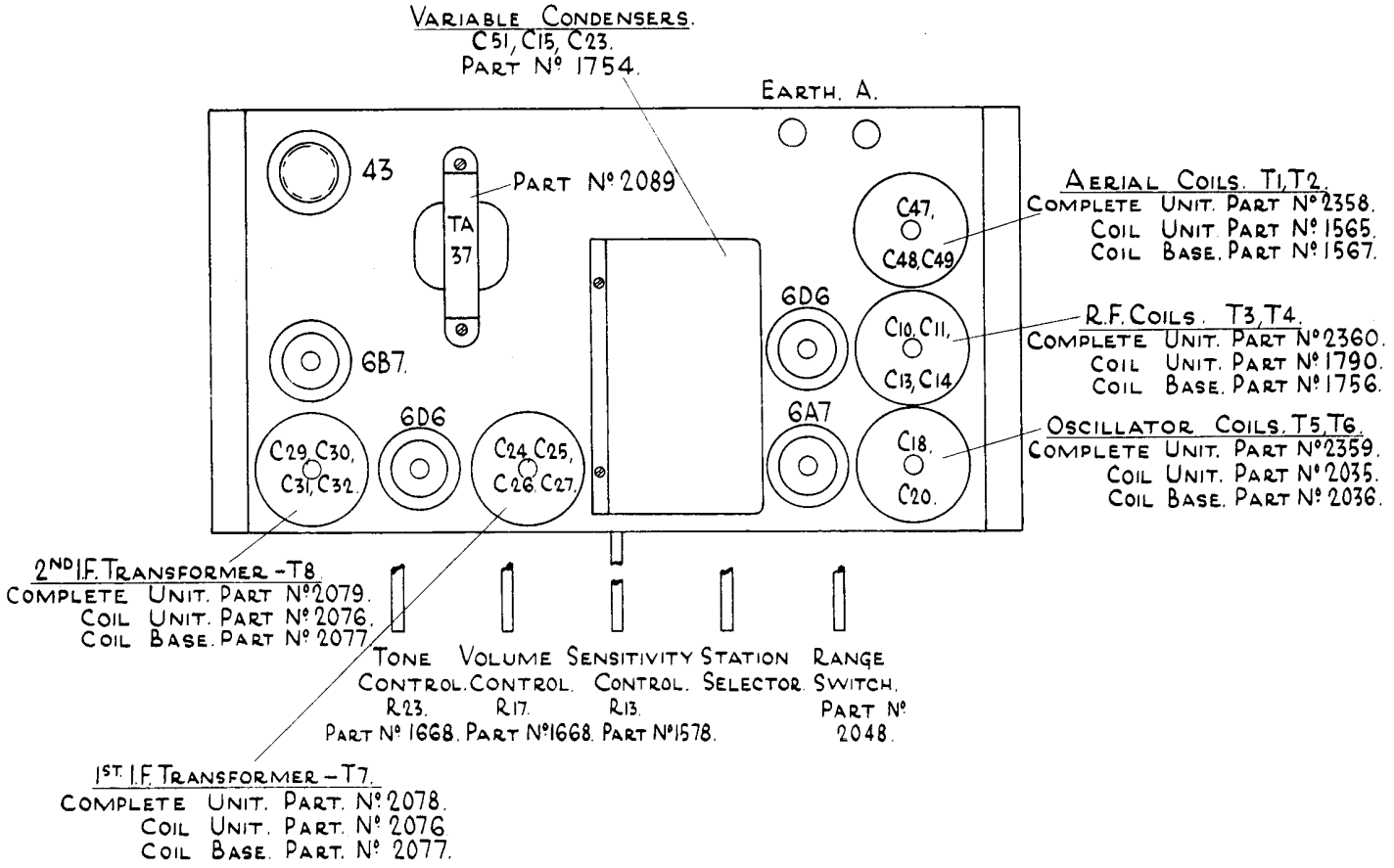


Fig. 50. Layout diagram (top view) (254)

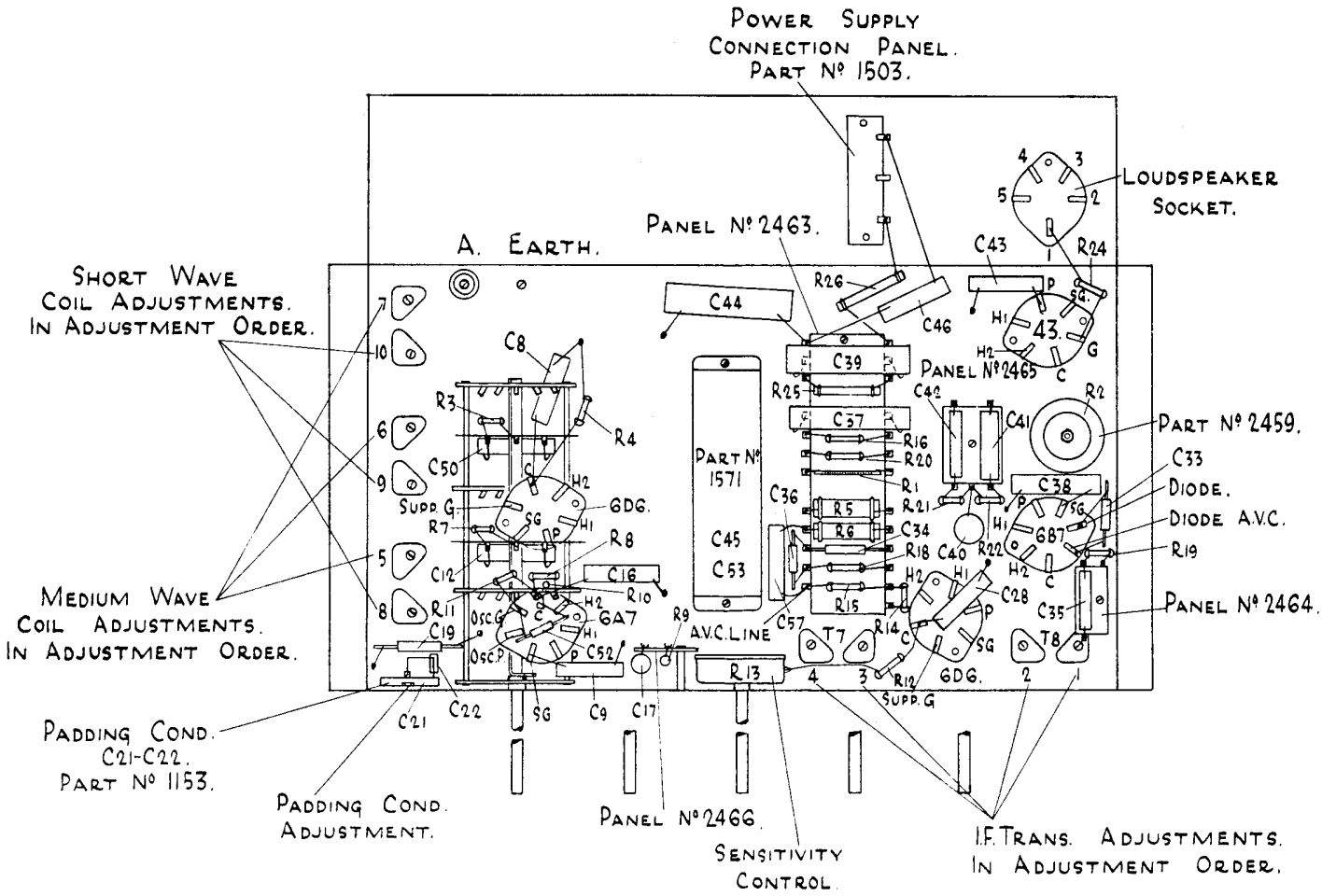


Fig. 51. Layout diagram (underneath view) (254)

The intermediate frequency (460 K.C.) is produced by the combination of the R.F. signal with the local oscillator signal, within the 6A7, and to this frequency the primaries and secondaries of the I.F. transformers (T-7 and T-8) are tuned by trimmer condensers. The I.F. signal, in the plate circuit of the 6A7, is selected by the first I.F. transformer (T-7) to be applied to the control grid of the 6D6 I.F. amplifier for amplification. The output of this valve is coupled, by the second I.F. transformer (T-8), to one diode of the 6B7 second detector for rectification across resistors R-17 and R-18.

A signal is transferred through C-33 to the other diode of the 6B7, and a D.C. voltage is developed in this circuit (across resistor R-14) proportional to the incoming signal. This voltage is applied (via filter R-15 and C-57) to the control grid circuits of the R.F. amplifier, converter, and I.F. amplifier valves to give automatic volume control.

In the diode circuit of the 6B7, an audio signal is produced across R-17 (volume control), and it is conveyed (via C-35) by the arm of the volume control to the control grid of the 6B7 for amplification. The output of the 6B7 is resistance capacity coupled to the 43 output pentode, where it is amplified to a suitable level for reproduction by the loudspeaker. The loudspeaker is matched to the output of the 43 by the stepdown transformer T.A.16Y.

The valves using 6.3 volt heaters are connected in series with the dial lamp filament across the 32 volt D.C. supply. Resistor R1 is connected across the dial lamp filament to

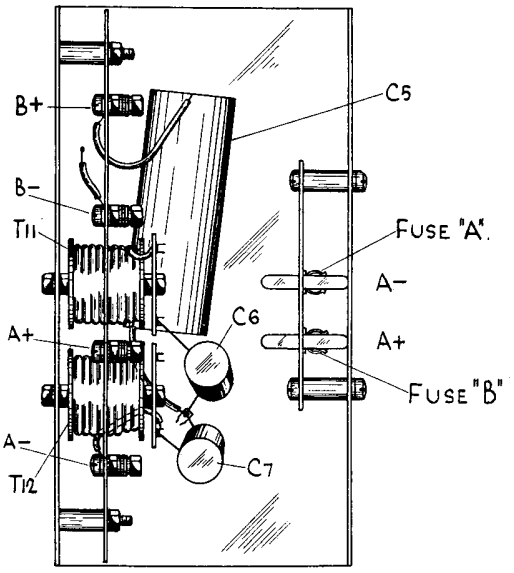


Fig. 52. Filter Unit No. 2488

equalise the current drawn by the lamp with that drawn by the heater of each valve. The heater voltage for the 43 output pentode (25 volts) is derived by connecting the heater of the 43 in series with a voltage dropping resistor R2, across the 32 volt D.C. supply.

MOTOR-GENERATOR UNIT.

The Motor-Generator, which converts the 32 volt D.C. supply to 180 volts B+, is mounted on sponge rubber in a cast-iron frame. Two filter circuits are assembled on the base-plate of this unit, and reference to Fig. 53 will show their relation to the circuit diagram. Condensers C54, C55, and C56 are situated within the motor-generator. A four lead cable connects the Motor-Generator to the filter unit No. 2488, and this unit filters the 32 volt D.C. supply as it enters the instrument.

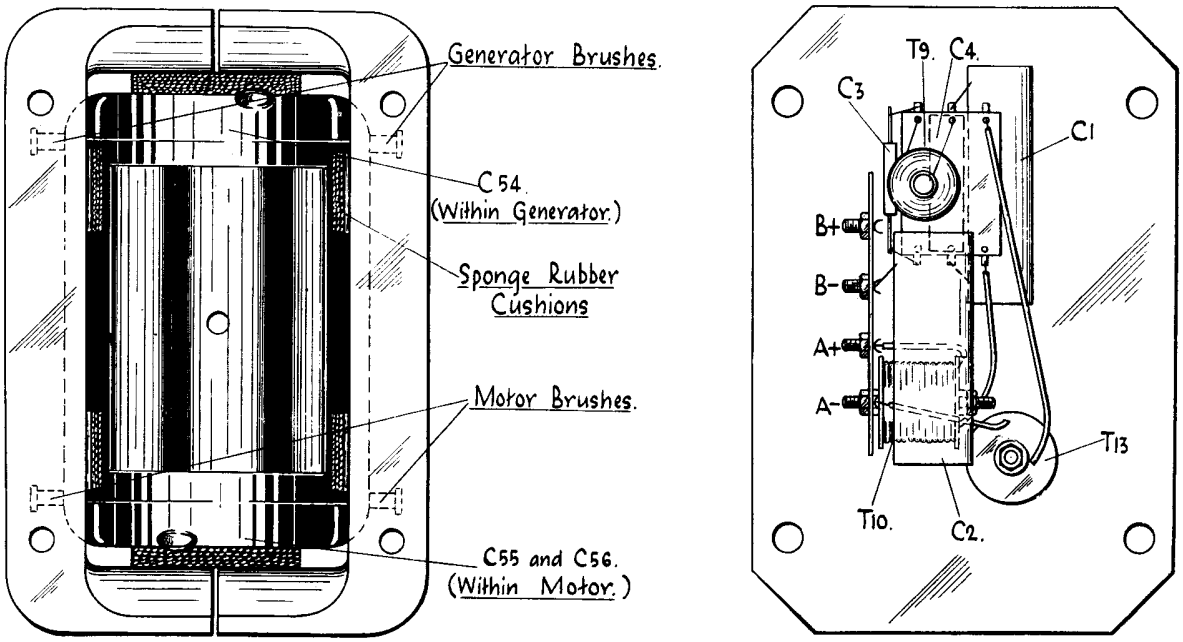


Fig. 53. Motor-Generator Unit (showing base plate assembly)

I.F. ALIGNMENT.

This receiver uses one stage of I.F. amplification, which includes two I.F. transformers. Four condensers align these transformers to resonance (460 K.C.), and the condenser adjustments are found beneath the chassis in their adjustment order —1, 2, 3, 4. See fig. 51. I.F. alignment instructions in detail appear on page 6.

R.F. ALIGNMENT.

MEDIUM WAVE.

Reference to fig. 51 will show the medium wave coil adjustments (5, 6, 7) and the padding condenser adjustment. Beginning with No. 5 (oscillator trimmer) refer to page 7 for full alignment instructions.

SHORT WAVE.

The short wave coil adjustments (8, 9, 10) are situated adjacent to the medium wave adjustments. See fig. 51. Beginning with No. 8 (oscillator trimmer) refer to page 8 for full alignment instructions.

WARNING.

If a fault is suspected within the Motor-Generator Unit it is not advisable to attempt a repair. Return the unit **complete** to the service department.

VALVE SOCKET VOLTAGES.

32 Volts D.C. Supply.

VALVE	Cathode to chassis Volts	Chassis to screen grid Volts	Chassis to plate Volts	Plate current M.A.	Heater Volts
6D6 Amplifier	2.5	70	175	4.0	6.3
6A7 Detector					
M.W.	3.0	70	175	1.5	6.3
S.W.	2.0	70	175	2.0	—
Oscillator	—	—	125	2.5	—
6D6 Amplifier	2.5	70	175	4.0	6.3
6B7 Detector	1.0	20	75	.75	6.3
43 Pentode	18.0	140	135	31.	25

Voltage across Loudspeaker Field — 32 Volts.

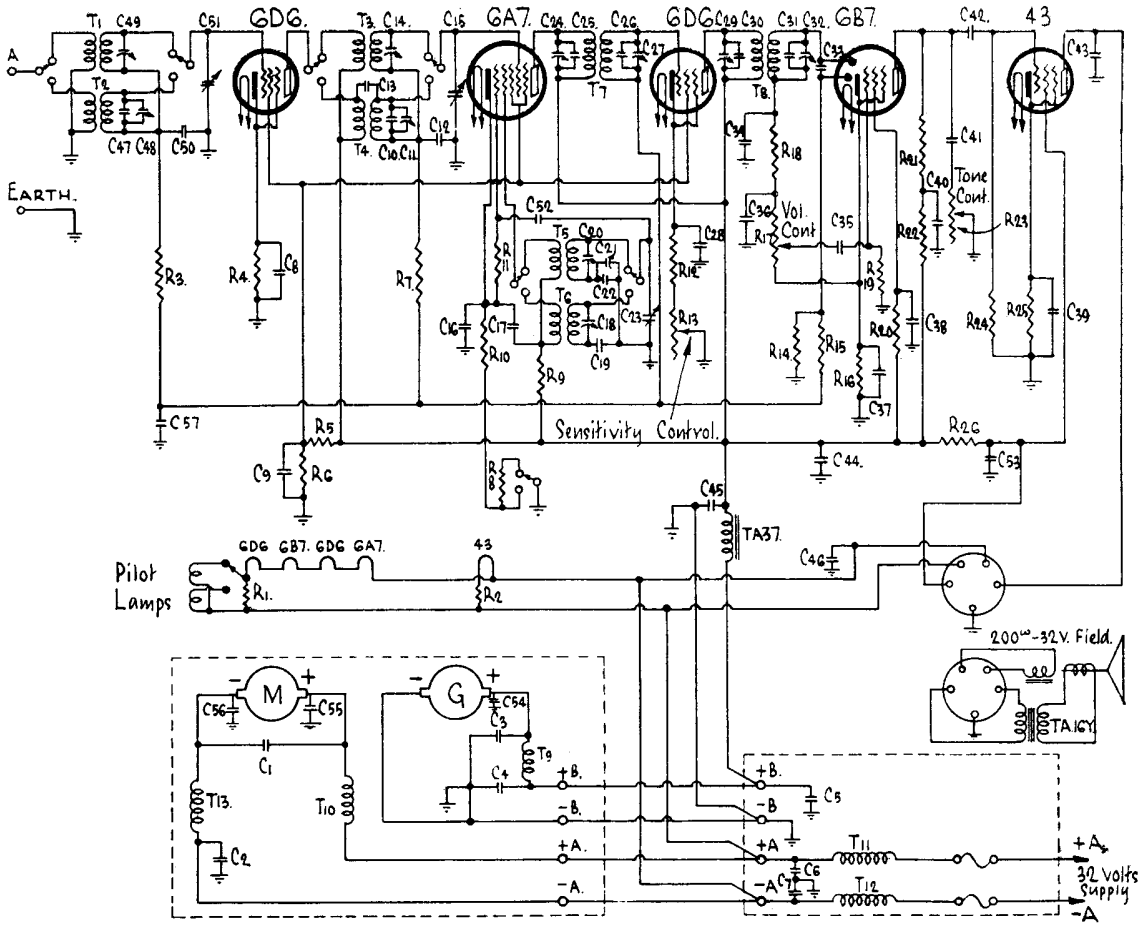
CONTINUITY TESTING SCHEDULE RADIOLA 254.

N.B.—All readings to be made with valves and loudspeaker withdrawn, and Motor-Generator Unit disconnected.

TEST BETWEEN	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
Chassis to aerial terminal, in both positions of range switch.	Continuity.	T1 or T2 primary open circuit. Range switch faulty.
Chassis to cathode 6D6 R.F. Amplifier.	600 ohms.	R4 short circuit or open circuit. C8 short circuit.
Chassis to cathode 6A7 converter, in both positions of range switch.	600 ohms Medium Wave. 300 ohms Short Wave.	R8, R10 short circuit or open circuit. C16 short circuit. Range switch faulty.
Chassis to cathode 6D6 I.F. Amplifier.	600-3600 ohms with rotation of sensitivity control.	R12 short circuit or open circuit. Sensitivity control R13 faulty. C28 short circuit.
Chassis to cathode 6B7 second Detector.	2,000 ohms.	R16 short circuit or open circuit. C37 short circuit.
Chassis to cathode 43 output pentode.	500 ohms.	R25 short circuit or open circuit. C39 short circuit.
Chassis to screen grid 6D6 R.F. Amplifier, 6A7 converter, and 6D6 I.F. Amplifier.	11,000 ohms.	R6 short circuit or open circuit. C9 short circuit.
Chassis to control grid clip 6B7 second detector.	No reading. ($1\frac{3}{4}$ megohms).	R19 short circuit or open circuit.
Chassis to plate 43 output pentode.	No reading.	C43 short circuit.
Chassis to A.V.C. line.	No reading.	C12, C50, C57 short circuit.
Chassis to screen grid 43 output pentode.	22,500 ohms.	R5, R6, R26 short circuit. C-9, C-17, C-44, C-53, C40, C45 short circuit. Wiring short circuit to chassis.
Chassis to control grid 43 output pentode.	300,000 ohms.	R24 short circuit or open circuit.
Chassis to plate 6B7 second detector with tone control R23 in maximum anti-clockwise position.	142,000 ohms.	C41 short circuit.
A.V.C. line to control grid clip 6D6 R.F. amplifier in both positions of range switch.	100,000 ohms.	R3 short circuit or open circuit. T1 or T2 secondary open circuit. Range switch faulty.
A.V.C. line to control grid clip 6A7 converter in both positions of range switch.	100,000 ohms.	R7 short circuit or open circuit. T3 or T4 secondary open circuit. Range switch faulty.
A.V.C. line to control grid clip 6D6 I.F. amplifier.	Continuity.	T7 secondary open circuit.
Screen grid 43 output pentode to plate 6D6 R.F. amplifier in both positions of range switch.	500 ohms.	R26 short circuit or open circuit. T3 or T4 primary open circuit. Range switch faulty.
Screen grid 43 output pentode to plate 6A7 converter.	500 ohms.	T7 primary open circuit.
Screen grid 43 output pentode to plate 6D6 I.F. amplifier.	500 ohms.	T8 primary open circuit or short circuit.
Screen grid 43 output pentode to plate 6B7 second detector.	125,500 ohms.	R21, R22 short circuit or open circuit.
Screen grid 43 output pentode to oscillator plate 6A7 converter, in both positions of range switch.	20,500 ohms.	T5 or T6 primary open circuit. R9 short circuit or open circuit. Range switch faulty.
Plate 6B7 to control grid 43 output pentode.	No reading ($\frac{1}{2}$ megohm).	C42 short circuit.
Cathode 6A7 to oscillator grid 6A7.	60,000 ohms.	R11 short circuit or open circuit.
Cathode 6B7 to rectifier diode 6B7.	400,000 ohms.	R18 short circuit or open circuit. Volume control R17 faulty. T8 secondary open circuit.
Yellow wire to black wire loudspeaker cable.	200 ohms.	Loudspeaker field winding open circuit or short circuit.
Red wire to blue wire loudspeaker cable.	450 ohms (approx.).	T.A. 16Y primary short circuit or open circuit.
Fixed plates of variable condenser C23 to coil end of padding condensers C21-C22 and C19 in both positions of range switch.	Continuity.	T5 or T6 secondary open circuit.
Across resistor R1.	50 ohms.	R1 open circuit or short circuit.
Across resistor R2.	23 ohms.	R2 open circuit or short circuit.

CONTINUITY TESTING SCHEDULE FILTER UNIT No. 2488

TEST BETWEEN.	CORRECT READING.	PROBABLE CAUSE OF IRREGULAR READING.
A— input connection to A— output connection.	Continuity.	T-12 open circuit. Fuse "A" open circuit.
A+ input connection to A+ output connection.	Continuity.	T-11 open circuit. Fuse "B" open circuit.
A— output connection to frame.	No reading.	C-7 short circuit.
A+ output connection to frame.	No reading.	C-6 short circuit.
B+ output connection to frame.	No reading.	C-5 short circuit.



Code	Part No.	COILS.
T1	2358	Aerial Coil. 200-550 Metres.
T2	2358	Aerial Coil. 19-50 Metres
T3	2359	R.F. Coil 200-550 Metres
T4	2359	R.F. Coil 19-50 Metres
T5	2360	Osc. Coil 200-550 Metres
T6	2360	Osc. Coil 19-50 Metres
T7	2078	First I.F. Transformer
T8	2079	Second I.F. Transformer
T9		R.F. Choke
T10		Line Filter Choke
T11		Line Filter Choke
T12		Line Filter Choke
T13		Line Filter Choke
	2089	T.A. 37 Choke
		CONDENSERS.
C38		.1 mf. Paper Cond.
C39		25 mf. 25v. Elect. Cond.
C40		.5 mf. Paper Cond.
C41		.01 mf. Paper Cond.
C42		.05 mf. Paper Cond.
C43		.005 mf. Paper Cond.
C44		.5 mf. Paper Cond.
C45	1871	8 mf. 500v. Elect. Cond.
C46		.05 mf. Paper Cond.
C47		10 mmf. Mica Cond.
C48		10-50 mmf. Mica Trimmer
C49		10-50 mmf. Mica Trimmer
C50		.05 mf. Paper Cond.
C51	1754	Variable Condenser
C52		50 mmf. Mica Cond.
C53	1871	8 mf. 500v. Elect. Cond.
C54		.05 mf. Paper Cond.
C55		.05 mf. Paper Cond.
C56		.05 mf. Paper Cond.
C57		.05 mf. Paper Cond.

Code	Part No.	RESISTORS.
R1		50 ohms Wire Wound
R2	2459	23 ohms Wire Wound
R3		100,000 ohms, ⅓ watt
R4		600 ohms, ⅓ watt
R5		11,000 ohms, 3 watt
R6		11,000 ohms, 3 watt
R7		100,000 ohms, ⅓ watt
R8		300 ohms, ⅓ watt
R9		20,000 ohms, ⅓ watt
R10		300 ohms, ⅓ watt
R11		60,000 ohms, ⅓ watt
R12		600 ohms, ⅓ watt
R13	1578	3,000 ohms Sensitivity Cont.
R14		1¾ Megohms, ⅓ watt
R15		1¾ Megohms, ⅓ watt
R16		2,000 ohms, ⅓ watt
R17	1668	300,000 ohms, Vol. Cont.
R18		100,000 ohms, ⅓ watt
R19		1¾ megohms, ⅓ watt
R20		1 Megohm, 1 watt
R21		100,000 ohms, ⅓ watt
R22		20,000 ohms, ⅓ watt
R23	1668	300,000 ohms, Tone Cont.
R24		300,000 ohms, ⅓ watt
R25		500 ohms, 1 watt
R26		500 ohms, 1 watt

Code	Part No.	CONDENSERS.
C1		.5 mf. Paper Cond.
C2		.5 mf. Paper Cond.
C3		700 mmf. Mica Cond.
C4		.1 mf. Paper Cond.
C5		.5 mf. Paper Cond.
C6		.1 mf. Paper Cond.
C7		.1 mf. Paper Cond.
C8		.1 mf. Paper Cond.
C9		.1 mf. Paper Cond.
C10		10 mmf. Mica Cond.
C11		10-50 mmf. Mica Trimmer
C12		.05 mf. Paper Cond.
C13		10 mmf. Mica Cond.
C14		10-50 mmf. Mica Trimmer
C15	1754	Variable Condenser
C16		.1 mf. Paper Cond.
C17		.05 mf. Paper Cond.
C18		10-50 mmf. Mica Trimmer
C19		2800 mmf. Padding Cond.
C20		10-50 mmf. Mica Trimmer
C21	1153	10-50 mmf. Mica Trimmer
C22		390 mmf. Padding Cond.
C23	1754	Variable Condenser
C24		10-50 mmf. Mica Trimmer
C25		50 mmf. Mica Cond.
C26		50 mmf. Mica Cond.
C27		10-50 mmf. Mica Trimmer
C28		.1 mf. Paper Cond.
C29		10-50 mmf. Mica Trimmer
C30		50 mmf. Mica Cond.
C31		50 mmf. Mica Cond.
C32		10-50 mmf. Mica Trimmer
C33		700 mmf. Mica Cond.
C34		200 mmf. Mica Cond.
C35		.05 mf. Paper Cond.
C36		200 mmf. Mica Cond.
C37		5 mf. 25v. Elect. Cond.

Fig. 54. Circuit Data (254)

A.W.A. MODULATED OSCILLATOR

Type C1070

THE PURPOSE OF THE INSTRUMENT.

This instrument has been designed for use in servicing all kinds of radio receivers. Modulated or unmodulated signals of any frequency between 100 Kilocycles and 20 Megacycles are available.

THE FOLLOWING TESTS MAY BE CARRIED OUT RAPIDLY AND WITH AMPLE SERVICE ACCURACY:

1. Alignment of I.F. and R.F. circuits at any desired frequency.
2. Adjustment of receivers provided with wavelength or kilocycle scales to correct dial calibration by setting trimmers and padding condenser.
3. Examination of ganged T.R.F. circuits for errors in tracking.
4. Measurement of overall sensitivity of all types of receivers at any frequency, and gain of I.F. amplifiers.
5. Estimation of noise level at higher sensitivities by comparison of audio outputs between modulated and unmodulated carrier of equal strength.
6. Determination of stage gain in I.F. or R.F. amplifiers.
7. Testing of valves for performance under working conditions by insertion of several in succession in a given socket in a receiver and noting the change in stage gain or overall sensitivity.
8. Checking the performance of A.V.C. in receivers.
9. Measurement of selectivity of I.F. or R.F. amplifiers in terms of band width in kilocycles, for input signals one hundred or one thousand times larger than the signal on tune required to give some chosen value of audio output.
10. Determination of image ratio, or the ratio of the micro-volts input at the image or second spot frequency to the micro-volts at the wanted signal frequency, both giving equal audio output.

This comprehensive list of tests covers more than is usually required in receiver servicing. None of these tests requires an instrument with capabilities of accuracy available in a signal generator. Consequently the controls and methods of calibration can be modified in the direction of speeding up and generally simplifying operation. This object has been the aim in the design of the Type C1070 modulated oscillator, and has been achieved with but small reduction in accuracy below average signal generator performance.

Design and Performance

FREQUENCY RANGE.

100 K.C. to 20,000 K.C. in six ranges, selected by a switch.
Range A, 96 K.C. to 250 K.C.
Range B, 240 K.C. to 600 K.C.
Range C, 560 K.C. to 1420 K.C.
Range D, 90 metres to 220 metres (1,360 K.C. to 3,330 K.C.).
Range E, 37 metres to 96 metres (3,120 K.C. to 8,100 K.C.).
Range F, 15 metres to 38 metres (7,900 K.C. to 20,000 K.C.).

All ranges are directly calibrated on a rotovisor type dial; A, B and C are marked in kilocycles and D, E and F in metres.

Calibration accuracy is better than 1 per cent. on range C, and within 2 per cent. on the other ranges.

OUTPUT.

The attenuator calibration indicates directly the approximate microvolts output on Ranges B and C. It is calibrated 1, 3, 10, 30, etc., up to 100 M (100,000) with two extra markings not carrying accompanying figures. The one adjacent to the 100,000 mark is 300,000 and the last one is the extreme position for the pointer when turned clockwise.

The approximate output signal on the other ranges may be estimated from the following table:

Range	Multiplying factor for Attenuator Calibration
A	1.4
B	1
C	1
D	0.5
E	0.2
F	0.08

The average maximum R.F. output on each band is therefore:

A	400	Millivolts
B	300	"
C	300	"
D	150	"
E	60	"
F	25	"

The attenuator reacts noticeably upon the carrier only at the higher outputs. The frequency change caused through advancing the attenuator control from low outputs up to the position marked 100M is approximately as follows:

High frequency end of band 0.3 per cent.
Middle of band 0.1 per cent.
Low frequency end of band 0.05 per cent.

On position 300 M the shift of carrier frequency will be three times greater, as the change of frequency is directly proportional to the indication of the attenuator control.

It is important that the special shielded cable supplied should be used with the oscillator always, otherwise the above figures for R.F. output on each band will not hold. This cable has the correct characteristics to suit the attenuator, and to behave as a dummy aerial on the broadcast and the short wave ranges (for alignment purposes only).

Leakage signal through the attenuator cannot be detected except at about 20 M.C. where it is of the order of less than one microvolt. The relative ratios of attenuation, as marked on the attenuator scale are almost unaffected by the value of the operating radio frequency.

MODULATION.

The modulator oscillator is adjusted to approximately 400 C.P.S. by adjusting the air gap of the TA1060 Transformer. The modulation depth is set at about 30 per cent. on the low frequency bands by means of a resistance in parallel with the "tank" circuit of the audio oscillator. The only serious departure from the figure of 30 per cent. for the modulation depth occurs on band F where it rises to about 45 per cent. The battery switch has 3 positions, "OFF," "MOD. OFF," and "MOD. ON," allowing the radio frequency output to be obtained free from modulation in the middle position.

CONSTRUCTION.

The coils and wave change switch together with the wiring and the oscillator valve socket are individually screened, and form together a complete assembly. This assembly, the variable condenser and modulator oscillator system are mounted to a rear panel. In this way radio frequency currents in this panel cannot give rise to external stray fields due to the shielding effect of the front panel and outside metal case.

The variable condenser is operated by a smooth eight to one reduction drive situated between the two panels. The piston or variable capacitance attenuator also lies between the two panels and is of special design. It contains no fragile electrical parts, as in the resistance type attenuators, that may require replacement.

At one end of the brass tube is placed an insulated metal disc that is connected to the tank circuit of the R.F. Oscillator. A second and similar disc is carried on the face of an insulated piston, and is connected to the output terminal on the front panel.

The batteries are strapped in the rear of the case, and are wired to a terminal panel at the side where clearance holes (insulated) are provided for insertion of the prods of a voltmeter to check voltages without opening the case.

EQUIPMENT.

Valves. Two type 30 Radiotrons are used—one as R.F. oscillator and one as 400 cycle Audio oscillator.

Batteries. Four 4.5 Volt Bias Batteries (drain 60 M.A.) and one 60 Volt Light Duty Battery (drain 3 to 5 M.A.) are required. The Bias Batteries are connected in parallel to operate the filaments in series.

The condition of the batteries may be checked with a voltmeter through the holes in the side of the case.

Satisfactory Voltage Limits are as follows:

"A" Battery .... 3.5 to 4.5 Volts.
"B" Battery .... 50 to 60 Volts.

It is not desirable to continue to use batteries of voltages below these limits.

To instal or change batteries or valves proceed as follows:

1. Turn the tuning control (the knob second from the right) so that pointer indicates 100 K.C. on range A, **otherwise the tuning condenser may be damaged.**
2. Lay the oscillator on the bench face up, and take out the screws round the edge of the front panel.
3. Lift the oscillator out of the case by taking hold of the edge of the front panel.
4. See that a good 30 valve is held firmly in each socket.
5. Assemble the batteries in the back of the case. See that they are held firmly with the straps provided. See diagram Fig. 55.
6. See that the battery switch is turned to "OFF."
7. Connect the batteries according to the diagram Fig. 55.
8. Re-assemble the oscillator in the case.

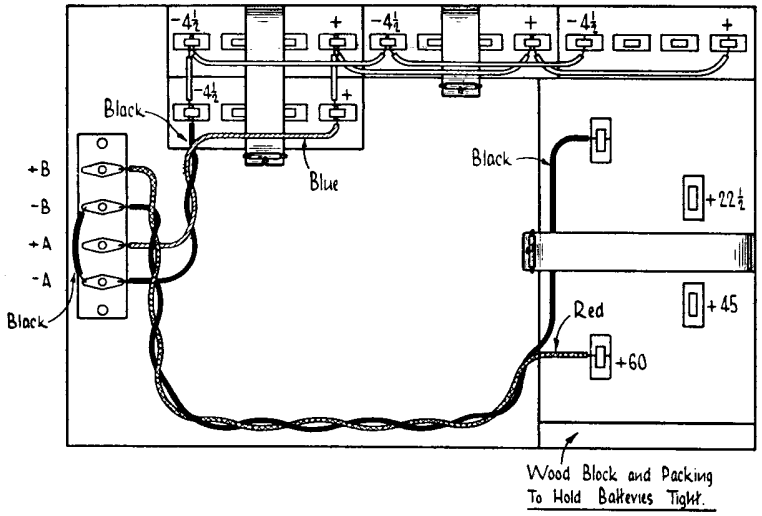


Fig. 55.—Installation and Connection of Batteries.

OUTPUT METER.

To make satisfactory use of the modulated oscillator it is necessary to connect an output meter to the receiver under test.

A standard rectifier type of output meter is most convenient or a conventional design of valve voltmeter may be used.

An economical substitute is suggested as follows:

A standard D.C. voltmeter of 1000 ohms per volt may be used in conjunction with a valve operating as a diode rectifier. The valve may be a filament type or indirectly heated type. The plate and all grids are connected together to form a diode plate.

An output meter may be constructed according to Fig. 2. Using a D.C. voltmeter of ranges 0-3, 0-30 and 0-300 volts and resistance 1000 ohms per volt the following A.C. voltage ranges were obtained using a type 76 and a type 30 valve:

D.C. Range.	R.M.S. A.C. Ranges.	
	76	30
0-300	0-250	0-290V.
0-30	0-33	0-35V.
0-3	0-6.5	0-9.0V.

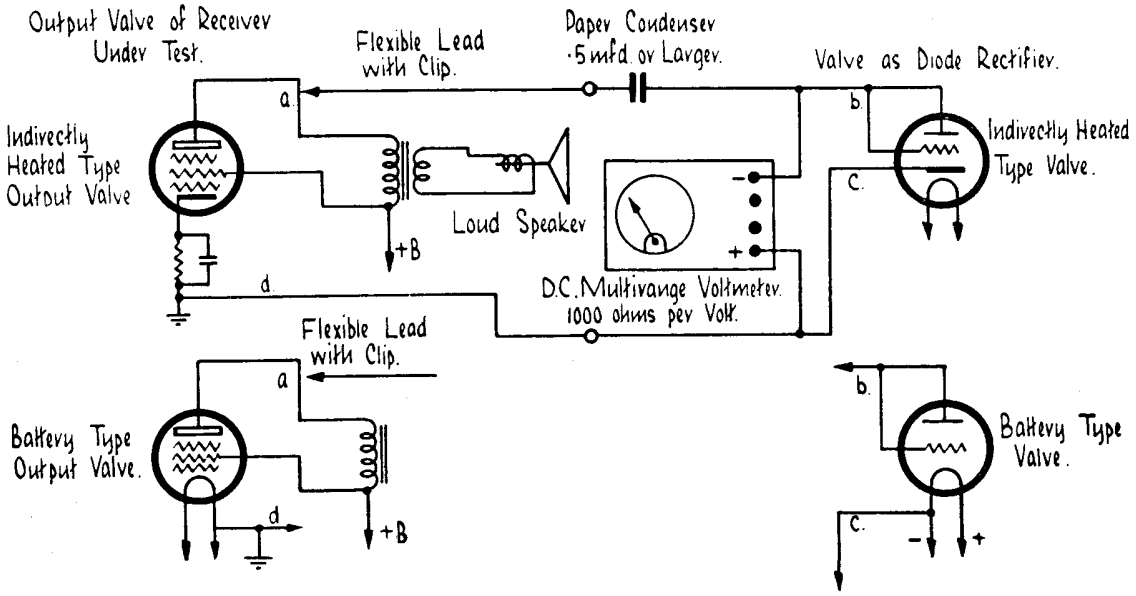


Fig. 56.—Output Meter.

CONTROLS.

The oscillator has four controls (from left to right):

No. 1. Range Switch. This control selects the coil for use on any desired range.

No. 2. Battery Switch. The battery switch has three positions.

(i) The first position, "OFF"; both the A Battery and B Battery circuits are open.

(ii) In the second position, "MOD. OFF," the A Battery is connected to both valves but the B Battery is connected to the R.F. oscillator only.

(iii) In the third position, "MOD. ON," the B Battery is connected to the Modulator valve also; thus modulated and unmodulated carrier are available.

No. 3. Frequency Selector. By turning this knob any desired frequency throughout the range corresponding to the setting of the range switch may be obtained. Use the scale corresponding to the setting of the Range Switch.

No. 4. Attenuator. By turning this knob the amount of the output signal may be adjusted to any desired level. The approximate value of this signal may be estimated from the data given on page 80.

OPERATION.

1. Set the modulated oscillator about one foot to the left of the receiver under test.
2. Connect the output cable to the terminals of the oscillator. Connect the braided lead with coloured tracer in the braiding to the insulated terminal of the oscillator by means of the spade terminal. Connect the plain lead to the earthed terminal.
3. Connect the other end of the cable to the receiver under test. The plain lead is to be connected to the earth terminal and the other lead (tracer) to the aerial terminal or grid cap of a valve as required. When connected to the grid cap it is necessary to connect a resistor between the grid cap and earth to complete the bias circuit (about 250,000 ohms or larger is suitable).
4. Connect an output meter in the plate circuit of the last valve. See Fig. 56.

5. Turn the battery switch to the "MOD. ON" position and select the desired test frequency by means of the range switch and the frequency control.

6. Tune the receiver to the frequency of the oscillator and adjust the attenuator to give a convenient deflection on the meter. Any tests listed on page 80 may now be carried out.

CAUTION.—Be sure that the Battery Switch is turned "OFF" when the oscillator is not in use.

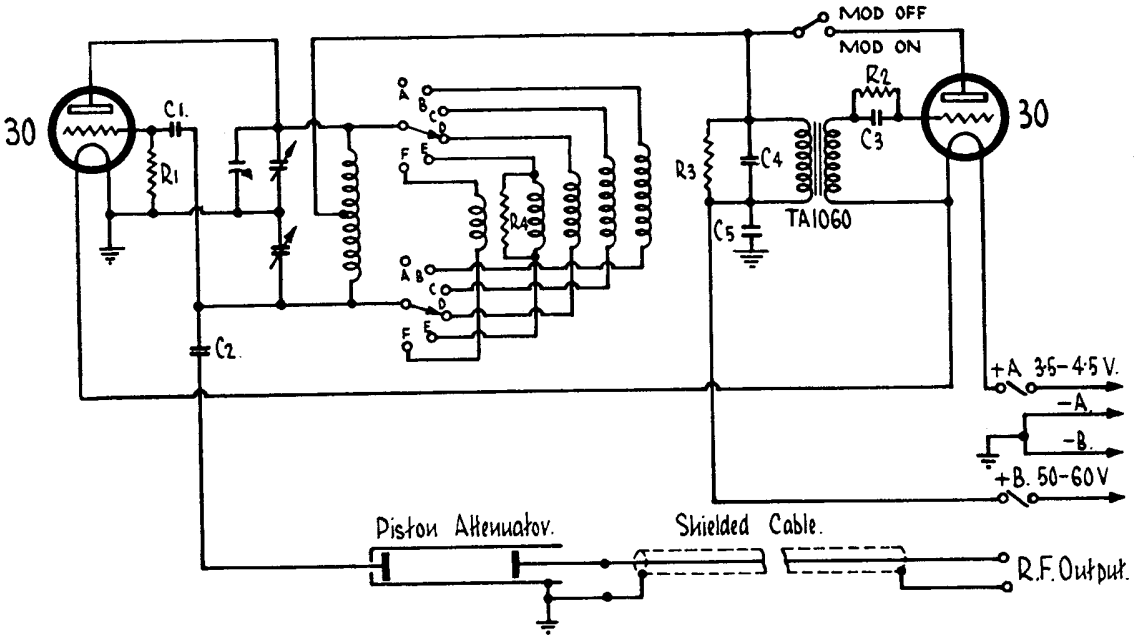


Fig. 57.—Circuit Diagram.